

ESG Economic Validation

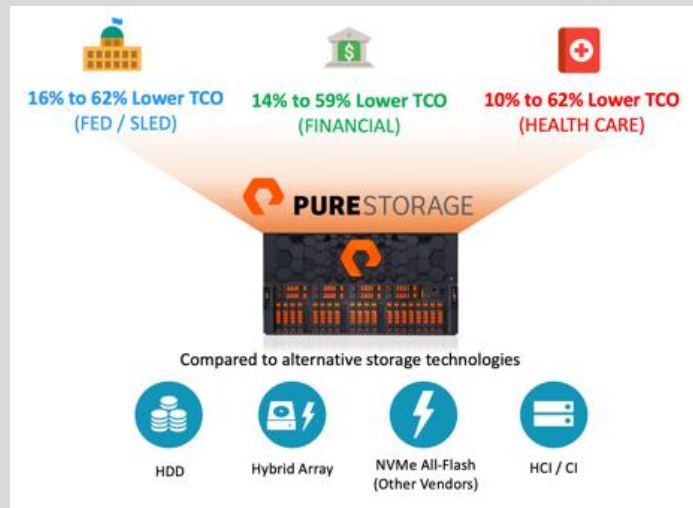
Validating the Economics of Improved Storage Efficiency with Pure Storage

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Executive Summary

Organizations know that there is a drastic increase in the volume and velocity of data they collect, and they recognize the value that can be derived from this data. By collecting and analyzing the constant stream of data provided by sources, organizations can operate more effectively, while greatly improving operations, lowering risk, and improving the bottom line. But storing massive quantities of useful data is expensive and IT must get the most value out of every GB they deploy.

ESG was recently commissioned by Pure Storage to validate, using a combination of ESG's research and economic validation services, the effectiveness of its storage efficiency technology when compared against alternative storage solutions and technologies. ESG validated data provided by thousands of real-world deployments that showed that Pure Storage solutions deliver 1.4X to 2.6X greater total storage efficiency than the alternative all-flash, hybrid, and CI/HCI systems that are currently deployed in today's health care, financial, and FED/SLED environments. ESG used this data to help model the expected total cost of ownership (TCO) for the typical storage requirements in each vertical. We found that Pure provided the lowest expected TCO \$/GB when compared to the status quo of each of the listed storage technologies. ESG's detailed TCO analysis showed that Pure customers can expect a 10% to 62% lower three-year TCO versus the current technologies that they may have deployed or are thinking of deploying (including current NVMe all-flash storage systems from competing vendors).



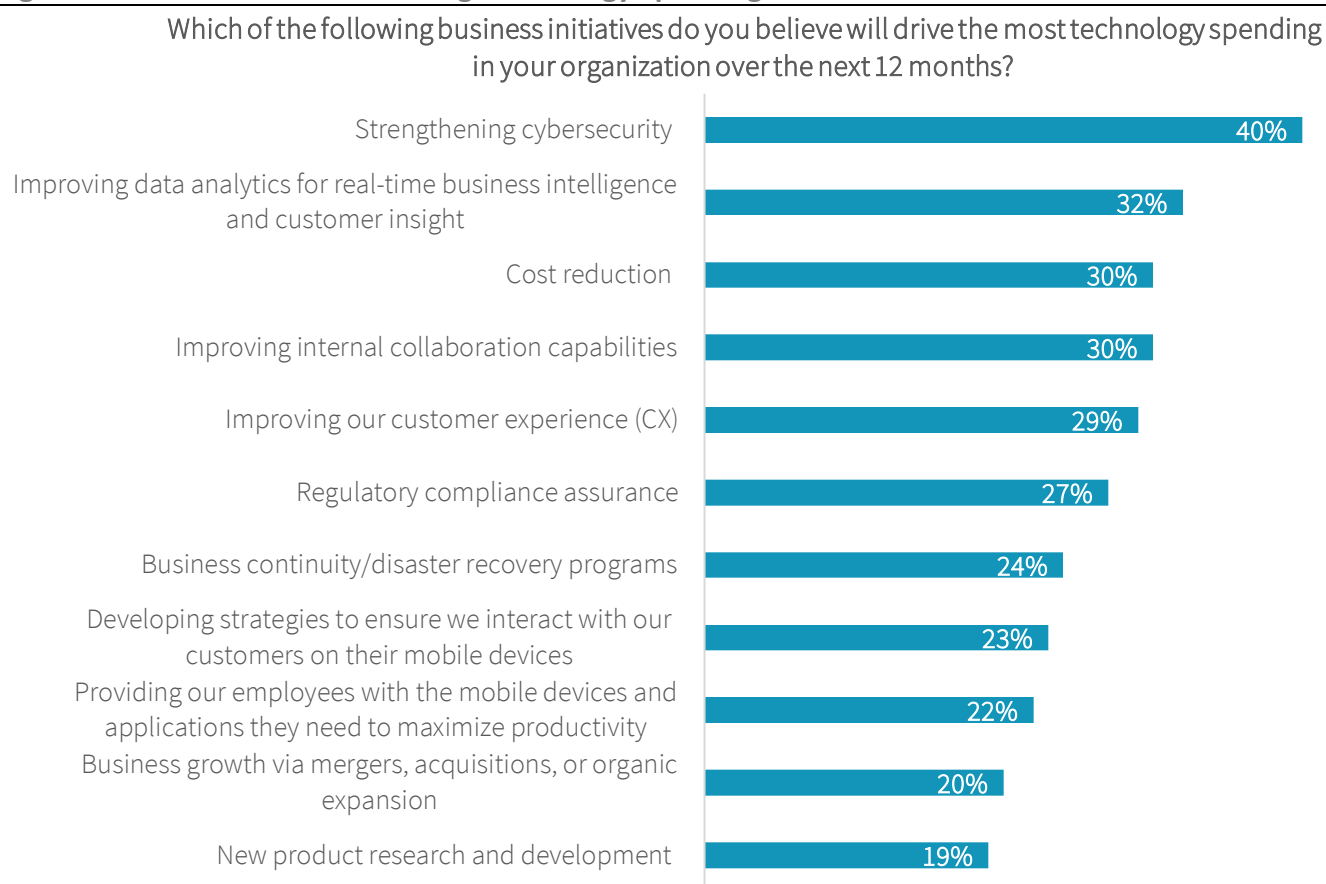
Introduction

ESG was recently commissioned by Pure Storage to validate the effectiveness of its storage efficiency technology when compared against alternative storage solutions and technologies. ESG performed this validation using a combination of our market research and economic validation services.

