ESG Economic White Paper

The Economic Benefits of Dell EMC PowerMax Compared to Alternative NVMe Solutions

By Aviv Kaufmann, Senior IT Validation Analyst; and Kerry Dolan, Senior IT Validation Analyst

September 2019

Executive Summary

Organizations must leverage technology innovations to speed digital transformation, as they strive to improve operational efficiency, provide a better customer experience, and develop innovative products, services, and business models. As data becomes recognized by many organizations as an increasingly valuable asset, more attention must be paid to where data resides, how it is managed, and how it is protected. Legacy storage platforms are often unable to meet the requirements of modernized workloads, which are necessary to gain competitive advantage in this highly competitive landscape. However, transforming and modernizing the data storage environment enables organizations to strengthen and differentiate their business by unlocking the value of their greatest asset: that which Dell EMC refers to as data capital.

ESG developed two analyses comparing Dell EMC PowerMax, a next-generation storage architecture powered by Intel Xeon Scalable processors with end-to-end NVMe capability, with another leading all-NVMe storage array based on legacy storage foundation. In both the small manufacturing company and large, growing financial organization scenarios, PowerMax demonstrated its ability to provide significant CapEx and OpEx savings, as well as economic benefits related to improved productivity and reduced business risk. These advantages stem from PowerMax's architecture and software features, offering customers a high-speed lane to digital transformation. ESG's modeled scenarios result in a three-year total cost of ownership for Dell EMC PowerMax that is between 9% to 35% lower than the competing all-NVMe solution.

Introduction

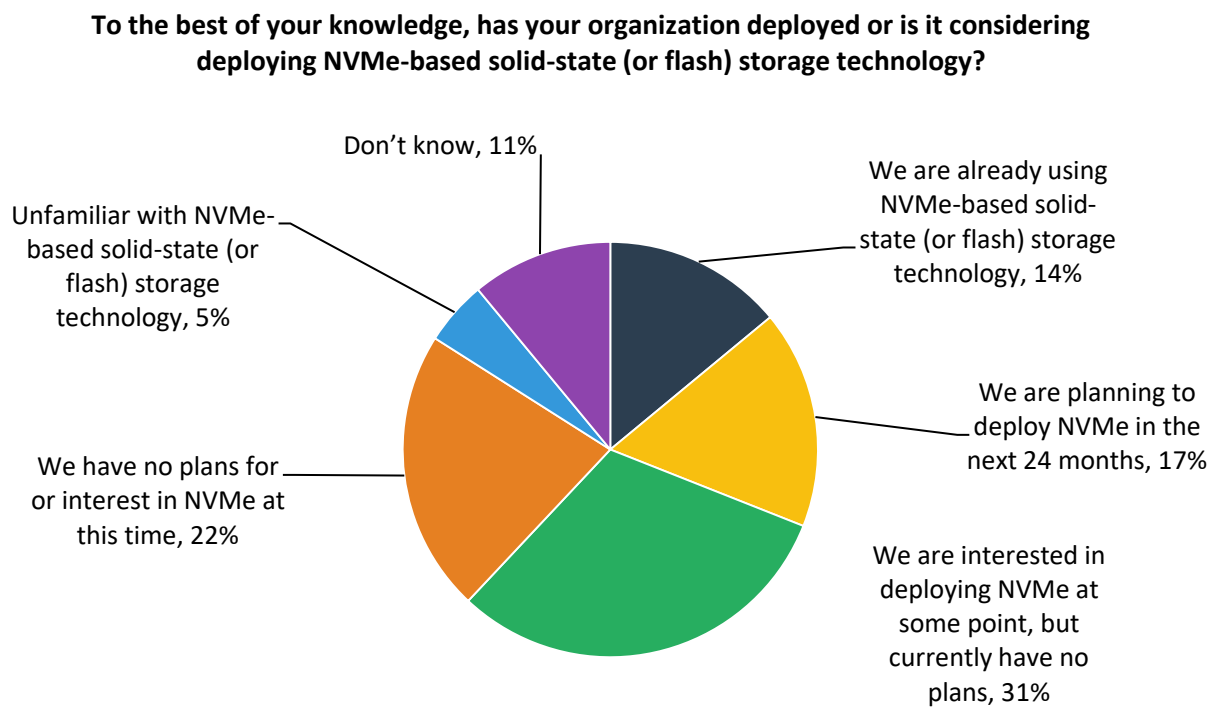
This ESG Economic White Paper focuses on the quantitative and qualitative benefits organizations can expect from Dell EMC PowerMax, whose next-generation architecture enables them to take full advantage of NVMe technology for performance, efficiency, scalability, availability, and low total cost of ownership (TCO). These benefits are demonstrated in this paper via comparison between the Dell EMC PowerMax all-NVMe platform powered by Intel Xeon Scalable processors with its next-generation storage architecture and a leading competitive all-NVMe solution based on traditional storage architecture.

Challenges

Digital transformation is not a buzzword, but a key objective across the business landscape. Organizations must maximize the value of their data through modernization of their infrastructure to innovate and compete, or they'll be left behind. A key part of leveraging this Data Capital is faster data access and application performance, to speed tasks such as data analytics that can shape successful business strategies, database transactions, virtualization, etc. Storage array performance is critical to that objective; high performance arrays work more intelligently, scale more easily to meet unpredictable demands, and operate more cost-efficiently.

While solid-state drives (SSDs) brought significant performance improvements, the non-volatile memory express (NVMe) protocol changed the game by enabling parallel I/O operations for maximum SSD performance and lowest latency. It is gaining ground quickly; when ESG last surveyed IT professionals on this topic at mid-range and enterprise organizations in North America, 14% were already using NVMe-based SSDs, another 17 % were planning to deploy them, and 31% were interested (see Figure 1).[1]

Figure 1. Use of NVMe-based Solid-state Storage



Source: Enterprise Strategy Group

[1] Source: ESG Brief, *Flash Storage: Growth, Acceptance, and the Rise of NVMe*, September 2017.

