StorageReview

JANUARY 2023

New Dell PowerMax Transforms Cybersecurity, Data Reduction, and Intelligent Automation

Intro

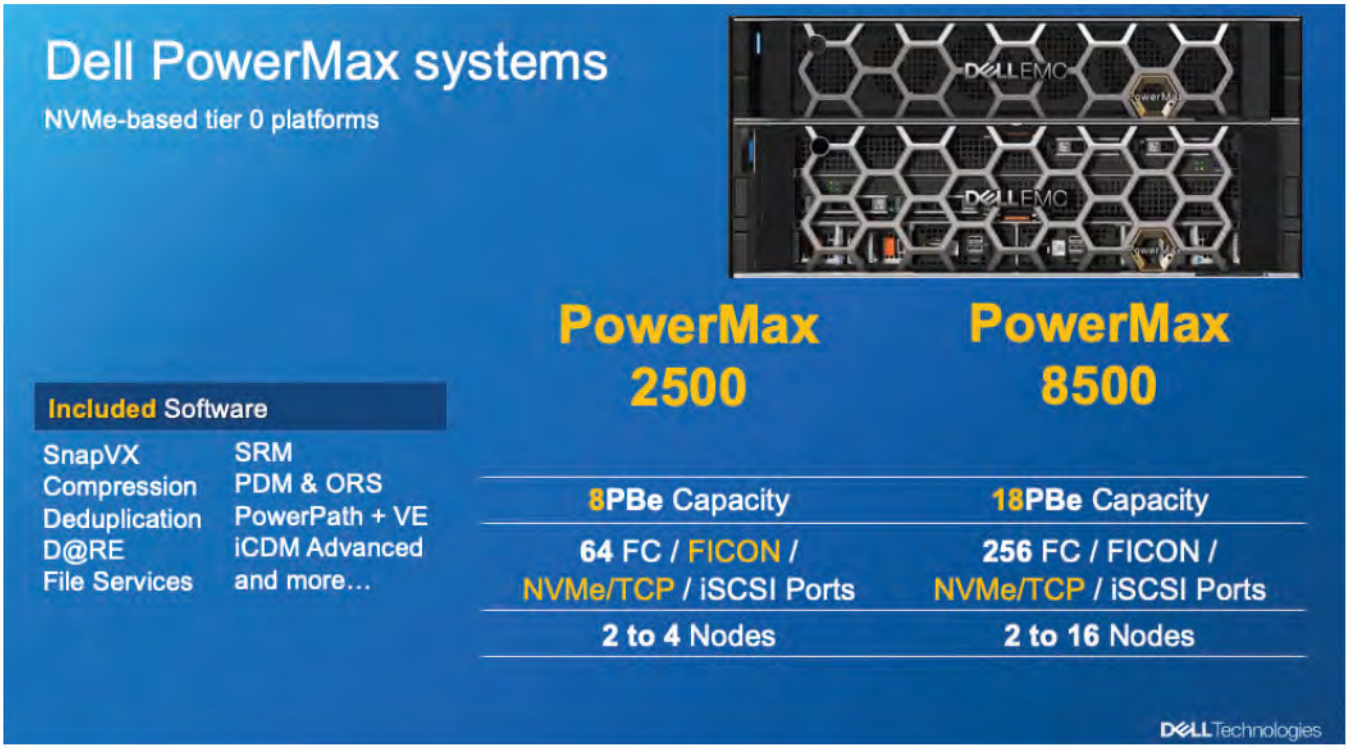
Dell PowerMax has been a constant in the primary storage space for decades. Mission-critical applications depend on the security and reliability of PowerMax. In fact, 95 of the Fortune 100 use PowerMax in their businesses.

This past summer, Dell launched the next generation of PowerMax and PowerMaxOS 10, with over 200 new features, including critical new cybersecurity and advanced automation. From the mainframe perspective, primary updates include the industry's first data reduction guarantee for mainframe and a series of cybersecurity and resiliency benefits.

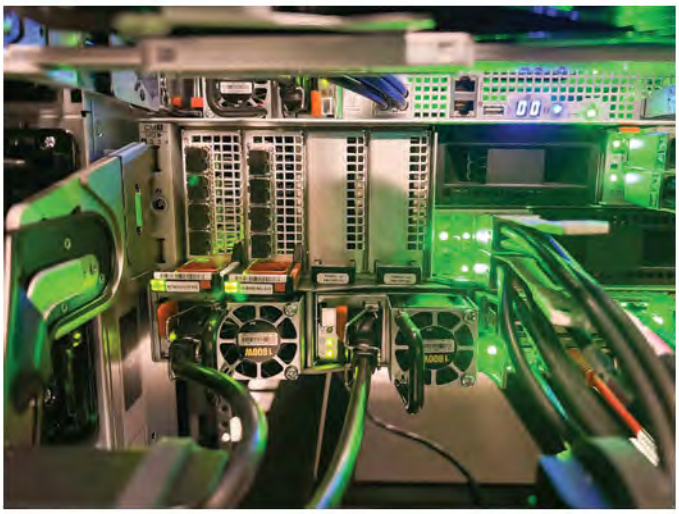
The tremendous growth in data retention has strained primary storage systems. Dell PowerMax has addressed this phenomenon by offering the industry's first data reduction for mainframe while advancing data reduction rates for open systems storage. PowerMax is the only solution offering a 3:1 data reduction guarantee and an improved 4:1 guarantee for open systems (non-mainframe) data.

Another significant PowerMax enhancement focuses on cybersecurity, and Dell has taken advantage of CloudIQ's alerting capabilities to detect attacks and minimize risk and exposure proactively. PowerMax offers up to 65 million secure snapshots to enable rapid recovery from a cyber attack. The next generation of PowerMax also benefits multi-cloud deployments by providing secure data mobility between cloud and on-premises data centers.

In addition to these significant software updates, Dell launched two new PowerMax units: PowerMax 2500 and PowerMax 8500. The new PowerMax systems offer inclusive software to simplify ordering. The 2500 is a powerhouse in a small footprint and scales to 8PBe of effective capacity (2PB physical). That is 7x more capacity in half the rack space than previous models. The 8500 delivers 2x faster performance, 50 percent lower response times, and scales to 18PBe of effective capacity (4.5PB physical). For mainframe, both units support IBM zHyperLink read for applications that demand the fastest connectivity via synchronous IO.



Dell PowerMax is unique in that it delivers efficient workload consolidation, consolidating mainframe and mainstream (open systems) enterprise (heterogeneous environments) and IBM i data types, and file in the same unit. Several technical elements are required to enable this, but the fact that one physical array can handle multiple data sets is important.