Challenges

The success of today's businesses is tied to the quality and quantity of the data that they can produce, collect, and analyze. To compete in today's digital age, organizations must rely on the actionable insight that comes from the data that they collect from as many sources as possible. Whether it be revealing new research insights, understanding relationships between seemingly disparate activities, uncovering new business opportunities, or streamlining internal operations, data is the critical cog that drives improvement across the organization. With emerging workloads such as digital media, collaboration, and business intelligence/data analytics accelerating storage growth faster than ever before, the burden falls on the IT organization to find a place to store and analyze the data.

Figure 1. Business Initiatives Driving Technology Spending



Source: Enterprise Strategy Group

Unsurprisingly, ESG research uncovered that cost reduction and improving data analytics for real-time business intelligence are two of the three most-cited business initiatives driving technology spending in 2019.¹ And in a separate study, the cost of on-premises storage infrastructure was the most-cited area with an opportunity to significantly streamline or reduce costs.² Technologies like deduplication, compression, and thin provisioning help to provide greater storage efficiency and thus reduce the physical storage that must be purchased, deployed, powered, and cooled. But it doesn't end there:

¹ Source: ESG Research Report, [2019 Technology Spending Intentions Survey](#), February 2019.

² Source: ESG Research Report, [2018 IT Spending Intentions Survey](#), February 2018.

Storage systems that provide not only greater storage efficiency, but also higher levels of performance, and easier administration, deployment, and maintenance provide the greatest overall value to the organization at the lowest possible cost.

The Solution: Greater Storage Efficiency with Pure Storage

Pure FlashArray//X is a 100% NVMe solution that delivers scalable, predictable latency and storage density for enterprise-level mixed workload consolidation. FlashArray//X includes:

- 100% NVMe performance: As low as 250 μ s latency; up to 2X faster than previous gen AFAs; NVMe and NVMe-oF.
- Cost efficiency: Average of 5:1 data reduction, 10:1 total efficiency; all array software included.
- Ultra-dense consolidation: 3PB effective in 6U.
- Simplicity: AI-driven management and predictive support; REST API for cloud orchestration; proven 99.9999% availability.
- Always-on data encryption and rapid data-locking capability, plus always-on QoS.
- Array and cloud-based snapshots, and ActiveCluster synchronous active/active or asynchronous replication.
- Non-disruptive software updates and non-disruptive controller upgrades (no forklift upgrades).
- Evergreen Storage business model, combining Pure's non-disruptive upgrades with investment protection.

Pure Storage Efficiency Benefits

The Purity Operating Environment was designed from the ground up for flash, with performance and efficiency top of mind. Data can be moved without negatively impacting performance, allowing for background optimizations that help improve storage efficiency. Pure provides integrated inline data reduction (deduplication and compression) that is designed to run at speeds required for mission-critical workloads. Pure deduplication runs at a variable and more granular level than competing solutions, allowing it to remove more duplicate data. Pure leverages both high-speed inline compression with append-only and write variable addressing to provide greater compressibility of data, and then applies post-process compression to further compression savings in the background. Purity's pattern removal identifies and removes repetitive binary patterns (not just extra zeros), and Pure performs space-efficient operations like copies and clones using metadata to avoid unnecessary inflation of data when migrating data or making copies. In addition, Purity's thin provisioning is always on. The result is a highly efficient storage array that makes the most out of every GB of data that it has available.

Figure 2. Pure Storage System's Data Efficiency Technologies



- Designed for Flash with Zero Impact Operations
- Actively moves data to improve efficiency
- Pattern Removal
- Inline Global Deduplication (512B Aligned, Variable Block Size)
- Inline Compression / Deep Reduction
- Always-on Thin Provisioning
- Copy Reduction
- Right Size Guarantee (RSG)