However, it's not enough to simply install NVMe drives and increase the speed of host connectivity while still relying on legacy controller resource ownership models. Organizations need a true scale-out storage platform that uses today's innovations to deliver high performance along with cost-efficiency, scalability, high availability, and security.

The Solution: Dell EMC PowerMax, Powered by Intel Xeon Scalable Processors

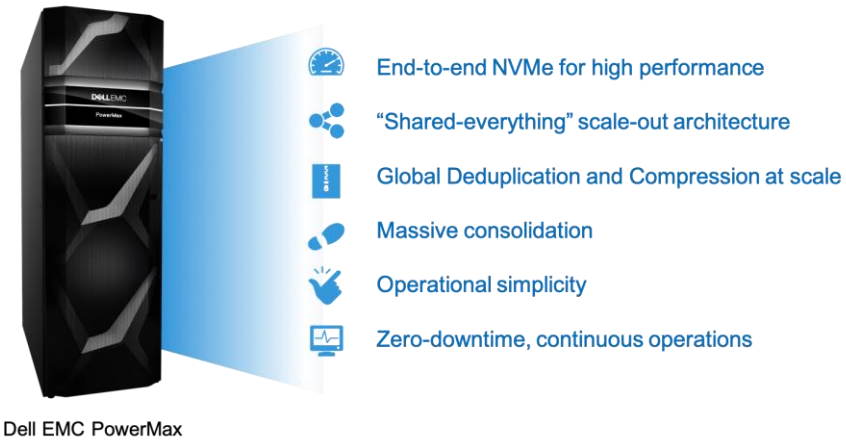
Dell EMC PowerMax delivers performance without complexity to power the most critical and demanding apps of today and tomorrow through the unique combination of powerful architecture, simple operation and trusted innovation. This next-generation storage platform features end-to-end NVMe for maximum performance; this includes NVMe flash drives, and future support for NVMe-over-fabric host connectivity and storage class memory (SCM). Dell EMC boasts up to 15M IOPS, 350 GB/s bandwidth, and 230 microsecond latency for mixed workloads on PowerMax. Service-level QoS options enable application-based latency settings. A key benefit is that higher, predictable performance enables more workload consolidation, shrinking the hardware footprint for lower power consumption and lower TCO.

PowerMax was built for massive scale and consolidation to handle a wide variety of workloads. The multi-controller, scale-out design supports open systems, mainframe, IBM i, and file storage all on the same array, eliminating the cost of multiple storage devices to buy and manage. It scales to 4 PB of effective capacity, and is a true scale-out array, with a shared resource architecture that distributes memory and storage provisioning across all controllers. Two models are available: the PowerMax 2000, ultra-dense for mission-critical and performance-driven workloads, and the PowerMax 8000 for even higher performance plus massive scale and consolidation.

Other features make PowerMax a step ahead. These include:

- *Built-in machine learning* (ML) for automated data placement. PowerMax can analyze 40M data sets in real-time with no overhead, using predictive analytics and pattern recognition to make over six billion decisions per day to ensure optimal data placement without additional storage administration overhead.
- *Efficiency* features include inline global deduplication and compression for up to 5:1 data reduction; space efficient snapshots; and thin provisioning. These features reduce both storage and management costs.
- *Designed for six-nines availability* to maintain production operations. This includes best-in-class data protection with SRDF active-active remote replication; space-efficient SnapVX local snapshots; recovery to any point in time; and direct backup to Dell EMC Data Domain. Non-disruptive data migration also keeps production operations running and costs down when moving legacy storage to PowerMax.
- *Data security* with hardware encryption, secure snapshots, and tamper proof audit logs.
- *Simplified management* with Unisphere for PowerMax, a modern user interface that reduces the time and costs to provision, manage, and monitor storage assets. CloudIQ software provides *proactive health checking and predictive analytics from any web-browser or mobile device*.
- *Powerful Xeon Scalable Processors* – both the PowerMax 2000 and PowerMax 8000 are powered by the latest generation Intel Xeon E5 processors, with up to 18 cores per socket to provide plenty of compute headroom for storage-related functions and offloading deduplication, encryption, and compression to maximize compute power.

Figure 2. PowerMax Delivers IT and Business Efficiency



Source: Enterprise Strategy Group

ESG Economic Validation

ESG completed a quantitative economic analysis that compared the Dell EMC PowerMax, a next-generation storage architecture powered by Intel Xeon Scalable processors with end-to-end NVMe capability, with another leading all-NVMe storage platform based on traditional architecture.

ESG's Economic Validation process is a proven method for understanding, validating, quantifying, and modeling the economic value propositions of a product or solution. The process leverages ESG's core competencies in market and industry analysis, forward-looking research, and technical/economic validation.

ESG Analysis

ESG leveraged information collected through vendor-provided material and public/industry knowledge of economics and technologies to create two three-year TCO/ROI models that compare the costs and benefits of Dell EMC PowerMax with a leading all-NVMe vendor based on traditional storage infrastructure. Scenario #1 describes TCO for a small manufacturing organization; Scenario #2 describes TCO for a large financial organization. Publicly available price lists and standard discounts were used.