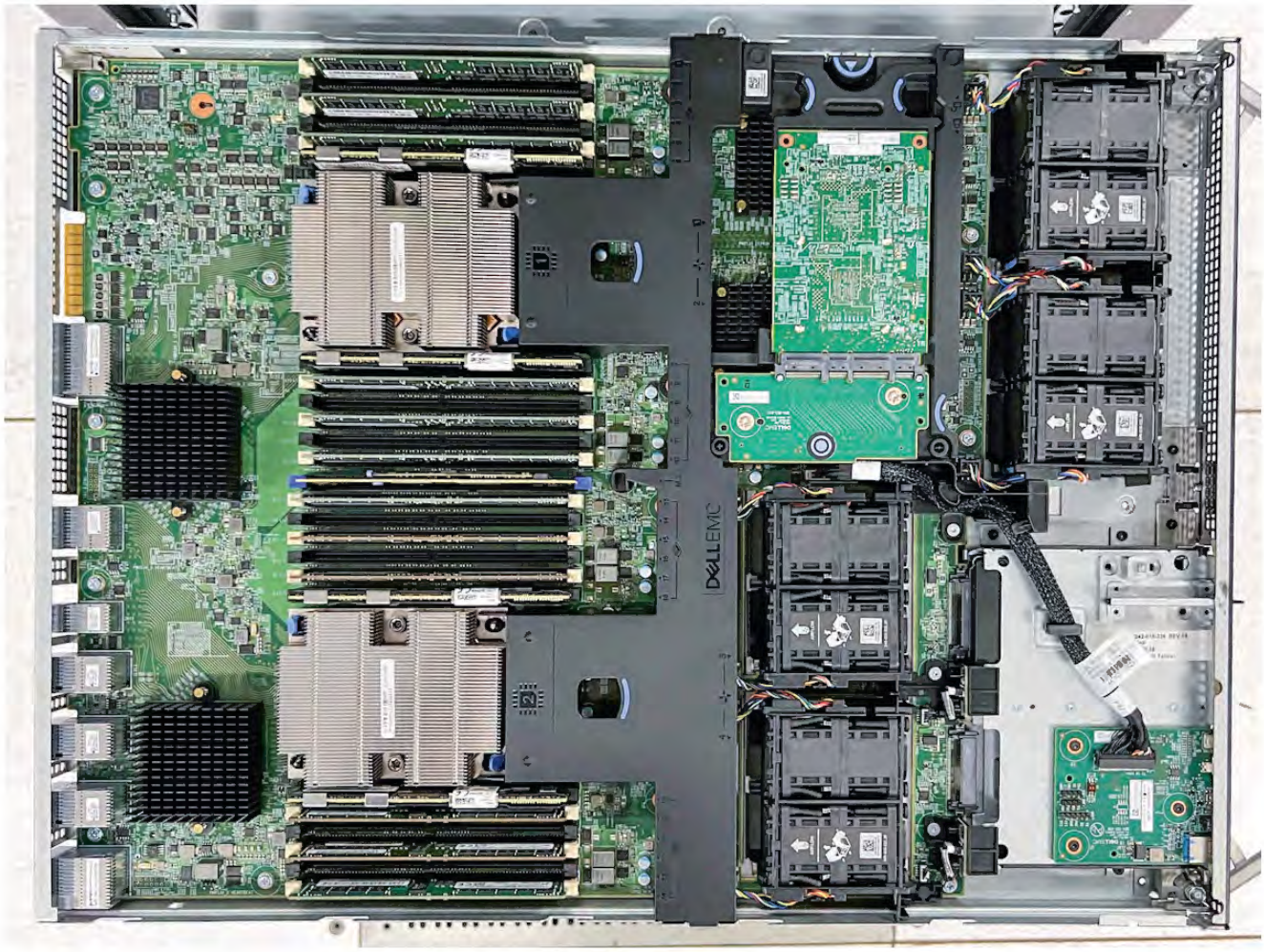
Owing to the fact PowerMaxOS code base can be implemented across different data types, the mainframe use cases stand to benefit from the overall investment Dell continues to make in PowerMax.

High-Performance and Increased Capacity in the New PowerMax 2500 and 8500

Dell has significantly enhanced the new PowerMax 2500 and 8500 storage arrays. Based on NVMe dynamic fabric technology, PowerMax eliminates traditional storage boundaries in performance, scalability, capacity, and security. Next-generation cloud-based applications and traditional workloads benefit from this new architecture.

The PowerMax 2500 is a compact, high-performance storage server, storing up to 7x more capacity (8 PBe) in half the rack space compared with the previous PowerMax 2000. Along with the high-efficiency design, the 2500 supports data services for heterogeneous environments, block, file, and virtual environments.

The PowerMax 8500 delivers outstanding performance at scale for demanding mixed workloads that require predictable performance and always-on availability while delivering up to 18 PBe capacity. The performance of the PowerMax 8500 is 2x faster, with 50 percent lower response times than the PowerMax 8000. Like the PowerMax 2500, the 8500 can easily consolidate open systems, mainframe, IBM i, file, and virtualized storage to simplify operations, significantly reducing TCO and increasing ROI.



The PowerMax 2500 and 8500 are the most energy-efficient enterprise-level storage platforms Dell has ever produced, delivering over 5x the effective capacity per watt consumed (PBe/watt) over the previous PowerMax generation.

The second-generation PowerMax models are more efficient, cramming 14x more capacity per rack unit, delivering 80 percent power savings per effective terabyte, doubling the performance, and cutting latency by 50 percent. With those numbers, PowerMax can significantly reduce TCO and increase ROI.

For a complete listing of PowerMax Specifications, download the PowerMax spec sheet.

More Efficient Modular Storage Hardware Platform

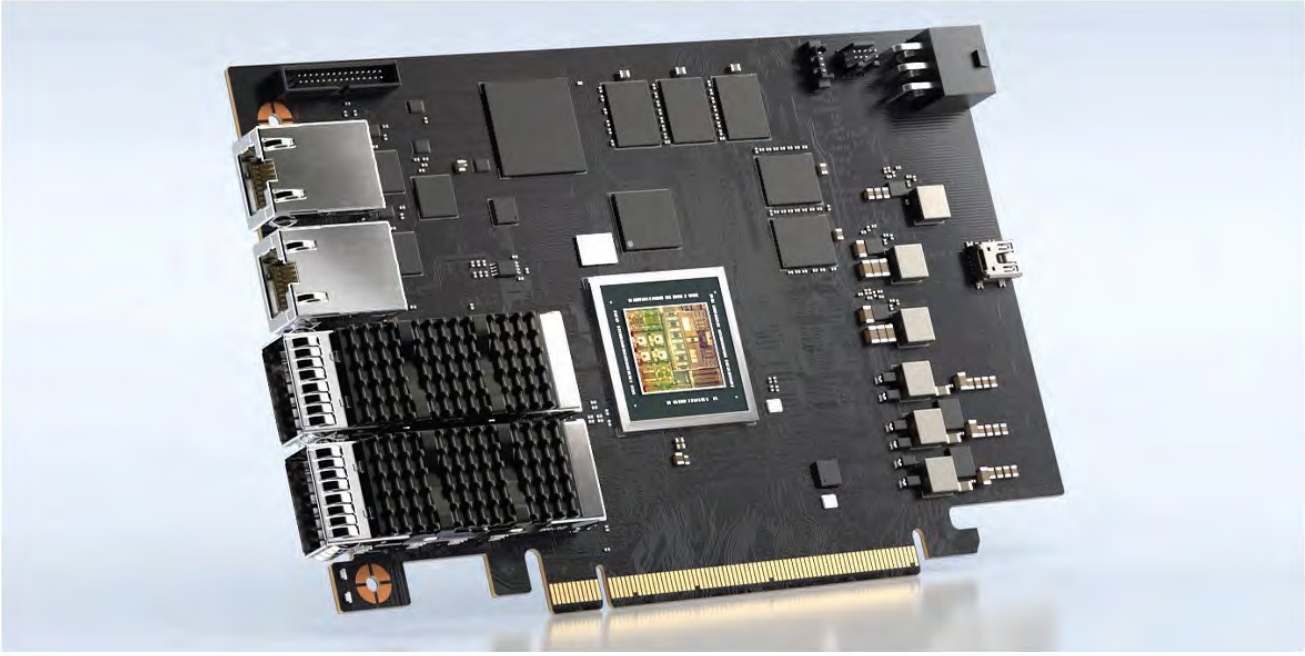
The next-generation arrays are built on modular building blocks called “nodes,” similar to the PowerBrick from the previous-generation PowerMax. Nodes contain the primary compute elements (CPU and memory) of the second-generation systems. Each second-generation PowerMax system has at least two nodes or a “node pair.” Each node has dual Intel Xeon Scalable processors, 24 DDR4 DIMM slots, and two 64-lane PCIe switches for front-end connections, among other advanced features.