Source: Enterprise Strategy Group

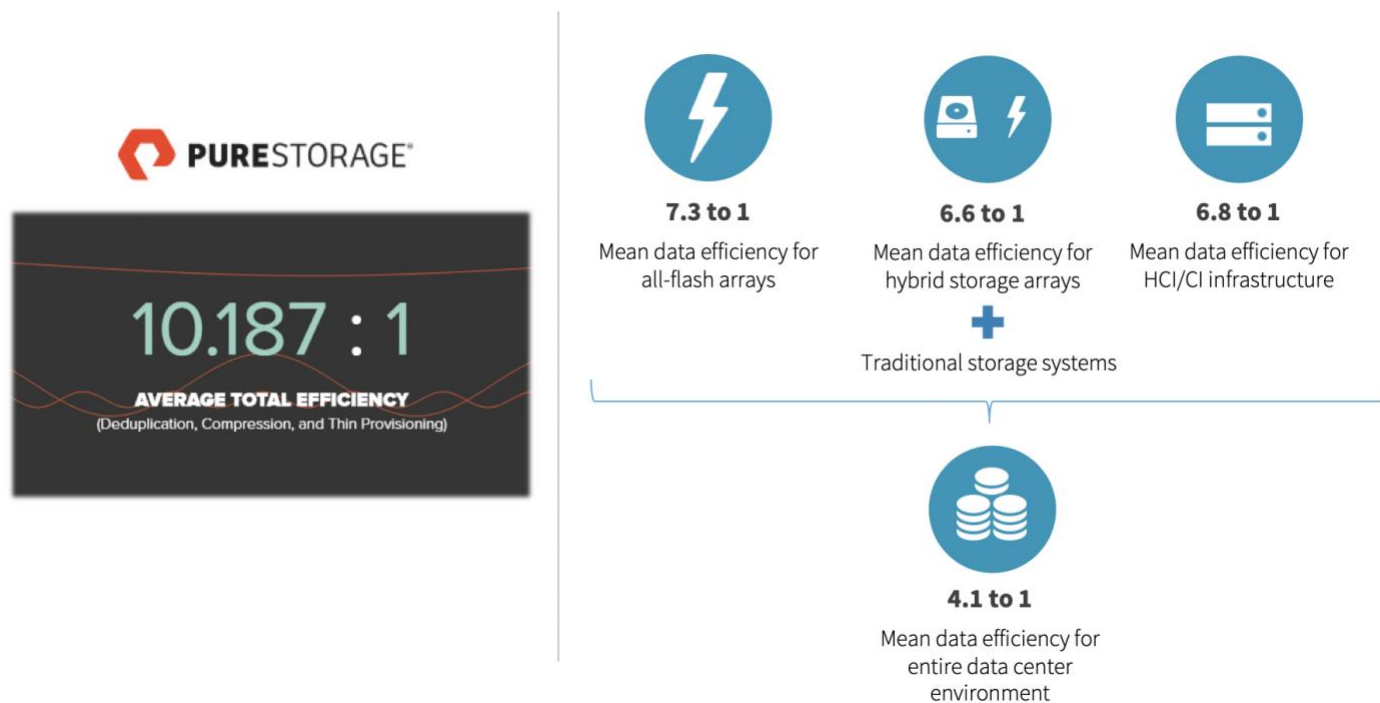
The overall data reduction rate and total efficiency (as seen across existing deployments) are reported in real time on the Pure website, with an impressive 5:1 average global data reduction ratio and 10:1 total efficiency ratio (including thin provisioning). In addition, Pure provides a Right-Size Guarantee (RSG) for overall efficiency for new deployments, which can be extended with any capacity increase. The Pure FlashArray//X can deliver 3PB effective in just 6U of rack space, further providing savings by lowering power, cooling, and floorspace costs per GB, and lowering administrative costs by allowing administrators to consolidate more applications into a single array.

ESG's Storage Efficiency Research Study

In order to validate that Pure Storage systems provide greater storage efficiency than alternative solutions, ESG executed a survey of 525 highly qualified storage practitioners and decision makers who were very familiar with their organization's on-premises storage infrastructure. ESG collected data on the typical proportion of raw capacity that was writable, the mix of storage capacity types (all-flash, hybrid, HDD, or CI/HCI), the propensity to leverage data efficiency technologies such as deduplication, compression, and thin provisioning, and the average data efficiency achieved by capacity type and in environments overall. The survey was targeted at organizations with 500 or more employees operating in the public sector (32%), finance (35%), or health care (32%) verticals and consisted of geographic regions of North America (US, Canada; 29%), South America (Argentina, Mexico; 24%), Western Europe (Germany, UK; 24%), and Asia-Pacific (Australia, New Zealand, Japan, Singapore, South Korea; 24%).

ESG collected the total efficiency reported by each storage technology and compared it with the total efficiency reported by Pure Storage FlashArray systems. ESG compared data across all deployments, as well as by region and vertical. This data helped form the basis for our vertical-specific TCO models highlighted later in this report. While there were some expected differences in the reported rates across regions and verticals, Pure Storage systems consistently provided 1.4X to 2.6X greater storage efficiency than the alternative storage solutions that were deployed (including all-flash storage systems). Figure 3 illustrates the efficiency advantage of Pure compared with the alternative solutions for consolidated results across all regions and verticals.

Figure 3. Total Environment Data Efficiency



Source: Enterprise Strategy Group

Economic Modeling

ESG's Pure Efficiency Economic Value Model

ESG leveraged the validated storage efficiency information collected from our research study, along with our public and industry knowledge of economics and technologies, to create a TCO/ROI model that compares the costs and benefits of deploying, managing, and supporting storage capacity over a three-year period. We used the median deployment size for each vertical across all deployments involved in the study as the basis for the required amount of storage and then added 20% capacity for future growth. We then applied the vertical-specific mean expected total efficiency as reported by Pure Telemetry data (Pure) and the ESG research study to calculate the capacity that must be deployed to satisfy the effective requirement. This calculation included the typical capacity required for data protection and system files for each storage technology. We then leveraged ESG's years of knowledge performing nearly 100 detailed TCO studies to estimate administration, infrastructure, and maintenance costs to compute the expected three-year total cost of ownership (TCO) to satisfy the requirements using each technology. The results are in the corresponding vertical-specific sections of this paper.