Scenario #1: Small Manufacturing Organization

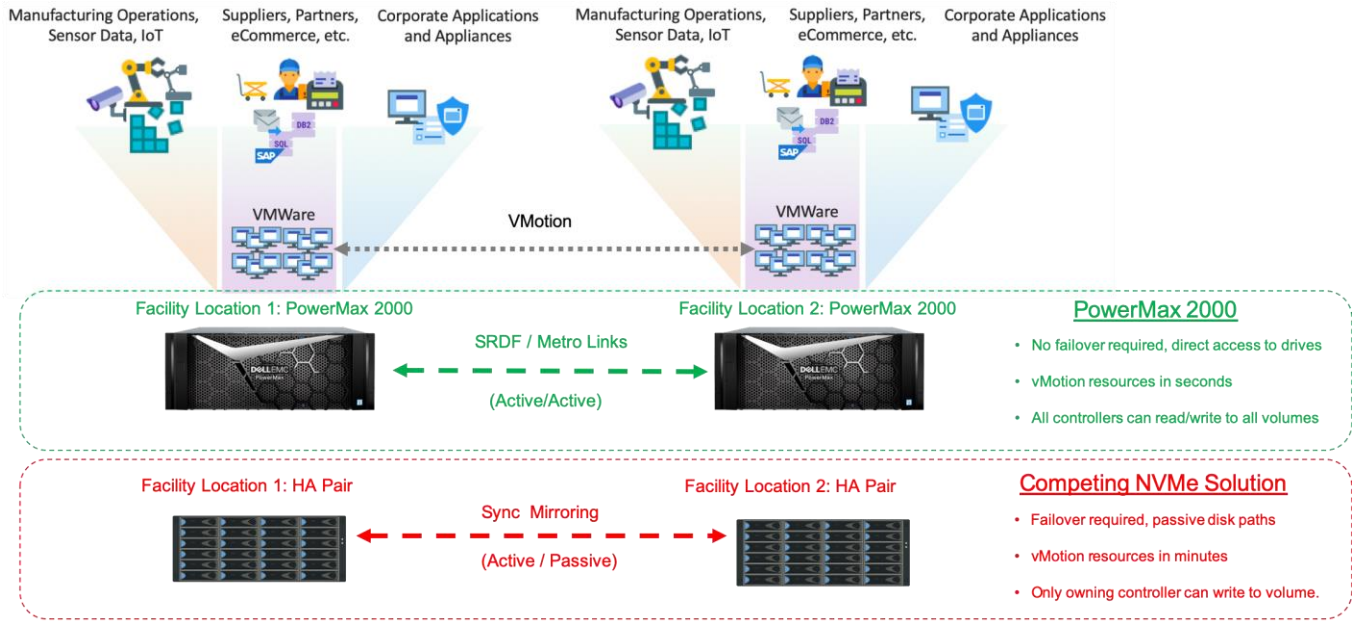
The first modeled organization represented a manufacturing company with a PowerMax 2000 at two active/active data centers, operating manufacturing, database, and corporate applications and virtual appliances. ESG's model assumed that the company moved virtualized resources between sites frequently using vMotion powered by SRDF/Metro, and that each data center required 188 TB of effective capacity. We assumed a 3.2:1 data reduction rate, resulting in usable capacity of 58 TB usable on each system; in addition, a 30% capacity buffer was assumed for oversubscription, snapshot space, and future growth.

Why This Matters

Traditional storage architectures cannot deliver the full functionality and cost savings available from innovations like NVMe.

The PowerMax shared resource scale-out architecture leverages end-to-end NVMe to improve performance, data availability, and cost-efficiency.

Figure 3. Small Manufacturing Organization Scenario: Configuration Comparison



Source: Enterprise Strategy Group

The competing solution used high availability (HA) array pairs at each location and could only operate in active/passive mode with synchronous mirroring. It should be noted that due to the need to allocate slightly more capacity for system-related functions, the competitive solution would only provide a 22.8% capacity buffer in order to fit into the same 24-drive count as PowerMax. Had we enforced the 30% requirement, the competing array would need to overprovision by deploying 12 more drives, or deploying larger capacity drives, and the PowerMax savings would have been even greater.

ESG noted several key differences between the two solutions. First, with PowerMax, both locations have direct access to all SSD drives, since the SRDF/Metro links support active/active operations. The competing solution, because it leverages a legacy controller/LUN ownership model, only supports active/passive mode with synchronous mirroring. Second, with PowerMax, data can be moved using vMotion without using a failover, and resources are available in seconds. This is not the case with the competing solution, which requires failover and manual failback operations in order to move data between the two locations. Third, with PowerMax, all controllers can read and write to all volumes across both locations. With the competing solution, only the controller that owns the LUN can write to the volume. This results in a more automated and higher performance DR solution for PowerMax, with many failover operations happening transparently to the end-user.

Key Savings Drivers

For the small manufacturing organization scenario, PowerMax 2000 delivered significant savings, primarily as a result of:

- ***Simplicity***. PowerMax is simpler to configure, tune, and manage, resulting in operational savings in administration and additional benefits of increased productivity and faster resolution of issues. The competing solution required many more administrative steps and manual monitoring, troubleshooting, and remediation of capacity and performance issues.

- ***Replication***. The PowerMax true active/active, scale-out solution allows volumes to be accessed by any controller, avoiding time-consuming failover/failback operations, and lowering RPO/RTO to seconds, rather than minutes. This resulted in significantly lower impact to operations and lower risk to the organization.

ESG found that the modeled organization could realize $1.06M in total savings and benefits over three years using the PowerMax all-NVMe solution compared with the competing vendor. This includes $206,772 from savings in hardware, software, licensing, support and maintenance, power, cooling, floorspace, and storage administration, and $855,845 in additional economic benefits due to higher productivity, shorter downtime, and reduced business risk.