Dynamic Media Enclosure

The storage component for the PowerMax 2500 and 8500 is called the Dynamic Media Enclosure (DME). Each DME has 48 top-loading slots for 2.5” U.2-based NVMe flash drives that are side loaded into the DME slots. The PowerMax 2500 can scale up to two node pairs and two DMEs, while the PowerMax 8500 can scale up to eight node pairs and up to eight DMEs.

The DMEs are more than just high-density drive enclosures. The DMEs are “smart” fabric-attached units that include dual link controller cards (LCCs) for high availability. Each LCC includes NVIDIA’s BlueField DPU. The core of the PowerMax architecture is built around NVMe-oF with NVIDIA Quantum InfiniBand as the transport layer. The BlueField DPUs are key to making this possible.

Enhanced Scale and Performance with NVIDIA BlueField DPU



NVIDIA DPUs come standard with the new PowerMax 8500 and enhance the system's overall scale and performance. Having the compute nodes and DMEs connected on the dynamic NVMe/InfiniBand fabric allows compute and media to scale independently. This means if an application is compute-intensive, customers can remedy the situation by adding more compute nodes. If capacity is an issue, add more DMEs and NVMe flash drives.

The dynamic fabric architecture of the PowerMax means that any node on the fabric has access to any data drive in the system, no matter which DME it is physically located in. This is a significant performance benefit since I/O from any host connected to any node in the array can be routed to any drive with efficiency and low latency. The DPU-enhanced architecture streamlines access, removing extra "hops" through adjacent nodes.

BlueField DPUs support secure boot, adding to the security of the PowerMax platform. PowerMax is designed for Zero Trust security architectures, with end-to-end security features in place to safeguard customer data.

For more details, check out Dell's Blog on NVIDIA BlueField DPU Technology.

PowerMax Data Reduction Enhances Data Storage Efficiency

PowerMax storage platform is the first in the industry to offer complete mainframe data reduction. In fact, Dell guarantees a 3:1 data reduction ratio for mainframe and 4:1 for open systems on the 8500 and 2500.

How does Dell hit these lofty data reduction goals?

A key element (missing from the mainframe environment until this release) is the ability to boost overall system efficiency using data-reduction techniques.

By combining inline compression, inline deduplication (for non-mainframe data), pattern detection, efficient data placement, and machine learning, the system can write more host data than the overall available physical capacity and continue delivering the performance expected from an enterprise storage system.

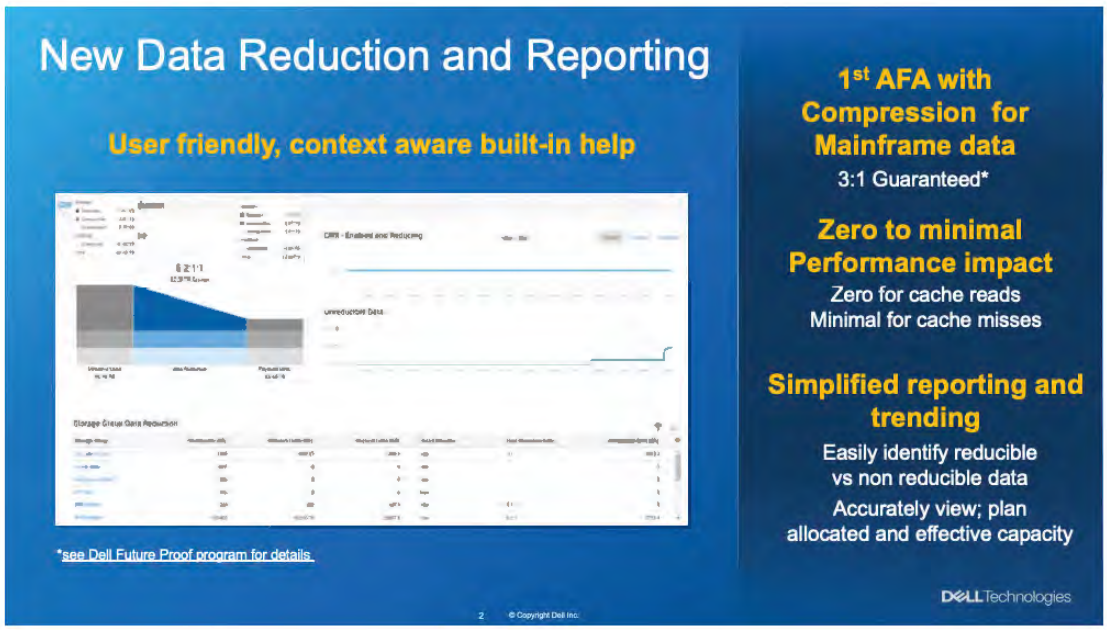
PowerMax looks at two specific resource areas for enhancing data storage efficiency: physical capacity and effective capacity.

- Physical Capacity is the total amount of physical capacity available after applying RAID protection.
- Effective Capacity is the amount of data the host can write with data reduction enabled. The effective capacity for the 2500 is 8PBe. The effective capacity for the 8500 is 18PBe.

All these features are great but implementing them independently would fail to deliver the required efficiency or performance. So, let's look at the individual components of each feature.