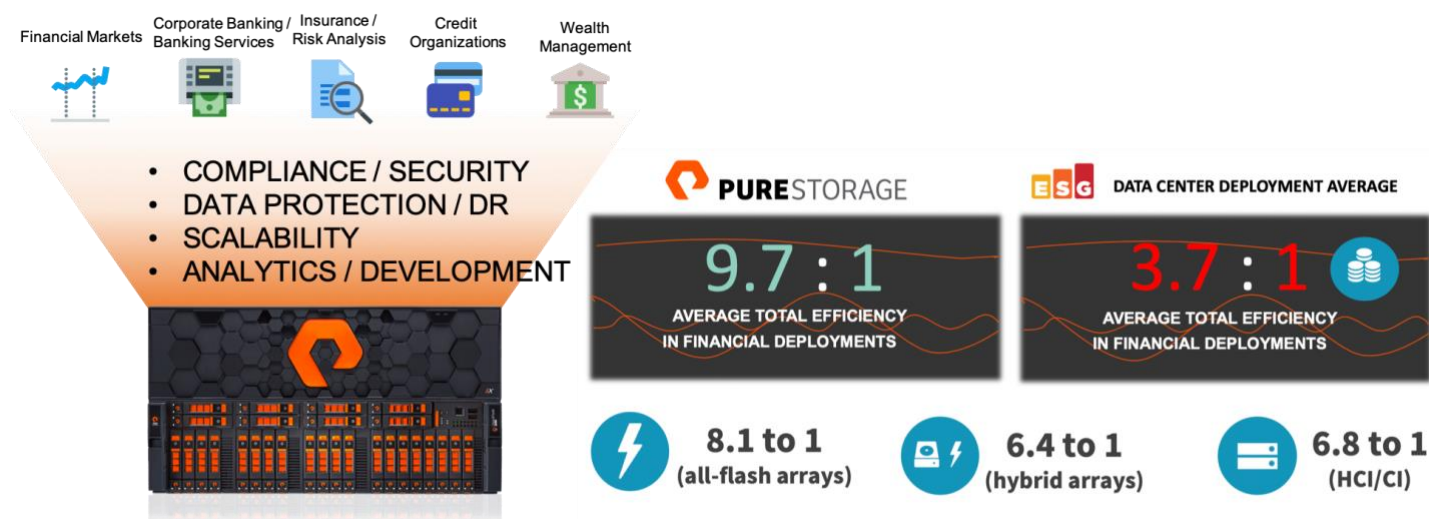


Vertical Highlight: Storage Efficiency for Financial Organizations

The financial vertical consists of organizations in the banking, insurance, wealth management, and financial market industries. Thanks to the value of advanced analytics such as artificial intelligence (AI) and machine learning (ML), the financial industry is larger and more profitable than ever. Financial organizations are quickly becoming technology companies operating on the bleeding edge—deploying the latest hardware technologies and pushing the development of greater software capabilities. Financial organizations demand storage systems that provide low latency and are highly scalable and agile enough to handle burst in demand or ever-changing requirements. Of course, security, compliance, and availability are always king as massive financial penalties are involved for even the smallest slip of any of the three.

The value of analytics in the financial industry is undeniable. Scores of analysts are constantly scrutinizing streams of information attempting to derive valuable insight. Data from financial markets, micro- and macro-economic models, customer data, transactional databases, etc., are cross-referenced and correlated to provide information that can help to increase or open new revenue streams, attract or retain customers, maximize gains, and minimize cost or risk. Capacity requirements are colossal as data must be collected, distributed, transformed, analyzed, delivered, and protected. The need for updated development and test environments that do not impact production amplify the storage capacity and performance requirements. Storing this volume of data as efficiently as possible should be a top priority for financial organizations.

ESG's research study revealed that financial organizations generally benefit from slightly lower overall storage efficiency rates than those seen in the health care and FED/SLED verticals, although the advantage that Pure Storage had over the status quo was the greatest of the three verticals. Pure Storage systems provide an average of 9.7:1 total efficiency savings, a value that is 2.6X greater than the 3.7:1 seen in typical data center deployments. Alternative all-flash arrays provided an average of 8.1:1, hybrid storage arrays provided 6.4:1, and CI/HCI provided 6.8:1 total efficiency savings. The greatest efficiencies were seen in Asia-Pacific where the reported efficiency was roughly 14% higher than the global average. The results are summarized in Figure 4.

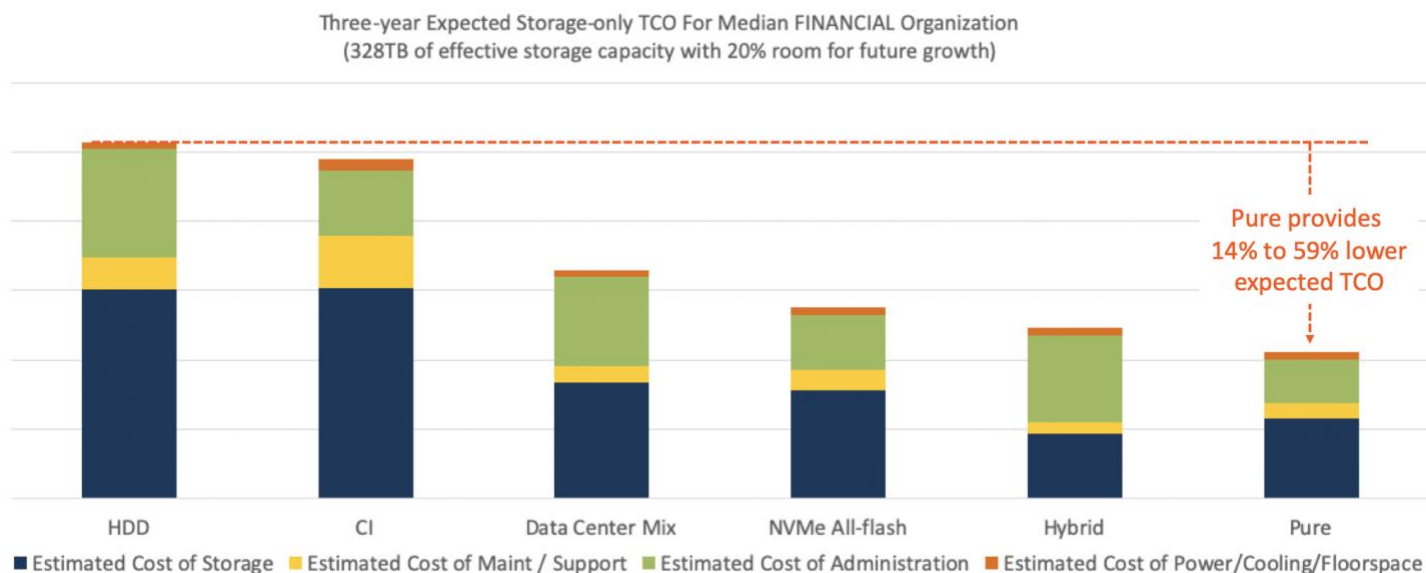
Figure 4. Validated Total Efficiency Realized Across Financial Deployments

Source: Enterprise Strategy Group

Modeled TCO Example: Financial Storage Deployment

ESG modeled the expected three-year total cost of storage ownership for a typical financial organization with requirements of 328TB of stored capacity plus 20% additional space for future growth (total effective storage capacity of 394TB before efficiency savings). The required capacity for each storage technology (to deliver the typical financial organization's needed capacity) was calculated by dividing the 394TB by the validated total efficiency savings highlighted in Figure 4. A typical cost of raid protected storage capacity was estimated based on a blend of three or more solutions for each technology. Cost of administration, maintenance, support, power, cooling, and floorspace was estimated for each technology as a percentage of total cost of acquisition using averages of previous TCO models for each storage technology as guidance.