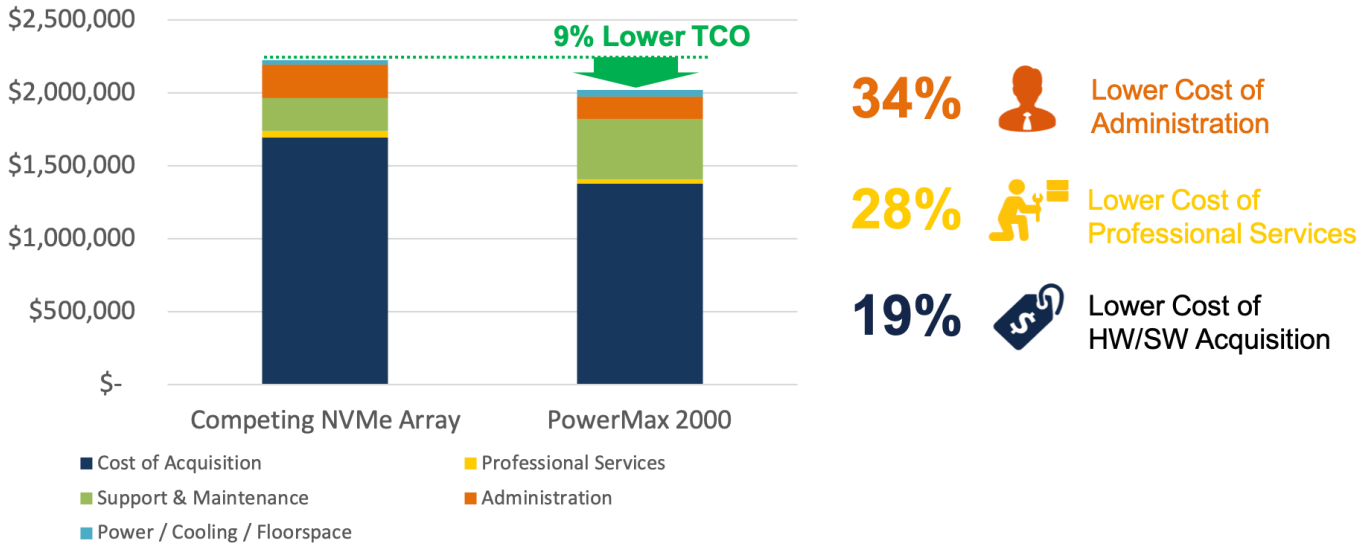
Figure 4. Small Manufacturing Organization Scenario: Three-year TCO Analysis Summary

Source: Enterprise Strategy Group

Savings Detail

In this scenario, over three years, PowerMax 2000 can deliver 9% lower TCO, including 34% lower cost of storage administration, 28% lower cost of professional services, and 19% lower hardware/software acquisition cost. The administrative savings come from the pre-configuration of the array, active/active deployment, the ability of all controllers to access all volumes, and PowerMax auto-load balancing and auto-tuning. There is also less data movement and administrative effort for sharing resources.

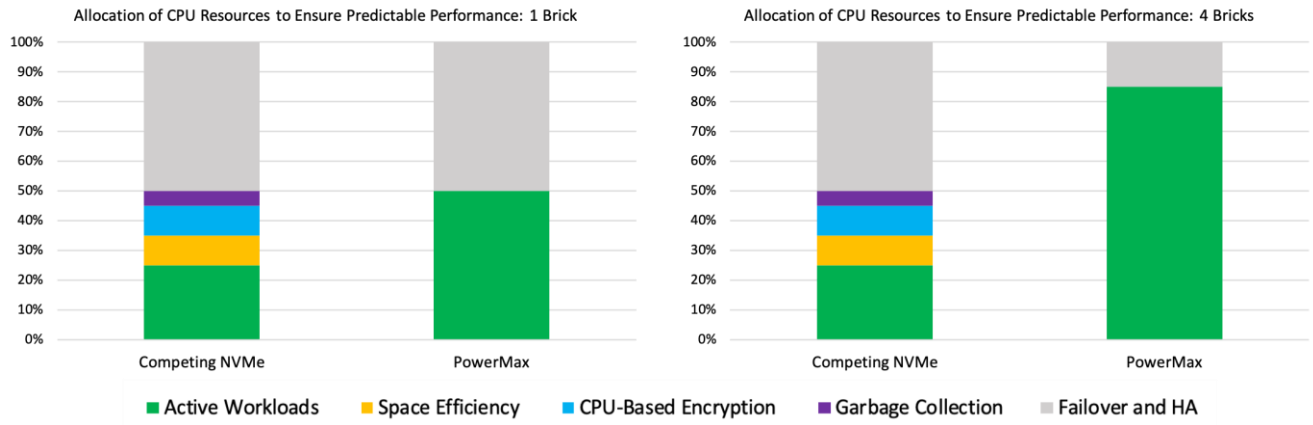
Figure 5. Small Manufacturing Organization Scenario: Expected Three-year Total Cost of Ownership



Source: Enterprise Strategy Group

When sizing for real-world workloads, PowerMax needs to provision less CPU headroom than the competing solution, maximizing the capabilities of the powerful Intel Xeon Scalable processors. The competing array requires more CPU cycles to handle SSD and file system garbage collection, encryption processes, and deduplication/compression. In contrast, PowerMax needs no garbage collection, and requires little to no CPU for the hardware-based encryption, deduplication, and compression. A standard practice to ensure that workloads are not interrupted is to allocate enough CPU headroom for a single controller to handle the entire workload for the system in case of a failover event. In a balanced HA controller pair or single PowerMax brick, this amounts to reserving 50% of the expected CPU cycles. As more bricks are added to the PowerMax, the workload handled by a single controller can be spread across all remaining controllers. As a result, while active workloads should be sized to 50% of CPU with a single brick, with more bricks, it can be sized up to 80% of the workload. By contrast, the legacy NVMe solution not only must reserve 50% for failover at all times, but because of the CPU cycles required to handle the functions as described above, should also be sized to as low as 25% of available CPU cycles to allow for failover and to prevent disruption to workloads and features (see Figure 6).

