Solution Showcase

The Business-level Value of Dell EMC PowerMax

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Abstract: It is now apparent that three specific technology advancements—non-volatile memory express (NVMe), NVMe over fabrics (NVMe-oF), and storage-class memory (SCM)—are transformative and will end up guiding the future of high-end data storage. Each of those technologies reduce I/O latency significantly.

However, organizations working to transform their data centers shouldn't regard performance as the only end goal. Great performance is important because it increases an array's ability to handle any workload intelligently, scale to meet unpredictable demand, and operate cost efficiently. The Dell EMC PowerMax is an impressive example of this type of modern storage architecture. It has been designed deliberately to maximize the speed of NVMe and by extension, offer transformational efficiency benefits and business value.

Introduction

Before a company can out-innovate, out-think, and out-pace its competitors, it needs the right tools. It cannot thrive using traditional, siloed data center technologies requiring manual processes to run the business. Those architectures have become unsustainable burdens. Digital businesses can no longer afford them.

Instead, they need technologies transformative enough to be able to handle increased IT demands and boost efficiency. The wonderful side-effect of incorporating such technologies is that valuable IT resources become free to drive larger-scale digital transformation efforts—efforts that empower the company to thrive in a digital economy.

Consider flash storage, already playing a role in propelling digital transformation. But using flash is just the beginning. Several new technologies —NVMe, NVMe over fabrics (NVMe-oF), and storage class memory (SCM)—extend flash's benefits. They can dramatically reduce I/O latency and thus fuel a surge in data center efficiency to meet the extreme demands of next-generation applications (such as real-time analytics). And it's about even more than flash—it's about maximizing the utilization of a modern infrastructure—the CPUs, GPUs, networks, and storage.

Just adding an ultra-fast silo to an already overburdened and complex data center won't help. It only increases cost and management burdens. To support digital transformation initiatives effectively, data storage platforms require not just speed, but also integrated intelligence, automation, and the ability to offer enterprise-class data services without compromise.

One of the most highly regarded vendors in the data storage industry, [Dell EMC](#), champions this position. Dell EMC has been engaging in a concerted effort to help its customers and prospects pursue digital transformation the right way. The vendor's revolutionary new [Dell EMC PowerMax](#) storage systems, powered by end-to-end NVMe, are key to that effort.

An NVMe and SCM-based Future

As mentioned, three fairly new technologies, NVMe, NVMe-oF, and SCM, are major enablers that can empower IT to take a storage infrastructure to the next level of modernization:

- **Non-volatile memory express (NVMe)** is an open logical device interface for accessing non-volatile storage media attached via a PCI Express (PCIe) bus or switch. NVMe is designed to give host hardware and software a way to fully exploit the levels of parallelism possible in modern solid-state drives and multi-core Intel Xeon processors. The NVMe specifications, first released in 2012, were developed by the NVM Express Workgroup representing more than 90 companies. EMC was among the first members. Less than two years later, Intel announced its first NVMe product. The earliest products to employ NVMe were consumer-grade PCs, then came commercial-grade servers. Enterprise-grade, dual-ported NVMe storage solutions have just hit the market.

  Storage decision makers are bullish about NVMe—79% of IT managers surveyed by ESG who were familiar with NVMe technology said they expect it to eventually replace traditional SAS- or SATA-connected solid-state flash storage.[1]

- **NVMe-oF** uses a transport protocol to connect remote devices over a network (as opposed to NVMe's direct PCIe bus or switch connections). This communication protocol enables one computer to access block storage attached to another computer via remote direct memory access over a number of transport protocols such as FC, TCP/IP, or InfiniBand. The broader NVMe-oF standard was published in 2016, and earlier this year the Fibre Channel Industry Association (FCIA) published the industry's standard for FC-NVMe, NVMe-oF over Fibre Channel. Additionally, multiple Fibre Channel interconnect (i.e., HBA and switch) vendors claim their current generation products are NVMe-oF (FC-NVMe) ready.

- **SCM** is truly next-generation media that just may do to flash what flash did to spinning disk. It is the result of the IT industry's desire to create something nearly as fast as dynamic random access memory (DRAM), but with the capacity, economics, and persistence of NAND flash memory. And although it is a bit slower than DRAM, unlike DRAM, it preserves stored data even when power to an array is off. SCM is widely perceived to be one of the most potentially disruptive and impactful storage technology innovations to arise in recent years.

Dell EMC PowerMax

The PowerMax architecture boasts many powerful characteristics. It has the ability to scale out and up with a multi-controller architecture. It leverages end-to-end NVMe. It is resilient; it provides greater than six-nines availability, and it is efficient—able to support in-line global dedupe, compression, and SRDF replication. Operating the PowerMax appears to be simple as well, thanks to its ability to consolidate block, file, mainframe, and IBM i data on one system. The array comes with a built-in/real-time machine learning engine, CloudIQ cloud-based analytics monitoring, and controller-based data-at-rest encryption. Dell EMC also offers investment protection, including seamless migration and non-disruptive upgrades.