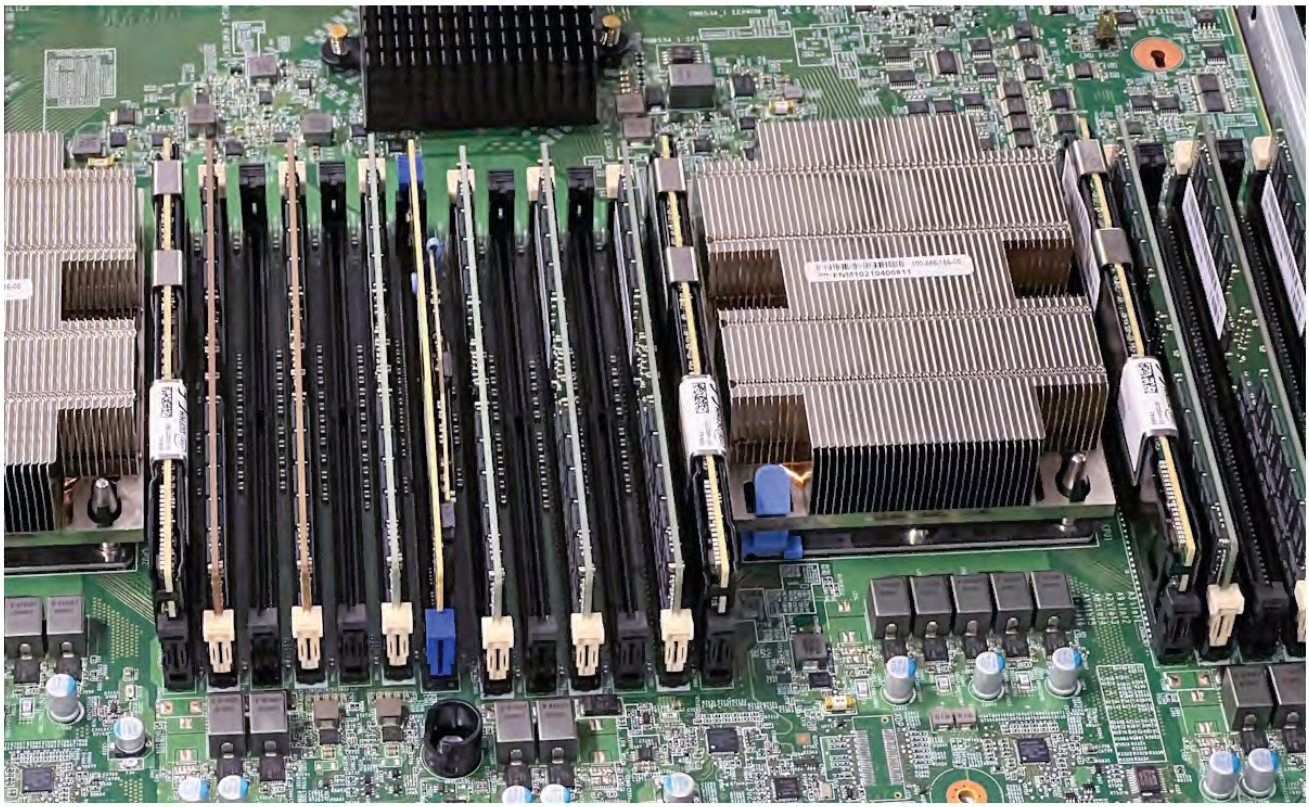
- Compression reduces the size of the data.
- Deduplication stores data as a single instance.
- Pattern detection includes a non-zero allocation function that excludes strings of consecutive zeros stored as part of compressed data.
- Compression, dedupe, and pattern matching use hardware assistance to reduce overhead.
- Machine Learning identifies the data stored on disk that is accessed repeatedly and keeps it unreduced.
- Using a function called compaction, data is stored strategically to minimize wasted space and reduce the need for defrag functions.
- Activity Based Reduction (ABR) reduces processing resources.

To get a detailed report of how the system is managing resources, PowerMax uses Unisphere for PowerMax. Information regarding capacity usage, data reduction, and system resources is displayed in the capacity dashboard, with Unisphere for PowerMax providing multiple ways to display capacity usage.



PowerMax is the First Dell Storage Platform to Use Persistent Memory

The second-generation PowerMax system is the first Dell Technologies storage platform to use Persistent Memory (PMEM) DIMMs (Dual Inline Memory Modules). PowerMax uses PMEM to store system metadata, improve data vaulting efficiency, lower TCO, and reduce overall system footprint.



The primary value proposition for using PMEM in the new PowerMax is it enables an overall lower cost of system ownership because workload density and capacity can be increased using a smaller overall system footprint.

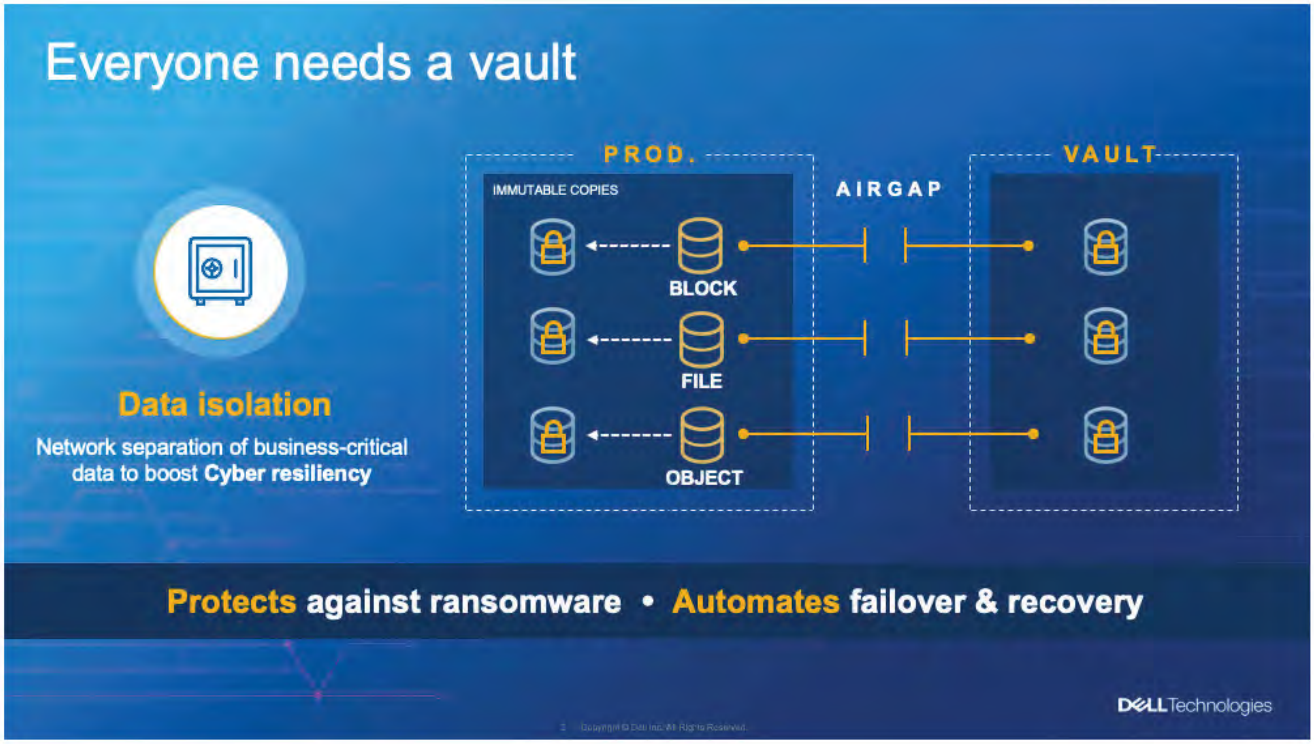
Flexible RAID Reduces Overhead

Disaggregation of storage and compute has allowed Dell to implement a new RAID distribution scheme called Flexible RAID Technology. Flexible RAID gives customers more granularity and configuration options, reduced RAID overhead, and higher availability.