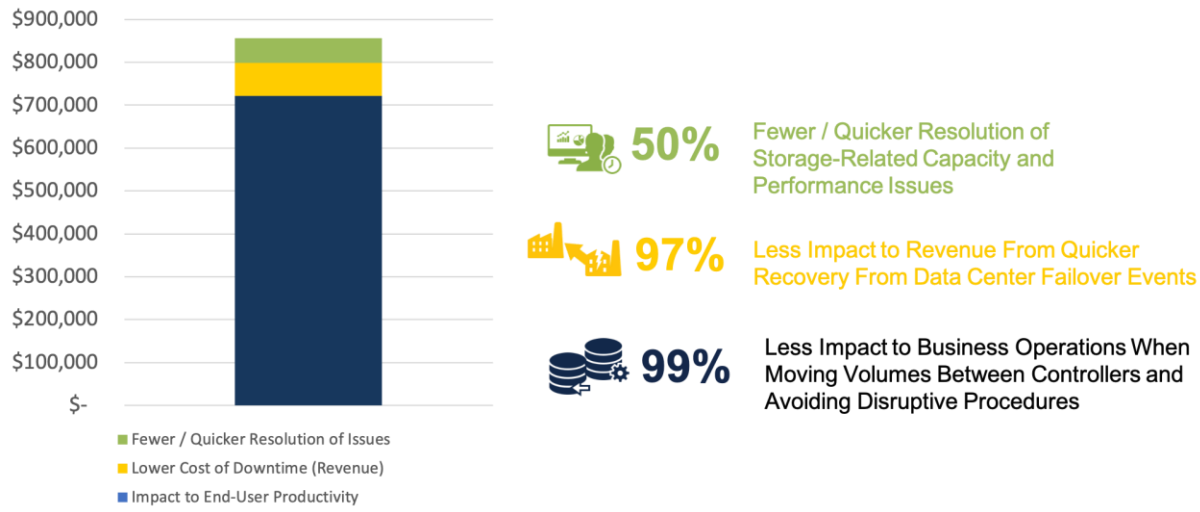
Figure 6. CPU Headroom Comparison



Source: Enterprise Strategy Group

In addition to providing a lower TCO, significant savings are possible due to PowerMax operational advantages as a solution, with 50% fewer/faster resolution of storage capacity and performance issues; 97% less impact to revenue from the faster automatic recovery from data center failover events; and 99% less impact to business operation by moving volumes between controllers non-disruptively. PowerMax's ability to access any data from any controller eliminates time-consuming failover and failback processes, while making data accessible.

Figure 7. Small Manufacturing Organization Scenario: Additional Expected Three-year Savings and Benefits

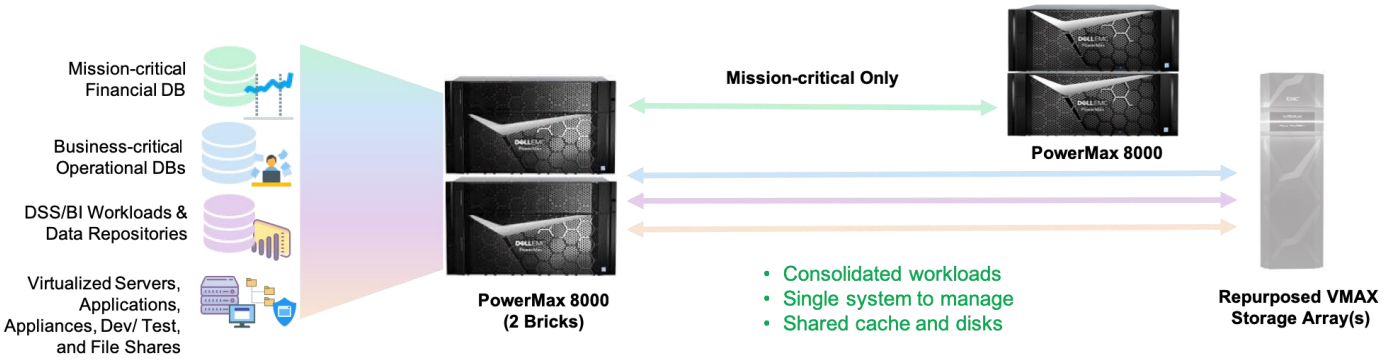


Source: Enterprise Strategy Group

Scenario #2: Large Financial Organization with Growth

The second scenario involves a large financial organization with a growth plan. The two-brick PowerMax 8000, powered by Intel Xeon Scalable processors, supports mission-critical and business-critical databases, decision support, dev/test, and virtual application servicers; the mission-critical databases are replicated to another two-brick PowerMax 8000 for maximum availability and performance, while the other applications are replicated to a repurposed Dell EMC VMAX. As in the previous scenario, workloads are consolidated across all PowerMax scale-out bricks, making administration simple and enabling access to all data from all controllers.

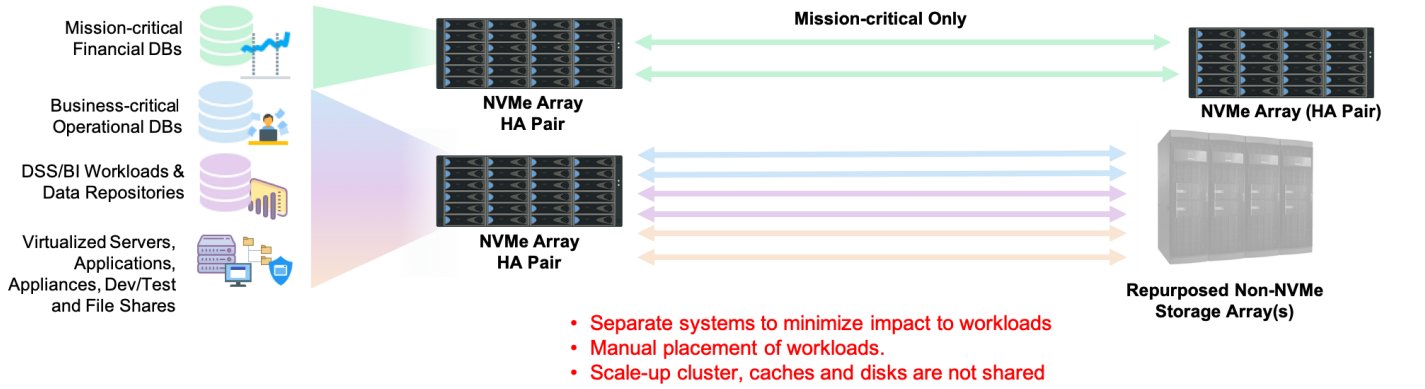
Figure 8. Large Financial Organization Scenario: PowerMax 8000 Initial Configuration (Before Growth)



Source: Enterprise Strategy Group

The competing all-NVMe deployment includes one HA array pair for the mission-critical databases, and another HA array pair for the other workloads. Although the entire system can be logically clustered to be managed through a single interface, this physical workload separation requires additional planning, management, balancing, and data manual placement, as in Scenario #1. Replication of mission-critical databases are done to an identical HA pair, while other workloads are replicated to repurposed non-NVMe arrays.