The results showed that the expected three-year total cost of storage ownership for Pure Storage systems was 14% lower than hybrid storage, 23% lower than competing NVMe all-flash storage arrays, 57% lower than storage provided by CI/HCI systems, and 59% lower than HDD storage systems. In addition, Pure's TCO was 36% lower than the average data center mix of storage technologies consisting of a mix of HDD, hybrid, and flash storage. It should be noted that, for simplicity, ESG assumed that each storage technology would meet the performance requirements at the cost of the capacity of storage deployed (in reality, non-flash-based systems would have to be greatly overprovisioned, at a much higher cost, to meet the performance requirements demanded by many financial applications, if they could be met at all). The TCO results for the modeled financial scenario are shown in Figure 5.

Figure 5. Three-year Expected Total Cost of Storage Ownership for a Financial Organization

Source: Enterprise Strategy Group

Why This Matters

For many financial organizations, the business impact of every second, every interaction, and every transaction is quite measurable. The business value contained in streams of real-time information is perhaps greater in the financial sector than any other vertical. Taking quick action on the insight provided through data warehousing, AI and ML workloads can result in millions of dollars of revenue. But keeping up with the capacity and performance required to collect, transform, and analyze this data quickly can become a complex, costly, and time-consuming task for IT organizations.

ESG has validated through market research that Pure Storage solutions provide 1.2X to 2.6X greater total storage efficiency (deduplication, compression, and thin provisioning savings) than the alternative all-flash, hybrid, and CI/HCI systems that are currently deployed in financial environments. ESG's economic models confirm that Pure Storage systems provide expected three-year TCO savings of 14% to 59% versus these alternative storage technologies in financial environments. With Pure Storage systems, financial administrators can affect the bottom line with mission-critical storage performance, availability, scalability, and agility—providing the potential to both grow revenue streams and lower cost to the organization.



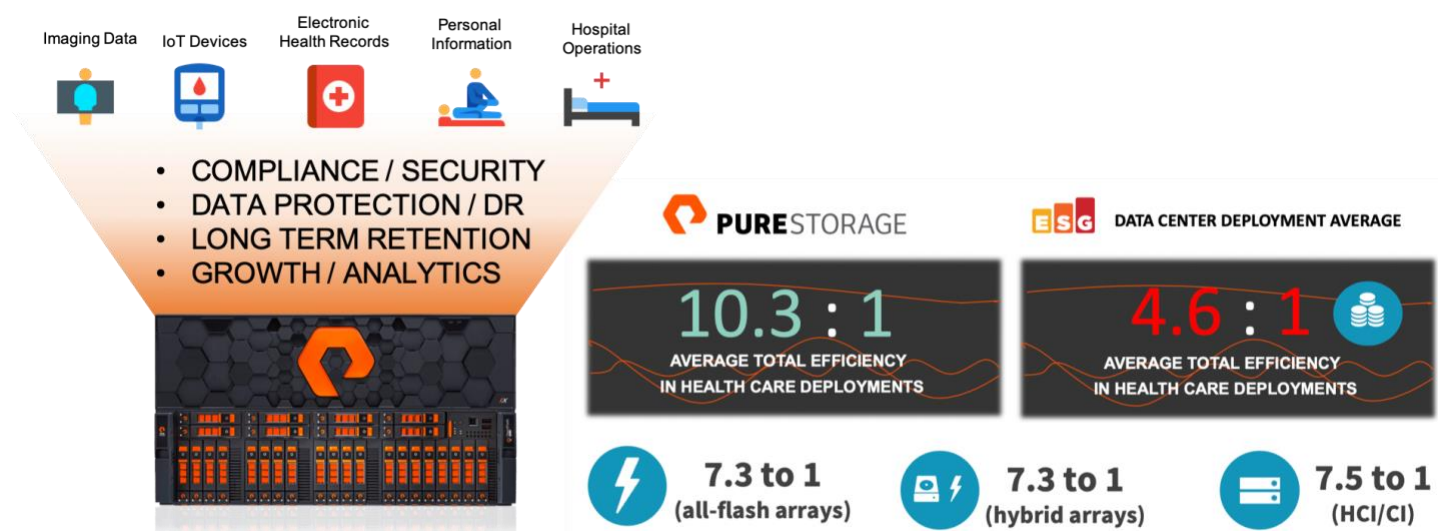
Vertical Highlight: Storage Efficiency for Health Care Organizations

There is perhaps no other vertical in which the data stored is more important than the health care industry. For some applications, the information stored on an array in the data center can be the difference between life and death for a patient. While the health care vertical certainly stretches much further than the emergency room, compliance and security are of primary concern for most health care organizations. Many compliance requirements are unique to the health care industry such as PHI and HIPAA. The need to correlate personally identifiable information (PII) consisting of sensitive health records across many applications can bring with it very large consequences if there is a data breach or loss of data, including legal ramifications. Putting this data into the cloud always causes concern, so the undeniable data ownership provided by an on-premises storage array can be quite important.

Capacity demands in the health care industry are large and rapidly growing. Medical imaging devices such as X-rays, MRI, and CT scanners generate massive amounts of digital images, and as resolution improves, so does the size of the images stored. Streams of data from connected devices such as patient monitors, RFID readers, video cameras, and drug delivery devices must be captured, indexed, and analyzed. Both the health care provider and the payor must maintain databases full of growing patient records and reports, and regulatory compliance now demands that all non-electronic patient health records be converted to digital formats. This means a massive amount of data must be protected, copied, distributed, and made available to time-sensitive applications and performance-hungry analytics. A more efficient storage solution that can provide high levels of performance is a great investment for the health care industry.

Perhaps due to the number of copies required and the number of records, forms, or documents that may contain duplicate information, ESG's research study revealed that health care organizations generally benefit from some of the higher storage efficiency rates across all regions. Pure Storage systems provide an average of 10.3:1 total efficiency savings, a value that is 2.2X greater than the 4.6:1 seen in typical data center deployments. Alternative all-flash arrays and hybrid storage arrays provided an average of 7.3:1, and CI/HCI provided a slightly better 7.5:1 total efficiency savings. The greatest efficiencies were seen in Western Europe where the reported efficiency was roughly 28% higher than the global average. The results are summarized in Figure 6.