Flexible RAID provides all compute nodes in the system with active-active access to storage resources that are distributed across all DMEs. The technology reduces RAID overhead, allowing higher system capacity while using fewer drives. For example, with Flexible RAID, 1 TB can be rebuilt in less than 10 minutes.

The Importance of Cybersecurity for Storage

Cyber security remains a hot topic, given the continued damaging cyber attacks over the past few years. Cyber attacks are expensive, brutal to prevent, and can ruin the reputation of any organization. Ransomware attacks are on the increase from all directions. IT administrators are typically held to account when an attack occurs, so they take an aggressive, proactive position in preventing cyber-attacks.



Cyber Recovery (CR) vaults and immutable copies of data provide the mandatory "fail-safe" protection to protect and preserve an organization's business strategy. Although the concept of Disaster Recovery (DR) remains a requirement, both DR and CR must coexist to recover from a cyber attack.

Addressable but immutable (in other words, indestructible) copies of current production data serve as the first line of defense in the recovery of production data after an attack. Immutable copies are non-addressable, essentially "invisible" mirror images of production data that have a defined "time to expire" date and time. Dell's immutable copies are "space-efficient" in terms of the amount of storage capacity required because they are pointer-based.

A Cyber vault is mostly disconnected and non-addressable (optionally air-gapped) by any network and inaccessible by even production servers. Think of the cyber vault data as the "plan B" for the immutable copies of production data. Air-gapping or decoupling the vault from your network is what makes the vault inaccessible to cyber criminals and is a means to "double down" on ensuring the company will have uncorrupted data to restore the business after an attack or ransom event.

Dell has taken a comprehensive approach to create data preservation and resilience regarding data protection on PowerMax. Unified controls, features, and functions related to cyber protection have been implemented across the entire product line, not simply limited to PowerMax. Dell has defined security controls based on industry standards referred to as the Dell secure development life cycle (SDL) which includes analysis activities and prescriptive proactive controls. There is also the Dell Product Security Incident Response Team (PSIRT), a chartered team responsible for coordinating the response and disclosure of all reported product vulnerabilities.

PowerMax Cyber Security for Heterogeneous Environments

With PowerMax, users benefit from a large number of cyber data protection and resiliency enhancements for storing both open systems and mainframe data, such as:

- Hardware Root of Trust (HWRoT) cryptographically affirms the integrity of BIOS and BMC firmware. HWRoT is based on one-time programmable, read-only public keys provisioned by Dell in the factory to protect against malware tampering.
- Secure Boot represents an industry-wide standard for security in the preboot environment. Secure boot verifies the image to be booted is precisely the image expected.
- Snapshot Policies protect applications automatically and require little or no maintenance. PowerMax supports up to 1,024 snapshots per device and 65 million snapshots per storage array. Users have the option of creating secure snaps by setting a retention period on snapshots. A secure snap cannot be terminated during the retention period. Once the retention time is reached, the snapshot is automatically terminated.
- Data at Rest Encryption (D@RE) provides hardware-based, on-array, backend encryption for PowerMax and VMAX All Flash systems. Back-end encryption protects information from unauthorized access when drives are removed from the system.
- CloudIQ combines proactive monitoring, machine learning, and predictive analytics to identify risks and anomalies in the storage environment. The cybersecurity component of CloudIQ continuously compares the configuration of the PowerMax array based on a set of customer-selected, security-related evaluation tests. If a deviation is detected, CloudIQ will notify the customer and provide remediation to correct the issue.
- Unisphere is a web-based application that enables customers to configure, administer, monitor, and troubleshoot PowerMax.

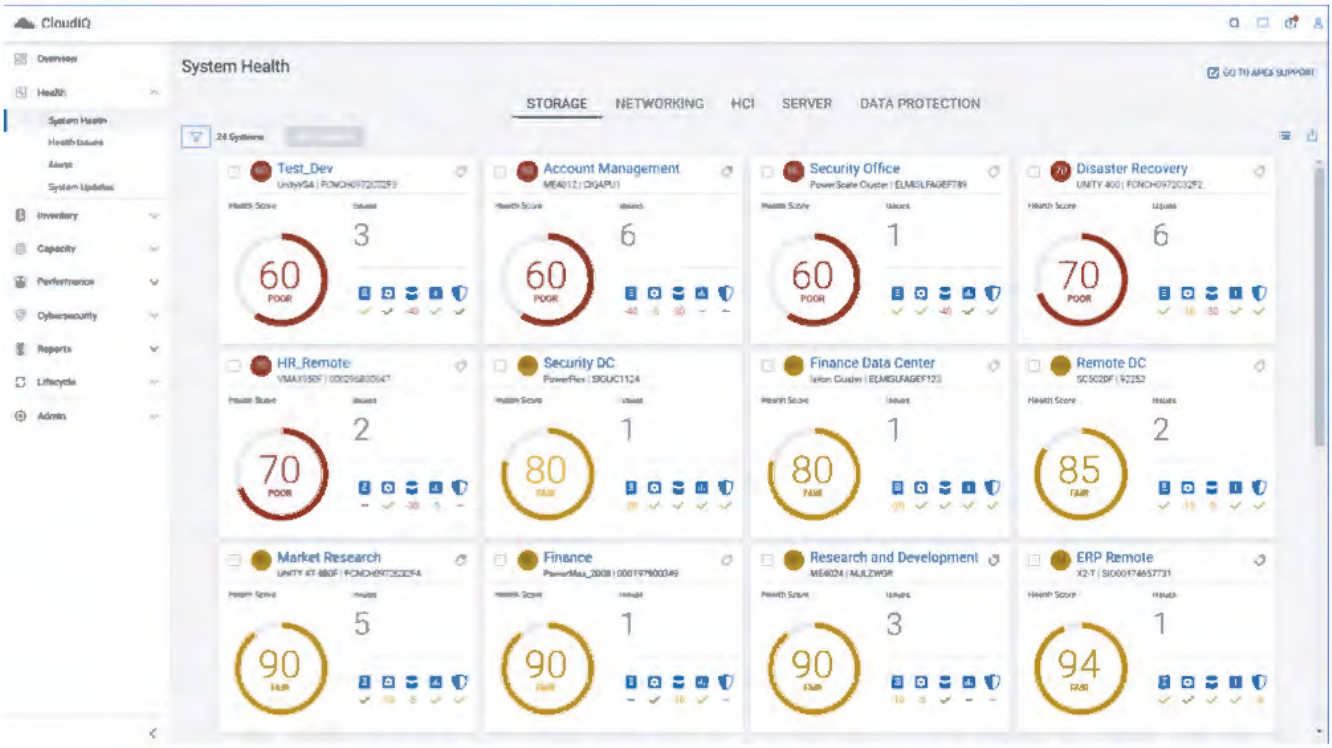
Dell also designed some unique mainframe capabilities into the PowerMax for improved cyber resiliency. Although not the first thing to come to mind when thinking of cybersecurity, mainframes play an important role for customers. Mainframes are viewed as the System of Record (SOR) for organizations. The platform delivers unmatched high-speed transaction processing, and mainframes offer Reliability, Availability, and Survivability (RAS).