Figure 9. Large Financial Organization Scenario: Competing Array Initial Configuration (Before Growth)

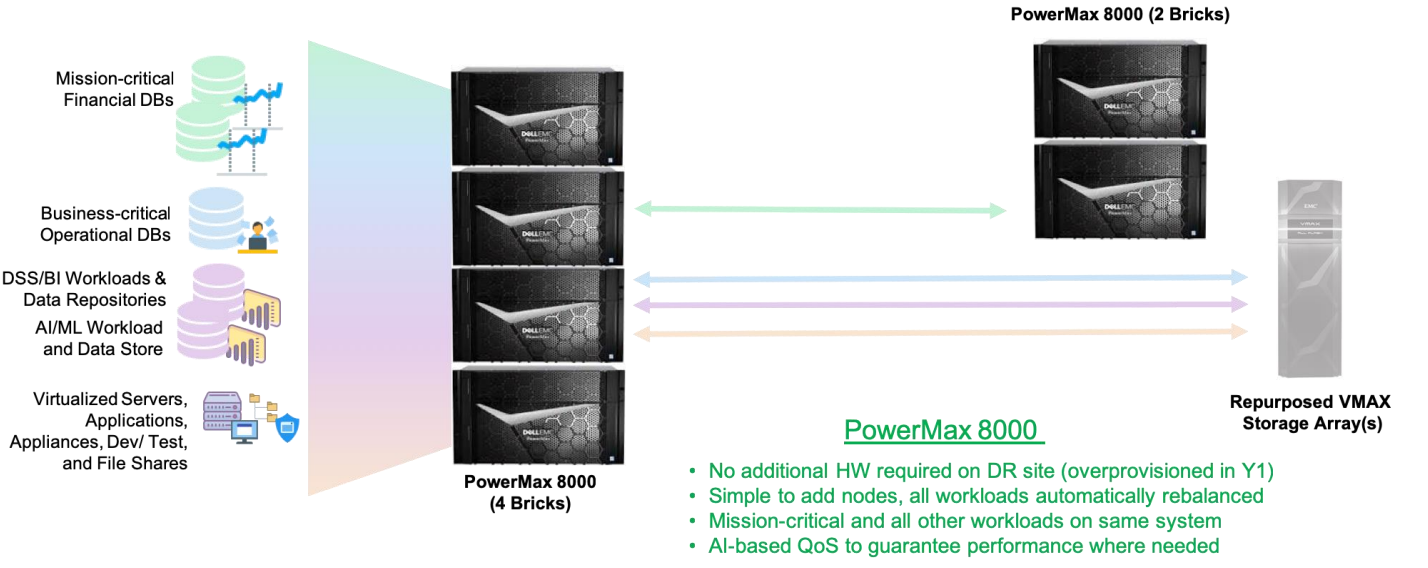


Source: Enterprise Strategy Group

Phase two of this scenario involves capacity growth in year two. The PowerMax deployment doubles to four bricks to support 20% mission-critical database growth; a second mission-critical database with 75% of the original database capacity, and the same performance; 20% capacity growth for business-critical and decision support/business intelligence databases; twice the virtualized application servers; the addition of a 200TB data lake and AI/MLworkloads; and 30% greater IOPS performance across workloads.

In this growth phase, two PowerMax bricks are added to the production site, but no additional bricks are required for the DR site. The initial two-brick system was able to handle that growth. Adding bricks is simple, and workloads are automatically rebalanced across all resources, so there is no additional administrative burden. All workloads remain consolidated on the array, with AI-based QoS to guarantee performance where needed.

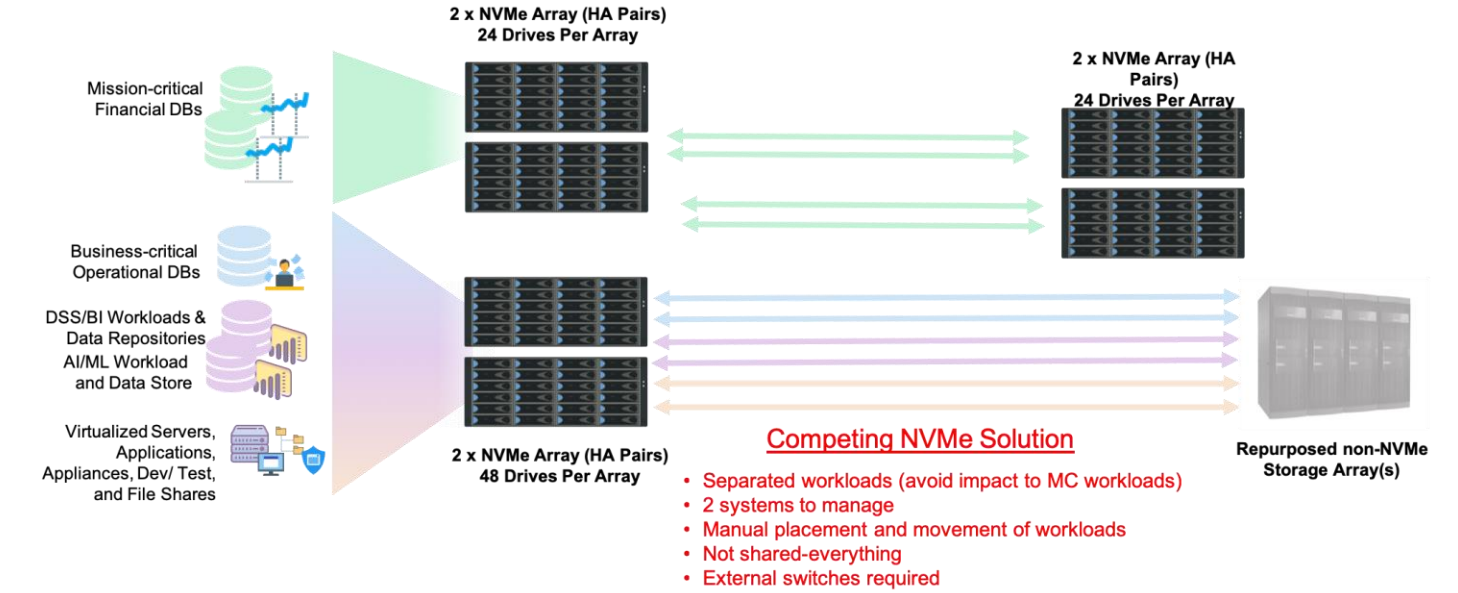
Figure 10. Large Financial Organization Scenario: PowerMax Growth Phase Configuration