Figure 6. Validated Total Efficiency Realized Across Health Care Deployments



Source: Enterprise Strategy Group

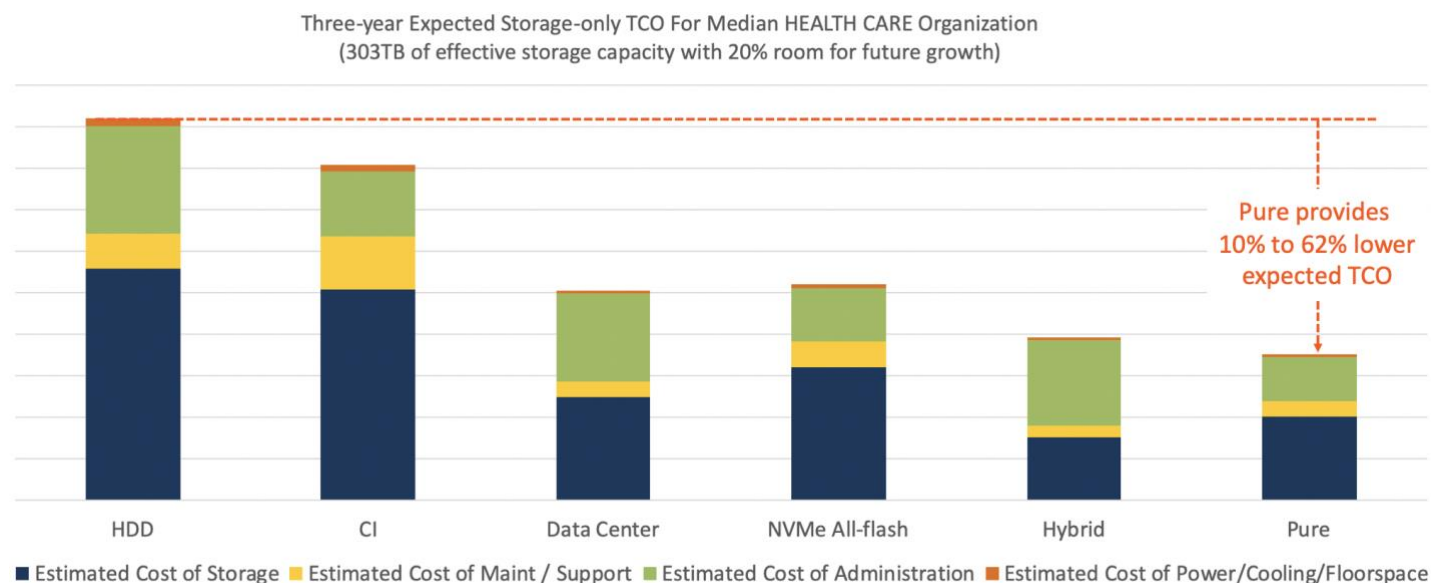
Modeled TCO Example: Health Care Storage Deployment

ESG modeled the expected three-year total cost of storage ownership for a typical health care organization with requirements of 303TB of stored capacity and 20% additional space (total effective storage capacity of 363TB before efficiency savings). The required capacity for each storage technology (to deliver the typical health care organization's needed capacity) was calculated by dividing the 363TB by the validated total efficiency savings highlighted in Figure 6. A typical cost of raid protected storage capacity was estimated based on a blend of three or more solutions for each technology. Cost of administration, maintenance, support, power, cooling, and floorspace was estimated for each technology as a percentage of total cost of acquisition using averages of previous TCO models for each storage technology as guidance.

The results showed that the expected three-year total cost of storage ownership for Pure Storage systems was 10% lower than hybrid storage, 33% lower than competing NVMe all-flash storage arrays, 57% lower than storage provided by CI/HCI systems, and 62% lower than HDD storage systems. In addition, Pure's TCO was 31% lower than the average data center

mix of storage technologies consisting of a mix of HDD, hybrid, and flash storage. The TCO results for the modeled health care scenario are shown in Figure 7.

Figure 7. Three-year Expected Total Cost of Storage Ownership for a Health Care Organization



Source: Enterprise Strategy Group

Why This Matters

The storage capacity needs of health care organizations are growing rapidly, fueled by the need to store multiple copies of patient and provider data, increasing quality and quantity of imaging data, and an ever-growing stream of data generated by connected technologies such as patient monitors, RFID readers, video cameras, and drug delivery devices. Ever under scrutiny to prioritize efforts on compliance and security initiatives, administrators cannot afford to spend valuable cycles dealing with capacity issues.

ESG has validated through market research that Pure Storage solutions provide 1.4X to 2.2X greater total storage efficiency (deduplication, compression, and thin provisioning savings) than the alternative all-flash, hybrid, and CI/HCI systems that are currently deployed in health care environments. ESG's economic models confirm that Pure Storage systems provide expected three-year TCO savings of 10% to 62% versus these alternative storage technologies in health care environments. With Pure Storage systems, health care administrators can spend less time dealing with capacity issues and more time providing first-rate services and reducing risk to the organization.