Additional mainframe capabilities include:

- zDP, Data Protector for z Systems, provides a granular level of protection for mainframe data which can create up to 1024 point-in-time copies of an entire z/OS environment (tens of thousands of devices across multiple PowerMax arrays) as frequently as every five minutes. This ensures that a processing error, intentional or due to human error, or a malicious attack, such as ransomware, does not impact the IT environment. The optional zDP two-actor security feature, based on z/OS security and enabled by PowerMax, ensures two people are required to alter the operational setting of the zDP solution.
- Geographically Dispersed Disaster Restart (GDDR) is a mainframe software product that automates storage failover and business-recovery procedures by reacting to events in the IT environment. Dell recently added a new component to enhance cyber resiliency called zCPA, Cyber Protection Automation for z Systems to automate the preservation of data in cyber vault arrays on a periodic basis.

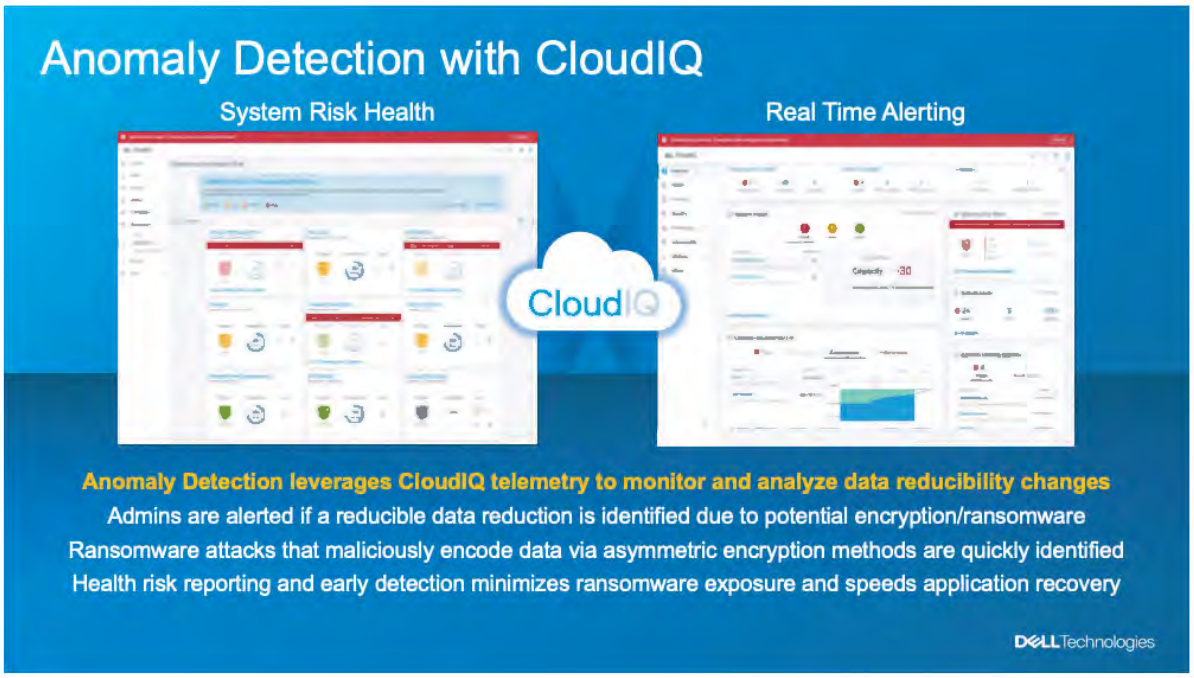
Proactively Monitoring PowerMax with CloudIQ

PowerMax includes CloudIQ, a cloud-based application that provides a detailed investigation of PowerMax arrays, including integration with VMware. Customers are provided with an independent, secure portal that allows them to register their PowerMax arrays and monitor storage from a single console. The secure portal ensures customers are restricted to those devices in their environment. CloudIQ is a powerful application that leverages machine learning and also tracks system health through pattern recognition and advanced analytics.



CloudIQ constantly compares the configuration of the PowerMax system to a set of user-selected, security-related evaluation tests. Upon identifying a deviation between the actual and desired configuration setting, CloudIQ proactively notifies users of the violation and provides remediation steps to correct the issue.

CloudIQ can be set to provide proactive notifications to the user in the event of an infrastructure security risk. The Security Advisories section of the Cybersecurity feature in CloudIQ notifies users of relevant Dell and VMware Security Advisories. Users quickly see a summary of vulnerabilities specific to their systems and versions, along with links to remediation details.



With CloudIQ cybersecurity, users can define legal configurations for PowerMax, monitor the system, and receive alerts if the array is out of compliance. CloudIQ can also track data patterns and detect anomalies, including changes to data reduction rates, to determine whether ransomware or malware may have infected the system. When suspicious anomalies are detected, CloudIQ alerts IT management to take corrective action.

Intelligent Automation

PowerMax systems are designed with intelligent automation in mind. They support advanced AIOps, DevOps, and containers to streamline operations and eliminate redundancy, so IT practitioners can focus on strategic initiatives. PowerMax brings autonomous storage to life with built-in machine learning that uses predictive analytics and pattern recognition to maximize performance with no management overhead. Automated storage provisioning for open systems workloads is accomplished using a simple REST API, saving considerable time and effort. And PowerMaxOS 10 provides the industry's first software-defined NVMe/TCP utility for storage resource automation, resulting in 44% less time to set up NVMe/TCP resources. NVMe/TCP helps lower deployment costs, reduces SAN design complexity, and allows for building a highly scalable PowerMax storage environment for mission-critical workloads.

Automating storage administration has become increasingly important as infrastructures scale to meet increasing demands. Automation needs to be well thought through and designed in a way that can scale across organizations, processes, and hybrid cloud infrastructure. Dell Technologies offers a range of solutions to integrate with automation tools using the PowerMax REST API that are becoming industry standards.

With PowerMax, customers can use a REST API that provides access to the storage system to build automation scripts and playbooks using tools such as Ansible. The PowerMax platform is the first storage platform in the industry that can perform provisioning and other administrative tasks for open-system block, file, and mainframe workloads using a single unified, comprehensive REST API toolkit.