Source: Enterprise Strategy Group

For the competing array without the shared resource scale-out architecture, workloads must remain separate to avoid impact on mission-critical applications. This also requires management of two HA pairs on each of the two logical systems. Placement and movement of workloads is manual, costing administrative effort. External switches are required for cluster/product functionality. Additional hardware is required to support replication, increasing deployment costs.

Figure 11. Large Financial Organization Scenario: Competing Array Growth Phase Configuration



Source: Enterprise Strategy Group

Key Savings Drivers

The PowerMax 8000 solution also delivers savings as a result of its simplicity, zero RPO/RTO replication, and CPU headroom advantages, as described in Scenario #1. Additional savings are a result of:

- *Scalability*. The PowerMax shared resource scale-out NVMe architecture is designed to scale without forklift upgrades or downtime. PowerMax is active-active everywhere and all caches and LUNs are shared. By comparison, the competing NVMe array is based on concatenating traditional scale-up architectures where cache and LUNs are owned by single controllers, resulting in the need for rigid planning and manual balancing of workloads and capacity, greatly increasing operational cost. PowerMax is also running the latest FC-NVMe and SCM technologies.

- *Consolidation.* PowerMax leverages ML algorithms and end-to-end performance optimization with PowerPath to automatically balance capacity and performance for mixed workloads. Mission-critical workloads can live on the same system as other workloads without impact, while the competing solution requires manual balancing of capacity and performance, and increased headroom requirements result in the need to overprovision and separate workloads for peak performance.

- *Efficiency.* PowerMax requires less physical capacity to meet the effective capacity requirements, as extra capacity is not required for garbage collection, write performance, snapshot reserve, copy overhead, or configuration limitations. PowerMax also deduplicates globally across all bricks, while the competing solution only deduplicates data owned by HA pairs. The capacity disparity is made worse by the need to separate mission-critical workloads on a dedicated system. This results in a lower cost of hardware, software, and licensing for PowerMax.

- *Availability.* PowerMax allows for true zero-impact NDU, allows for software to be downgraded, automates failover/failback and balancing operations, and offers RPO/RTO of seconds, rather than minutes. The competing solution requires forklift upgrades, failover during updates, and manual configuration of paths and failover commands. PowerMax users can expect to realize savings through avoidance of downtime and increased productivity.

In this scenario, ESG found that PowerMax delivers total savings of $4.74M over three years when compared with the competing array. This includes more than $3M in traditional CapEx and OpEx savings, and $1.7M in additional benefits realized through better productivity, shorter downtime, and reduced business risk.

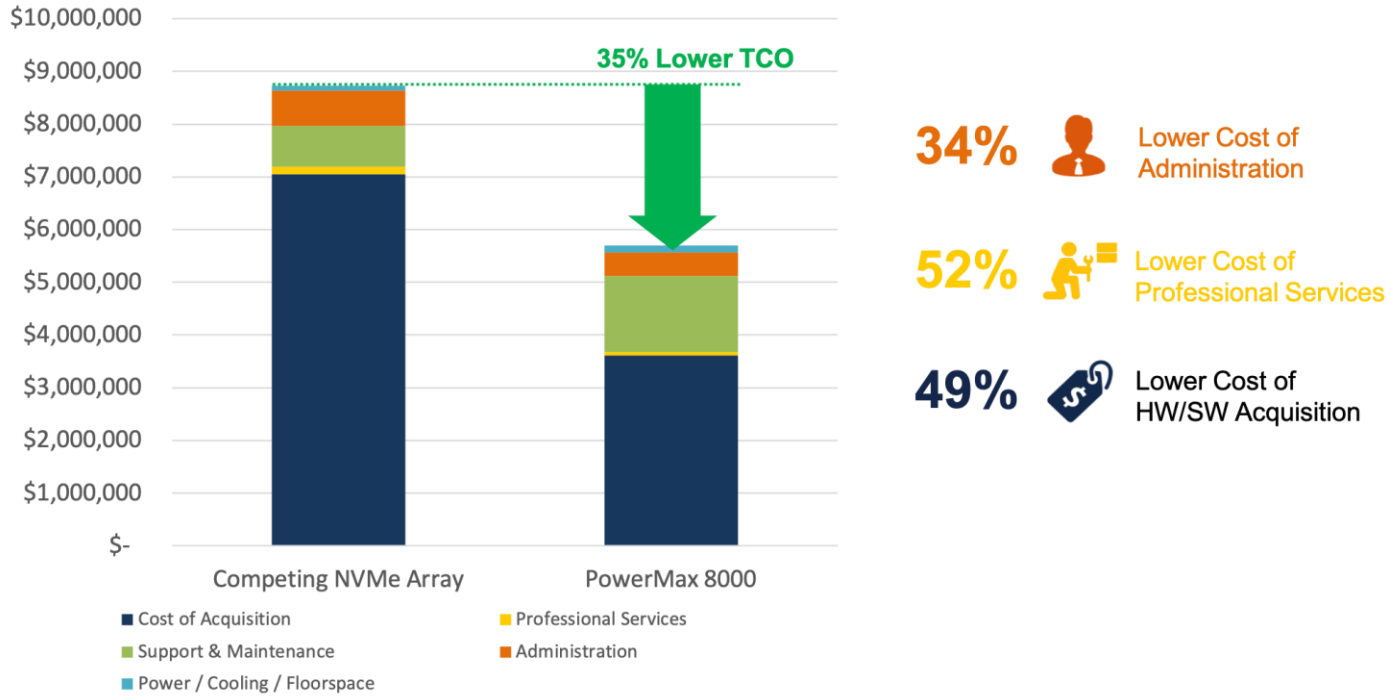
Figure 12. Large Financial Organization Scenario: Three-year TCO Analysis Summary

Source: Enterprise Strategy Group

Savings Detail

In this scenario, the PowerMax solution delivers 35% lower TCO than the competing array. This includes 34% lower administrative costs, 52% lower cost of professional services, and 49% lower cost of hardware and software.