PowerMax and Dell EMC's previous-generation flagship storage product feature some architectural differences. NVMe flash drives now provide the majority of a PowerMax array's capacity, with SCM supporting the most demanding low-latency apps. The built-in machine learning engine is equipped with predictive analytics and pattern recognition capabilities which automatically places data on the correct media based on I/O profile. PowerMax is also offered with FC-NVMe connectivity.

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[1] Source: ESG Master Survey Results, _2017 General Storage Trends_, November 2017.

A Step Ahead of Others

Unlike PowerMax, other early-to-market arrays with NVMe came with compromises.

Some vendors decided to enable NVMe only at the path to the high-performance cache in their array, thus limiting the value of NVMe. Some decided just to add minimal array software to off-the-shelf hardware. The result of their approach was an array that was fast but lacking in basic data services such as snapshots or replication. Others took a proprietary approach in an effort to bring their NVMe-based product to market faster. That was perhaps an acceptable short-term strategic decision, but they may find it harder to innovate their arrays with new media types in the future.

Importantly, all those approaches *introduced complexity* as well. They all created a separate silo of storage for high-performance apps. Dell EMC took a different approach. Its position is that only PowerMax delivers NVMe with no compromises—a result of its multi-controller, scale-out architecture, end-to-end NVMe (NVMe-oF, dual-ported NVMe-based drives and NVMe-based DAE), and the fact that it is built on cutting-edge industry-standard technology.

PowerMax comes in two new models that both run PowerMaxOS:

- PowerMax 2000—an ultra-dense data storage platform to house mission-critical/performance-critical workloads.
- PowerMax 8000—designed for massive-scale, enterprise-level consolidation. It can mix open and mainframe block and file workloads.

Both models, built for simplicity, come with straightforward appliance-based software packaging. The Essentials software package includes SnapVX, non-disruptive migration tools, QoS, compression, dedupe, and iCDM Basic (AppSync, an advanced copy management software application). The Pro package adds SRDF, eNAS, D@RE (data-at-rest encryption), PowerPath, iCDM Advanced (AppSync), and SRM. RecoverPoint and PowerProtect Storage Direct are also available as options.

Key Technical Differentiators

The End-to-end, NVMe-based Scale-out Architecture

PowerMax performance numbers are excellent. Dell EMC states that it offers up to 15 million IOPS, speed of 350GB per second, plus three times the performance density and up to 50% better response times than the predecessor VMAX All Flash system. It is also important to emphasize that PowerMax boasts a true scale-out architecture with global memory and storage provisioning across all 16 controllers compared with federated clusters. Deployments can start small at 13TB, and scale with demand.

PowerMax is a different brand, but it does leverage the VMAX technology. In general, Dell EMC's engineers made sweeping changes and improvements to the hardware and software functionality in a "two-pronged effort." They were (1) aiming to create a system that can possess dramatic performance, and (2) establishing an architecture that would efficiently leverage NVMe-oF and SCM technologies.

Artificial Intelligence for Autonomous Storage

PowerMax has a built-in machine learning engine (see Figure 1), which leverages predictive analytics and pattern recognition to place data on the correct media automatically according I/O profile.
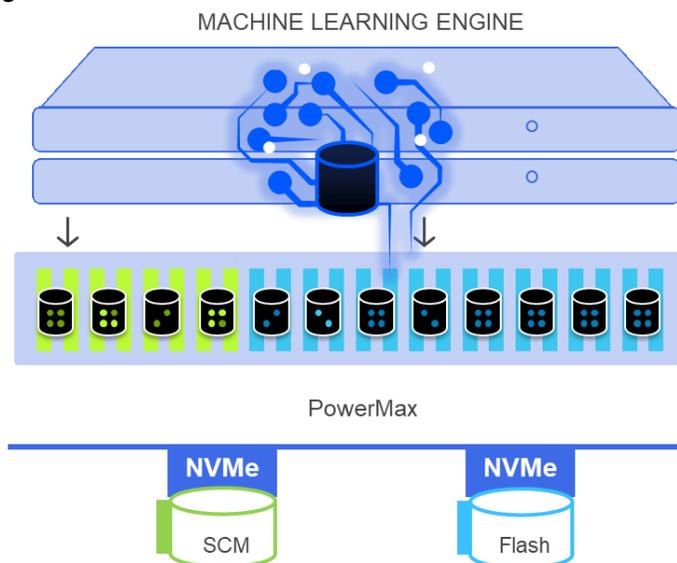
Dell EMC PowerMax

- Scales up to 4 PB and 256 front-end ports.
- Scales out to 8 PowerMax Bricks.
- Greater than 6x9s availability.
- Up to 15M IOPS with PowerMax 8000, and 2.7M IOPS with PowerMax 2000.
- 7.5M IOPS per floor tile.
- 187K IOPS per U.
- Built-in machine learning engine.
- Covered as part of the Dell EMC Future-Proof Loyalty Program.