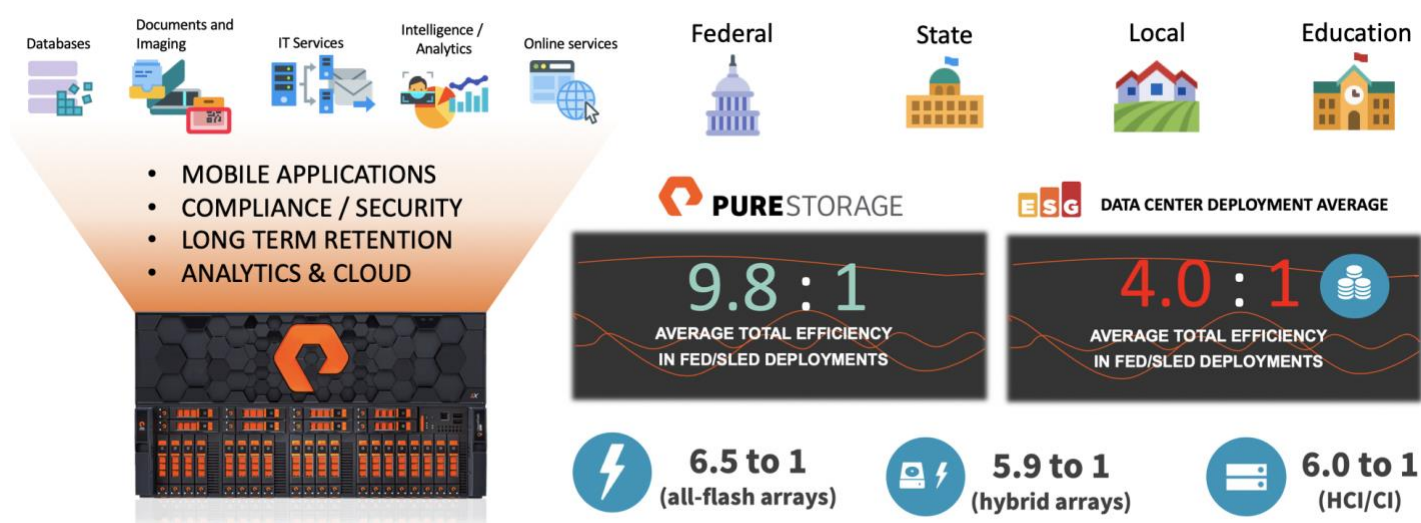
Vertical Highlight: Storage Efficiency for FED/SLED Organizations

FED is short for federal government, and SLED is an acronym for state, local, and education, which encompasses state, city, county, special districts, and education. FED is made up of some of the biggest single IT organizations there are, and SLED consists of about 90,000 separate organizations that purchase through roughly a third as many purchasing agencies. There is some degree of commonality as both purchase solutions through highly normalized and regulated marketplaces. FED/SLED organizations are subject to cost scrutiny and must budget IT purchases when funding is made available, so purchasing a right-sized and efficient storage system can help provide higher levels of capacity to better meet requirements until the next buying cycle.

FED/SLED workloads generally consist of more mature and trusted applications, which are similar to common collaboration, ERP, database, and IoT solutions, as well as a variety of specialized applications and IT services. HPC, video collection, and imaging are important applications in some federal and state agencies. AI has been gaining traction in government agencies since the launch of AI.gov, an initiative that promotes the use of and removes regulatory barriers on the development of new AI technologies. There are ongoing efforts to digitize much of what exists on paper, and security is of utmost importance. These initiatives are leading to a growth in storage needs, and like all IT organizations, storing data as efficiently as possible helps control costs. In a very cost sensitive vertical, it is critical that FED/SLED organizations understand the value of buying storage that provides the lowest storage TCO, and not simply the lowest cost of acquisition.

ESG's research revealed that Pure Storage systems provide an average of 9.8:1 total efficiency savings across the FED/SLED vertical, a value that is 2.5X greater than the 4:1 seen in typical data center deployments. Alternative all-flash arrays provided an average of 6.5:1, hybrid storage arrays provided 5.9:1, and CI/HCI provided 6.0:1 total efficiency savings in FED/SLED environments. Surprisingly, the lowest efficiencies were reported in North America, where the reported efficiency was roughly 25% lower than the global average. This presents a great opportunity for American FED/SLED agencies to improve storage efficiency. The results are summarized in Figure 8.

Figure 8. Validated Total Efficiency Realized Across FED/SLED Deployments



Source: Enterprise Strategy Group

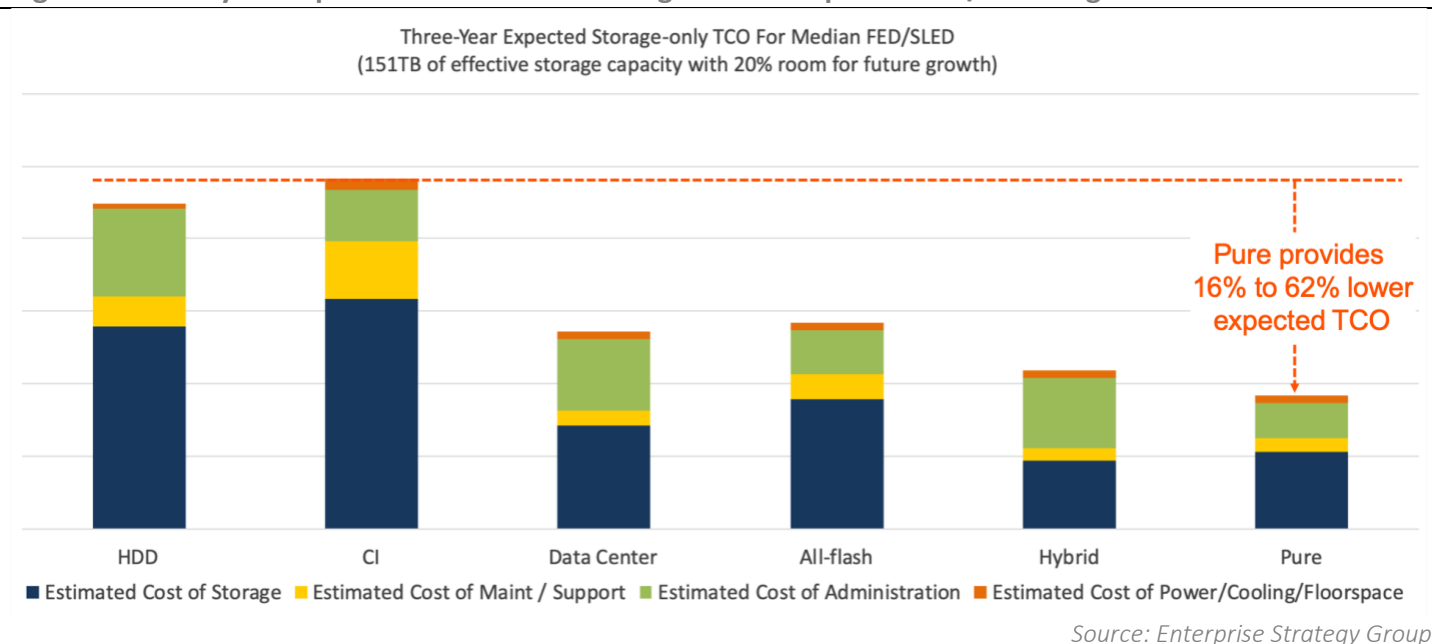
Modeled TCO Example: FED/SLED Storage Deployment