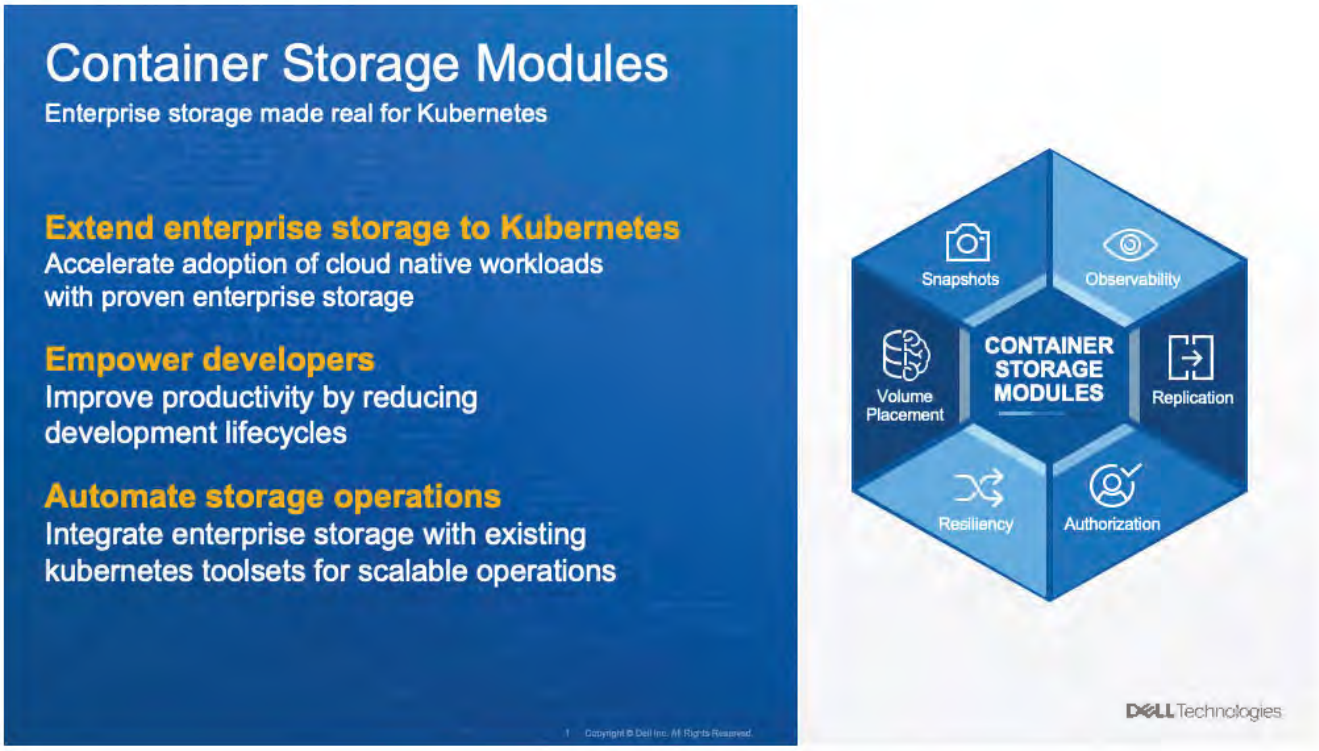
Multi-Array Workload Optimization

Multi-array workload planner analyzes the storage infrastructure across multiple PowerMax/VMAX arrays and recommends the best place to host workloads for optimal performance and resource utilization. Built-in data movement technology provides seamless data mobility across PowerMax and VMAX arrays using array-based orchestration and replication services to automatically discover, configure, and migrate data online. CloudIQ Health Check gives administrators faster time to insight; with all the information needed to take quick action and efficiently manage their storage environment. It enables proactive monitoring and predictive analytics to deliver alerts, aggregated PowerMax health scores, and provide proactive assistance with actionable insights and recommended remediation – all from the cloud and from your mobile devices, free of charge.

DevOps Automation and Containers

PowerMax customers can seamlessly consume storage infrastructure as code in a variety of development and automation environments using powerful APIs, SDKs, plugins for VMware automation tools like vRO and vRA, and modules for the most popular configuration management tools like Ansible. PowerMax supports a major shift in software development by being the first major enterprise storage solution to implement the Container Storage Interface (CSI) driver standard to enable containerized storage workloads to optimize productivity.

Dell Container Storage Modules (CSM) build on top of the Container Storage Interface (CSI) foundation to deliver unique, powerful storage and enterprise capabilities. CSM makes enterprise storage real for Kubernetes with simple, consistent integration and automation for DevOps and IT across storage and cloud-native stateful apps.



CSM accelerates cloud-native workload adoption with enterprise storage and enables a high-performing and resilient storage foundation for Kubernetes. CSM delivers a full stack of enterprise capabilities such as replication, authorization, failure recovery, and management. The inclusion of these capabilities accelerates deployment testing, which results in a faster application deployment lifecycle. Get involved on GitHub's CSI Driver for Dell PowerMax for even more detail.

Storage admins take advantage of these benefits for PowerMax, automating storage operations with existing Kubernetes toolsets for scalable operations and delivering an integrated experience bridging the gap between Kubernetes admins/developers and traditional IT admins.

Another core automation feature is optimized workload placement. In a storage infrastructure with multiple PowerMax arrays, the systems send information to Unisphere regarding storage usage and utilization. Whether a user provisions storage manually through Unisphere or using scripts, they can allow the system to determine which PowerMax storage array is best suited to support the new workload.

Efficient Workload Consolidation

PowerMax is designed to consolidate mixed workloads while delivering consistently high performance. PowerMax's scale-up and scale-out architecture are ideal for relational databases, real-time analytics, demanding transaction processing workloads, and big data applications that require uncompromising uptime and extremely low latency.

As previously described, the new PowerMax is the only platform in the industry where customers can natively run mainframe, open systems block, and file workloads on the same system without using gateways or third-party solutions. The ability to run mainframe workloads natively along with OS block and file is available on the PowerMax 2500 and 8500 and the PowerMax 8000.

The PowerMax 2500 and 8500 also feature a completely redesigned 64-bit, fully embedded NAS file platform for SMB and NFS workloads. This new file platform can provide four data movers (virtual machines acting as file servers) on the PowerMax 2500 and eight data movers on the PowerMax 8500. Each data mover can provide up to 512 TB of usable capacity, which can be carved up into 64 TB file systems.

Mainframe and File Enhancements

Dell also made significant mainframe and file enhancements.

File enhancements include:

- Redesigned 64-bit containerized microservice architecture
- Support for up to four file servers (PowerMax 2500); support for up to eight file servers (PowerMax 8500)
- Active/Active high-availability architecture scalable across 2-16 nodes
- Single Global Namespace file access scalable across all nodes
- 64 TB SMB and NFS file system support
- Data service integration for SRDF/S and SRDF/A, TimeFinder Snap, service levels, data reduction, D@RE, and non-disruptive upgrades
- Single I/O module for file, iSCSI, and NVMe/TCP