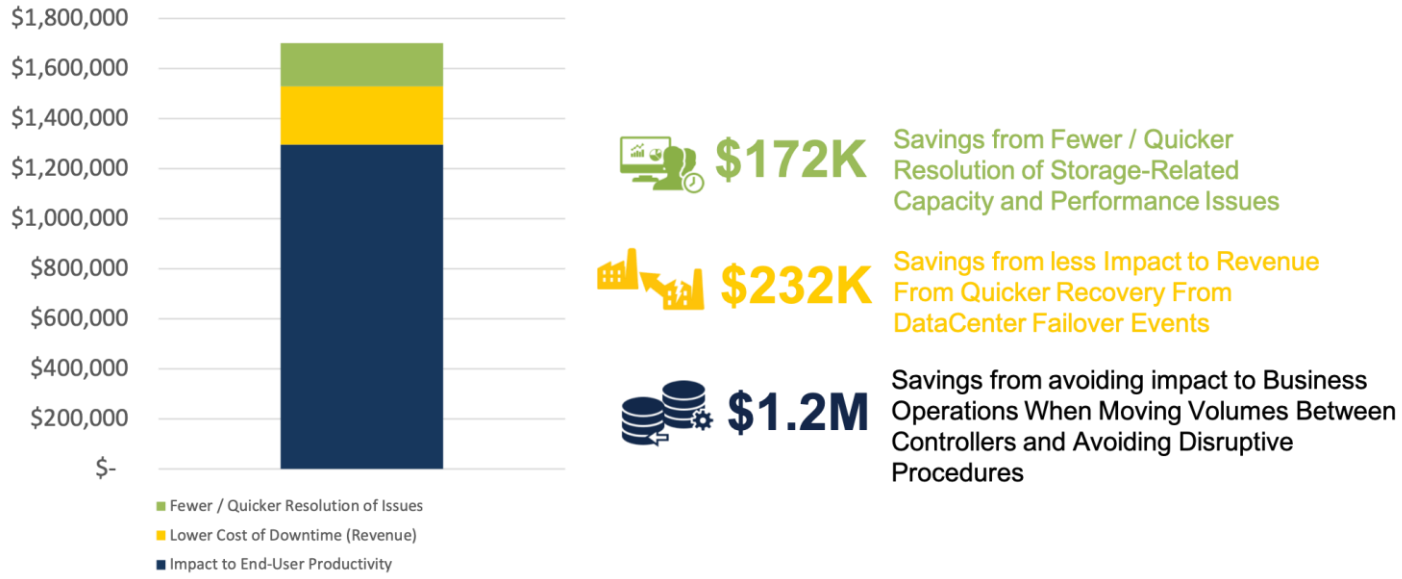
Figure 13. Large Financial Organization Scenario: Expected Three-year Total Cost of Ownership



Source: Enterprise Strategy Group

Additional savings and benefits include $172K in fewer/faster resolutions of capacity and performance problems, $232K from keeping revenue-generating activities in operation due to faster recovery from data center failover events, and $1.2M in savings by avoiding disruptive data movement activities.

Figure 14. Large Financial Organization Scenario: Additional Expected 3-Year Savings and Benefits



Source: Enterprise Strategy Group

The savings and benefits described in these examples were derived from valid, real-world scenarios. However, it is important to note that savings and benefits will vary depending on business requirements, so organizations should apply their own requirements when evaluating PowerMax. ESG recommends that each organization consider the categories and potential benefits and savings outlined in this report to perform their own analysis to better understand the potential savings.

The Bigger Truth

Advancements such as NVMe can greatly improve storage performance and functionality, but without the right foundation, the improvements are limited in scope. Even if a vendor updates the host and disk connections, placing NVMe drives on storage arrays that continue to utilize an HA-pair-based ownership model limits the capabilities provided by NVMe technology. This does not affect traditional benchmark performance metrics, but rather imposes limits on the scalability and operational agility of the system. With the ongoing shift toward essential digital transformation, organizations need tools that harness the power of the data and accelerate innovation to remain competitive.

ESG evaluated the benefits of Dell EMC PowerMax, a next-generation storage architecture that can fully leverage NVMe technology to improve performance, data availability, and cost-efficiency. Its end-to-end NVMe, scale-out architecture maximizes performance and minimizes latency, enabling organizations to consolidate more workloads, shrink their hardware footprint, provide enterprise-class data services with less administrative effort, and reduce TCO.

ESG performed two quantitative analyses to compare PowerMax, powered by Intel Xeon Scalable processors, with a legacy storage solution using NVMe technology. In a scenario using a small manufacturing organization, ESG found that over three years, PowerMax could deliver more than $1M in savings and benefits, including Capex, OpEx, increased productivity, and reduced business risk. For a scenario using a large financial organization with 20% growth in year two, the PowerMax advantage was $4.74M over three years, including more than $3M in CapEx and OpEx and $1.7M in benefits related to improved productivity and reduced business risk. Essential components of the PowerMax advantage include its high performance/low latency capabilities, automation and operational simplicity, scale-out architecture and active/active operations, massive consolidation with automated workload balancing, and efficiently delivered data services.

The real-world scenarios ESG looked at provide a glimpse into potential savings and benefits that Dell EMC's PowerMax can deliver by helping organizations use today's technologies to their fullest advantage. ESG recommends that organizations consider these categories and potential benefits when evaluating all-NVMe storage solutions based on their own business requirements.