ESG modeled the expected three-year total cost of storage ownership for a typical FED/SLED organization with requirements of 151TB of stored capacity and 20% additional space (total effective storage capacity of 182TB before efficiency savings). The required capacity for each storage technology (to deliver the typical FED/SLED organization's needed capacity) was calculated by dividing the 182TB by the validated total efficiency savings highlighted in Figure 8. A typical cost of raid-protected storage capacity was estimated based on a blend of three or more solutions for each technology. Cost of administration, maintenance, support, power, cooling, and floorspace was estimated for each technology as a percentage of total cost of acquisition using averages of previous TCO models for each storage technology as guidance.

The results showed that the expected three-year total cost of storage ownership for Pure Storage systems was 16% lower than hybrid storage, 35% lower than competing NVMe all-flash storage arrays, 62% lower than storage provided by CI/HCI systems, and 59% lower than HDD storage systems. In addition, Pure's TCO was 32% lower than the average data center

mix of storage technologies consisting of a mix of HDD, hybrid, and flash storage. The TCO results for the modeled FED/SLED scenario are shown in Figure 9.

Figure 9. Three-year Expected Total Cost of Storage Ownership for a FED/SLED Organization



Why This Matters

The FED/SLED vertical is extremely large and covers a wide range of organizations consisting of both leaders and laggards when it comes to information technology. An expanding need to store massive amounts of collected data, support mobile applications, digitize assets, and support new initiatives in the field of artificial intelligence have led to an expansion of storage requirements. As a very cost sensitive and collective purchasing power, FED/SLED organizations would be wise to invest in technology that provides them the lowest TCO, and not simply the lowest cost of acquisition.

ESG has validated through market research that Pure Storage solutions provide 1.5X to 2.5X greater total storage efficiency (deduplication, compression, and thin provisioning savings) than the alternative all-flash, hybrid, and CI/HCI systems that are currently deployed in FED/SLED environments. ESG's economic models confirm that Pure Storage systems provide expected three-year TCO savings of 16% to 62% versus these alternative storage technologies in FED/SLED environments. With Pure Storage systems, federal, state, local, and education admins can help get the most out of their storage investment while modernizing their data center and delivering quality service to the organization.

Issues to Consider

- The results of our study are based on a “blended” analysis of TCO and reported efficiencies across real-world deployments. A blended TCO gives a good indication of how the solution compares to the status quo of other deployed and/or available technologies. This blended analysis should not be used in place of a detailed, one-to-one normalized analysis that ESG recommends any organization perform when evaluating a technology or making any buying decision.
- Storage efficiency savings vary greatly between deployments and are heavily dependent on the workload, type of data stored, applications, number of copies, etc. The reported savings highlighted in this report are the average total efficiency (deduplication, compression, and thin provisioning) across a number of deployments and should only be interpreted as such. Your actual savings may be much higher or lower.
- The TCO calculated in this analysis was based on meeting capacity requirements only. In reality, the Pure system priced in this analysis would have significant performance and feature benefits over some of the other non-flash-based systems. No additional cost was figured in for the additional hardware that would be required to meet the performance of the Pure systems—this further increases the value of Pure’s TCO story when compared with traditional storage systems and the reported data center mix.

The Bigger Truth

The rapid increase in the amount of data that is generated and must be stored is a tale that has been told for several generations now. As technology improves, videos and images get larger, new technology is developed, and the world becomes connected like never before—new streams of intelligent data are provided. We have learned to let the machines do the learning, and we have begun to realize and to make use of the true value of our data. But this data must be stored, and storage can be expensive. Storage efficiency technologies like deduplication, compression, and thin provisioning have enabled us to make better use of our storage, and the public cloud has provided us with seemingly endless amounts of storage—but the two do not go hand in hand. If you want to truly reap the benefits of storage efficiency, then you will need an on-premises storage array.

There are many storage technologies out there—most claim low cost and many claim the benefits of storage efficiency, but ESG learned that Pure Storage was designed for flash with storage efficiency top of mind. Pure leveraged a combination of technologies to ensure not just efficient storage, but a claim of the most efficient storage. But claims are just that until the evidence exists to support them.

ESG was recently commissioned by Pure Storage to validate the effectiveness of its storage efficiency technology, when compared against alternative storage solutions and technologies, using a combination of ESG’s research and economic validation services. ESG performed a research study across 525 organizations and validated data provided by thousands of real-world deployments. The results showed that Pure Storage solutions deliver 1.4X to 2.6X greater total storage efficiency than the alternative all-flash, hybrid, and CI/HCI systems that are currently deployed in today’s health care, financial, and FED/SLED environments.

We then leveraged the validated storage efficiency information collected from our research study, along with our public and industry knowledge of economics and technologies, to create a TCO/ROI model that compares the costs and benefits of deploying, managing, and supporting storage capacity over a three-year period. We used this data to help model the expected TCO for the typical storage requirements in each vertical, and found that Pure provided the lowest expected TCO \$/GB when compared with the status quo of each of the listed storage technologies.

TCO \$/GB is an important metric that all health care, FED/SLED, and financial organizations should be considering when making storage purchases since it takes into consideration all costs that will be incurred as well as some of the operational benefits that can be realized. ESG suggests that every organization perform its own TCO \$/GB projections and comparisons before making a buying decision. ESG validated that Pure Storage provides improved efficiency and cost savings versus alternative storage technologies and should certainly be considered by any organization looking to get the most from every GB of its storage investment.

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