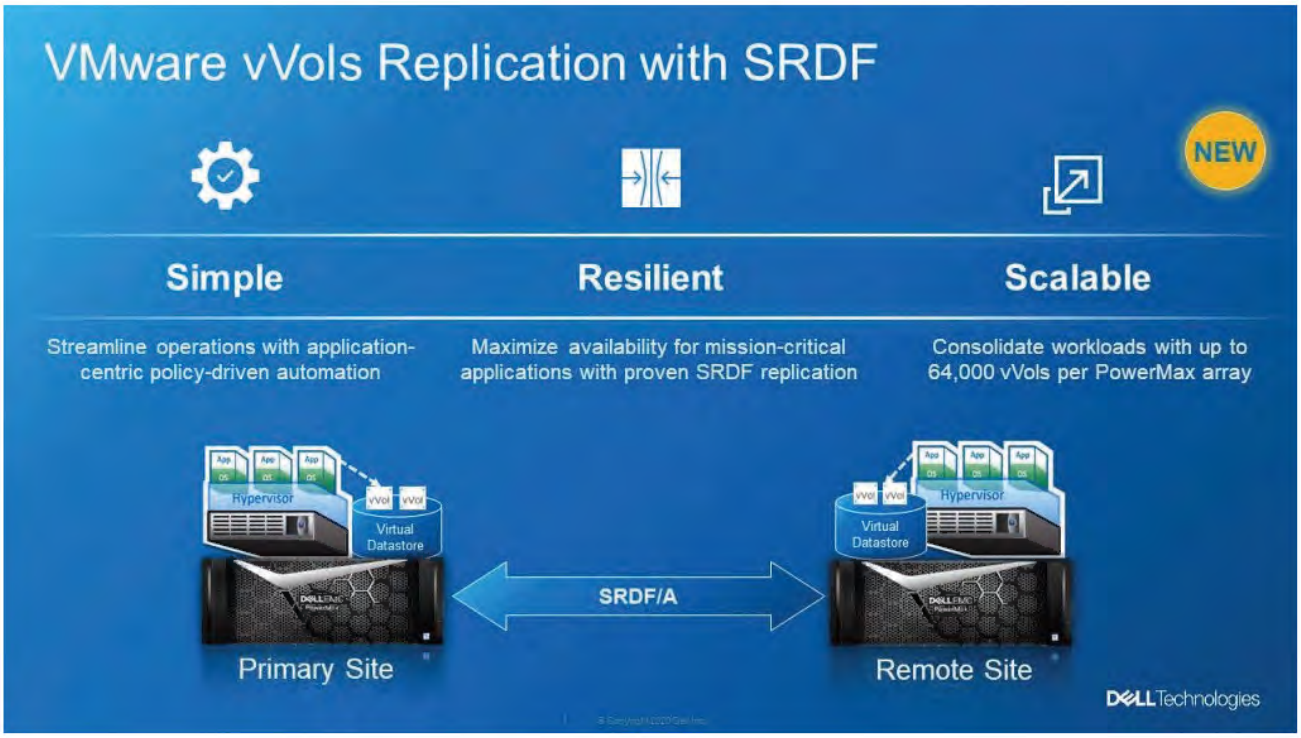
Mainframe enhancements include:

- Mainframe workloads can run on the entry class PowerMax 2500
- The PowerMax 2500 and 8500 are the first storage platform to offer complete mainframe data reduction, guaranteeing a 3:1 data reduction ratio
- End-to-end 32Gb FICON support using the same I/O module as 32Gb Fibre Channel
- Hardware support for 8Gb zHyperLink reads using a PCIe connection to IBM z Systems hosts

Dell PowerMax Tight Integration with VMware

Dell has years of experience working with VMware and support is tightly integrated into many Dell servers, storage systems, and HCI appliances. PowerMax is no different and provides seamless VMware integration, delivering the highest scalability for VMware vVols deployments and high availability. With impressive linear scale-out, PowerMax increases storage capacity and performance while achieving 100 percent uptime.

PowerMax has consistently delivered innovative capabilities to support VMware environments running mission-critical workloads. Examples include offering PowerMax as a principal storage platform for VMware Cloud Foundation (VCF), providing customers with high-performance storage for their hybrid cloud deployments. In addition, Dell Technologies and VMware have partnered to provide integrations for vVols, vRealize Orchestrator, and vRealize Automation to further extend high-end storage access to mission-critical workloads.



PowerMax has been architected to consolidate virtualized workloads, resulting in increased performance. vSphere deployments benefit from integrated data reduction, automatic data placement, and machine learning that streamline storage operations. PowerMax is also qualified for deployment in a Virtual Infrastructure domain through VCF.

The latest iteration of PowerMax brings greater simplicity, scalability, and data resiliency for VMware deployments by integrating PowerMax SRDF/A replication with VMware vSphere vVols and VMware Site Recovery Manager (SRM). Automating VM movement between sites ensures maximum availability for mission-critical applications. Further, as customers migrate from a hardware-centric storage approach to an application-centric method for managing storage with VMware vVols, Dell PowerMax runs virtual volumes at scale (64,000 vVols) with the highest levels of resiliency.

PowerMax integration with VMware management makes it easy for VMware administrators to manage storage and improve efficiency. Critically, with deep VMware support, this means PowerMax has a unique ability to help organizations consolidate mainframe, block, file, and virtualized data on a single mission-critical storage array.

VMware vRealize Orchestrator (vRO) is a process automation tool that performs automated management and operational tasks across VMware and third-party applications. With vRO, automated routines are created for workflows using simple drag-and-drop. Dell offers vRO plug-ins for PowerMax, bringing a deeper range of storage functionality in the form of programmable blocks that can be dropped into a workflow process map. Specifically, the functionality includes storage provisioning, scheduled and on-demand snapshots, VMware-integrated storage operations, and more.

VMware vRealize Automation (vRA) makes PowerMax vRO workflow automation recipes into an anything-as-a-service catalog for the entire IT ecosystem. Workflows automated in vRO can also be used in the self-serve catalog.

Final Thoughts

The Dell PowerMax storage platform features two new hardware models, the 2500 and 8500. PowerMaxOS 10 has been released with over 200 new features and functions, making PowerMax the standout storage platform for mainframes. A key feature of the new platform is the ability to support provisioning and administrative tasks for open-system block, file, and mainframe workloads using a single REST API toolkit.

Dell has incorporated a comprehensive set of cyber security features to prevent malicious attacks and secure corporate data. The addition of HWRoT, Secure Boot, MFA, Secure access controls, and detection and response using CloudIQ make this new release a storage system fortress. And PowerMaxOS 10 provides the industry's first software-defined NVMe/TCP utility for storage resource automation, resulting in 44 percent less setup time for NVMe/TCP resources.

Mainframes offer large organizations reliable, secure and high-performance storage capable of handling mission-critical applications. Dell PowerMax not only addresses these needs but adds additional arrows to the quiver by offering guaranteed 3:1 data reduction, additional security, and data visibility features for mainframe workloads. Support for heterogeneous environments is unique in this space. Given the extremely deep data services and the ability to handle literally any enterprise workload in a single cluster, Dell PowerMax clearly has differentiated itself in the mainframe world as arguably the most versatile solution on the market.

This next-generation PowerMax delivers performance, extreme scalability, low latency, and high availability. Customers benefit from the ability to modernize without disruption with data-in-place Anytime Upgrade and Dell's Future-proof program.

Additional resources:

Dell Paper on PowerMax Data Reduction
Dell PowerMax website
Dell Mainframe Solutions website

BRIAN BEELER, AUTHOR,

Brian is the owner and President of StorageReview.com.

This report is sponsored by Dell Technologies. All views and opinions expressed in this report are based on our unbiased view of the product(s) under consideration.