Figure 1. PowerMax Machine Learning

Real time machine learning

PowerMaxOS brings autonomous storage to life

MACHINE LEARNING ENGINE

- Leverages predictive analytics and pattern recognition
- Analyzes and forecasts **40 Million** data sets in real-time[1]
- Driving **6 Billion** decisions per day to maximize performance with no overhead[2]

PowerMax

[1]Based on Dell EMC internal analysis of PowerMax with 200TB of capacity, July 2019
[2]Based on Dell EMC internal analysis of a single PowerMax 2000 or 8000 array, July 2019

NVMe — SCM

NVMe — Flash

DELLEMC

Source: Dell EMC

Dell EMC has run detailed tests on this capability. It informs ESG that a typical 200TB PowerMax array can analyze and forecast 40 million data sets in real-time—driving, each day, 6 billion decisions about:

- Where to place data.
- Which data should be compressed or deduplicated.
- Which QoS service levels need more performance.

With its automatic I/O recognition and data-placement intelligence, PowerMax maximizes performance without incurring extra overhead. This level of AI-based detailed analysis is only possible thanks to the latency improvements and end-to-end NVMe-based architecture designed into the product.

Notably, the vendor now includes CloudIQ cloud-based monitoring and storage analytics into its high-end hardware. CloudIQ previously was available only in Dell EMC's midrange storage. The value of CloudIQ is centered on its ability to give users new and valuable insights into the health of the storage system. It proactively monitors and measures overall health using intelligent, comprehensive, and predictive analytics—and that makes it easier for IT to identify storage issues quickly and accurately. These analytics (which admins can access from anywhere through a web interface or mobile app) can drive business decisions that could lower the organization's total cost of ownership associated with the array. The monitoring abilities of CloudIQ are praised by organizations currently using it for its ability to facilitate higher uptime, increase performance, improve data protection, and support effective configuration and capacity-planning efforts. CloudIQ is free and included with PowerMax arrays.

Enterprise Tier-0 Data Services

Building on its VMAX legacy, PowerMax offers a rich set of enterprise-level tier-0 features. SnapVX, SRDF, and ProtectPoint deliver mission-critical data protection and resiliency. AppSync, copy data management, integrates with other Dell EMC storage systems to extend PowerMax's data protection capabilities while simultaneously enabling data to be repurposed for test and development or analytics. Furthering its ability to support enterprise-wide workload consolidation, PowerMax

also features embedded NAS, data-at-rest encryption, non-disruptive upgrades, seamless data migration, greater than six nines availability, and service-level-based management.

Dell EMC has also introduced great efficiency enhancements, with in-line, global dedupe and enhanced compression that is hardware optimized to not compromise performance. PowerMax's data reduction technology offers granular control with the ability to be enabled, or disabled, per application and is integrated with all PowerMax data services. The net result provides a significant efficiency boost as data services, such as those for data protection, only move or store data in its optimized form, with no negative impact to performance.

The Future-Proof Loyalty Program

The Future-Proof Loyalty Program is Dell EMC's customer program that provides investment protection with a set of technology capabilities and programs that enable Dell EMC's storage products to provide value for the lifetime of the customer's applications. It is different because it is available to customers at no additional cost—it comes with no higher maintenance prices or higher product prices. For PowerMax, the program consists of the following offers:

- A three-year satisfaction guarantee.
- A 5:1 storage efficiency guarantee.
- Never-worry data migrations.
- Hardware investment protection.
- All-inclusive software.
- Predictable support pricing.
- Flexible cloud consumption models.
- Cloud-enabled architectural features.

Transformational Benefits for a Digital Business

PowerMax and its performance, efficiency, and availability capabilities could offer transformational benefits to an organization at a business level. PowerMax's features appear to set the bar for modern storage, and those features can mean a lot to the organizations using it:

- Its scalability and high availability through the multi-controller "shared everything" scale-out architecture would keep applications running without compromise and give organizations flexibility to expand capacity and performance on demand.

- Its efficiency through its in-line, global dedupe and compression would result in a smaller footprint and lower costs for power and cooling, thus driving a lower total cost of ownership.

- Its future-proof nature—thanks to its end-to-end NVMe, SCM, and non-disruptive migration capabilities—would make it ready for all current and future applications and workloads. That should give organizations greater investment protection and more peace of mind.

- Its operational simplicity encompassing block, file, mainframe, IBM i, machine learning, and cloud-based analytics would allow an organization to achieve massive multi-protocol consolidation. Time is money, and simpler administration with a few clicks from any device using the web interface or mobile app would give storage admins more time to focus on other strategic, value-add activities.

- Its always-on, 99.9999% availability with sync and metro replication would offer organizations essentially zero-downtime, fully continuous operation. Such a level of uptime would allow IT to adhere to even the tightest of SLAs.

Delivering IT and Business Efficiency

Benefits are associated with high-performing storage. Fast storage supports workload consolidation, shrinks hardware footprint, reduces power consumption, and thus lowers costs. Those gains lead to easier management, plus business benefits such as improved resource utilization. Users of high-performing (flash) storage surveyed by ESG say they are saving, on average, 24% in storage capital expenditures and 25% in storage operational expenditures.[2] That is a huge amount of money freed to support strategic projects and business opportunities.

Flash users reported saving 24% on CapEx and 25% on OpEx.

And from a day-to-day efficiency perspective, applications simply run faster. For example, users experience very quick responses when they run database queries. Thus, those users can run more queries, more quickly. Great performance also reduces time needed to diagnose and fix performance issues. And the ample headroom provided by really fast-performing storage will allow a growing organization to scale.

Delivering Infrastructure Consolidation and Reducing IT Complexity

An end-to-end NVMe-based architecture would provide transformational-scale potential, especially related to infrastructure consolidation. Many data centers are filled with disparate technologies, all cobbled together. IT's ability to consolidate them has been limited in part by storage performance bottlenecks.

But performance dramatically increases with the proper combination of NVMe, NVMe-oF, and SCM. The result would be a reduction in capital and operational costs associated with running a data center. Of course, consolidation is only really safe with an infrastructure that meets the highest reliability standards. PowerMax is rated for more than 99.9999% uptime.

PowerMax is a great consolidator of not just open systems, but also mainframe, IBM i, and file storage. An organization would achieve great efficiency benefits by using just one system image to manage tons of storage.

And notably, dedupe and compression are available on both PowerMax 2000 and PowerMax 8000. Without question, data reduction is beneficial to any business struggling with rampant data growth. Dell EMC anticipates a 3:1 data-reduction ratio on average for PowerMax, but that ratio may reach 5:1 or more with some applications.

With the added support of CloudIQ, PowerMax offers a cloud-based storage analytics platform that can centralize the monitoring of a PowerMax ecosystem, even one distributed across multiple sites. In addition, CloudIQ offers predictive analytics to optimize capacity and performance utilization, helping administrators make the proper adjustments as storage demands evolve. With proactive health alerts, CloudIQ identifies potential risks to the PowerMax ecosystem before they happen, allowing resolution to take place prior to an issue occurring. And CloudIQ monitoring can occur at your desk or on your mobile device to track PowerMax, VMAX, XtremIO, Unity XT, and SC arrays.

Enabling Business Opportunity

In a digital economy, IT services drive revenue and accelerate people's productivity. PowerMax delivers value in this area by setting up the business to thrive in a digital economy. Its exceptional performance means the whole organization is likely going to be able to leverage data faster and in more creative ways. For example, IT could spin up additional DevOps efforts quickly and efficiently or start expanding the company's use of business intelligence tools for a competitive edge.

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[2] Source: ESG Research Insights Brief, *Flash Storage Fuels IT Transformation*, May 2018.

And reclaimed budget money can be put toward projects to help the company thrive going forward. Shifted funds could support analytics to provide more timely insights, application development to better engage with customers, or even the development of advanced digital products and services to help the company break away from the competitive pack.

The Bigger Truth

In the past couple of years, Dell EMC increased its already-enormous commitment to hardware R&D and started racing ahead of the market. The result, we see now, is future-proof storage hardware that Dell EMC is dedicated to supporting, enhancing, and accelerating over the long run.

At the highest level, Dell Technologies is all about digital transformation. A big part of that strategy right now centers on using Dell EMC to help organizations transform their enterprise IT environments. Next-gen applications such as real-time analytics put huge demands on arrays, especially when combined with the demands of traditional applications. Dell EMC invented PowerMax specifically to handle those huge demands with its powerful architecture, simple operation, and trusted innovation. And the nice part is that although PowerMax was carefully designed to take organizations securely into a digital future, all of the rich, mature data services that came with VMAX are still there, too.

Dell Technologies has a strategy. Dell EMC is a major part of it. And within the strategy, the PowerMax platform has now been anointed as the future of Dell EMC high-end storage. This is an array that has the latest and greatest technology of today, plus a lot of headroom to support the high-demand applications of tomorrow.

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