Next-Generation PowerMax Family Overview

September 2022

H19312

White Paper

Abstract

This white paper provides an overview of the PowerMax 2500 and 8500 storage systems. It highlights how the new architecture, features, and functions enable the value propositions that these systems bring to Dell Technologies customers.

Dell Technologies

Copyright

Contents

Executive summary

Overview

Introduced in 2018, the Dell PowerMax family was the first Dell Technologies hardware platform that used an end-to-end Non-Volatile Memory Express (NVMe) architecture for customer data. The NVMe-based PowerMax was specifically created to fully unlock the bandwidth, IOPS, and latency performance benefits that NVM media offers to host based applications that are unattainable using the previous generation of all-flash storage arrays.

Data center requirements are not stagnant, however. Storage infrastructures are being tasked to meet the increasing demands by next-generation data center and applications that require more security, performance, automation, and far greater efficiencies.

To meet these demands facing our customers, Dell Technologies is pleased to introduce two new PowerMax family members – the PowerMax 2500 and 8500.

New in 2022, PowerMax 2500 and 8500 systems represent the next generation of the PowerMax Family. These systems are specifically designed to provide a disaggregated, share everything solution to meet the ever-increasing levels of performance, storage density, intelligent automation, and high security required by enterprise data centers and applications. The PowerMax 2500 and 8500 have been specifically architected to provide customers with:

- The world's most secure storage platform – Incorporating security into the hardware with Hardware Root of Trust (HWRoT), secure boot, self-encrypting drives, anomaly detection, multi-factor authentication, and other features
- High performance – Up to 2X more IOPS and throughput than previous-generation PowerMax systems (PowerMax 2000 and 8000 series)
- Innovative architecture – New disaggregated storage architecture that allows customers to scale storage and compute independently, a new Flexible RAID scheme, and a redesigned internal dynamic end to end NVMe fabric using NVMe/PCIe NVMe/IB (InfiniBand)
- Higher storage density – provide customers with 7X more effective capacity than previous PowerMax generations as the platform is architected to provide over 4 PBe, 32 front end ports in only 5U for the PowerMax 2500 with the capability to scale out to over 18 PBe and 256 front end ports for the PowerMax 8500
- Industry leading power efficiency – Up to 80 percent power savings per PBe delivering 5X the effective capacity per watt consumed when compared to the previous PowerMax generation
- Improved data reduction capabilities – World's first platform to offer mainframe storage compression with a 3:1 data reduction guarantee, while also guaranteeing a 4:1 data reduction for open systems
- First enterprise class storage platform to offer NVMe/TCP host connectivity with a built-in integration to a Centralized Discovery Service that reduces setup times by 44 percent
- New modern Integrated File Services – Next-generation 64-bit containerized micro service architecture supporting up to 64 TB NFS and SMB file systems

Aside from these features, the PowerMax 2500 and 8500 have over 200 other new features and functions. With their new architecture, features, and functions, the PowerMax 2500 and 8500 have been designed from the ground up to meet the demands of next-generation data centers and applications well into the mid-2020s and beyond.

Glossary of terms

This document uses the following PowerMax terminology.

Terminology	Equivalent term	Definition
Dell PowerMax 2500	PowerMax 2500	PowerMax 2500 is the second-generation entry level NVMe scale-out offering for the PowerMax family. It is designed to provide customers with a small ultra-dense storage footprint (4 PBe in only 5U).
Dell PowerMax 8500	PowerMax 8500	PowerMax 8500 is the second-generation flagship NVMe scale-out offering of the PowerMax family. It features a true disaggregated storage architecture which can deliver up to 18 PBe of capacity to customers.
Dell PowerMax family	PowerMax	The 'PowerMax family' refers to the Dell NVMe-based, mission-critical data storage offering. The family includes the first-generation offerings, PowerMax 2000 and 8000, and second-generation offerings, PowerMax 2500 and 8500.
Disaggregated Storage Architecture	Disaggregated Storage	Disaggregated storage decouples a storage array's compute and storage components so that they can be scaled and provisioned separately.
Dynamic Media Enclosure	DME	DME refers to the NVMe-oF attached enclosures that house the physical storage drives of the system. All DMEs in the system can be accessed by all compute nodes using internal NVMe-oF SAN topologies.
Dynamic Random-Access Memory	DRAM	Dynamic random-access memory (dynamic RAM or DRAM) is a type of random-access semiconductor memory that stores each bit of data in a memory cell, usually consisting of a tiny capacitor and a transistor, both typically based on metal-oxide-semiconductor (MOS) technology. DRAM is the highest performing storage medium but also the costliest from a $/GB perspective. DRAM must be continuously supplied with power and periodically rewritten to retain data.
Effective capacity (in Terabytes)	TBe	This capacity measurement includes the benefits of thin provisioning, inline compression, deduplication, and space-efficient copies.
Endpoint	Endpoint	A point on a fabric in which an initiator or receiver can be attached.
Flexible RAID Technology	Flexible RAID	A new RAID distribution model enabled by the disaggregation of compute and storage in the PowerMax system. It provides active/active RAID protection across storage pools in the system DMEs.

Terminology	Equivalent term	Definition
Node	Node	Contains the compute elements of the second-generation PowerMax storage system – CPU, memory, and I/O modules. Roughly equivalent to a first generation PowerMax director.
Node Pair	Node Pair	Two PowerMax nodes – roughly equivalent to a first-generation PowerMax engine.
Non-Volatile Memory Express (NVMe)	NVMe	NVMe is a command set and its associated storage-interface standards that specify efficient access to data storage devices and systems based on Non-Volatile Memory (NVM).
NVMe over Fabric	NVMe-oF	NVM Express over Fabrics (NVMe-oF) defines a common architecture that supports a range of memory and message-based fabrics for the transport of NVMe data and commands.
NVMe over PCIe	NVMe/PCIe	NVMe/PCIe is an extension of the NVMe base specification that defines the binding of the NVMe protocol to memory-based fabrics using Peripheral Component Interface Express (PCIe).
NVMe over InfiniBand	NVMe/IB	NVMe/IB is an extension of the NVMe base specification that defines the binding of the NVMe protocol to hybrid memory, message-based fabrics using Ethernet, and the InfiniBand transport protocol. NVMe/IB is an example of a hybrid memory, message based (NVMe/RDMA) fabric.
NVMe over TCP	NVMe/TCP	NVMe/TCP is an extension of the NVMe base specification that defines the binding of the NVMe protocol to message-based fabrics using Ethernet and the Transport Control Protocol (TCP). NVMe/TCP is an example of a message-based fabric.
Peripheral Component Interconnect Express (PCIe)	PCIe	A high-performance peripheral I/O bus architecture employed in enterprise servers, storage devices, cloud computing equipment, PCs, mobile devices, industrial computing, and automation systems, and Internet of Things (IoT) applications. It is not an overstatement when said that our modern interconnected world would not exist if not for PCIe.
PCIe Switched Fabric	PCIe Fabric	A switched fabric architecture that uses PCIe switches to connect the PCIe root to various PCIe endpoints.
Persistent Memory	PMEM	A type of memory, also referred to as “storage class memory”, which combines the durability of flash storage while approaching the performance characteristics of more expensive DRAM. Instead of using electrons to store information, it uses heat to change the state of the cell, from amorphous to crystalline, changing the resistance of the cell. By doing this, PMEM can retain its data even after the power is off.

Terminology	Equivalent term	Definition
PowerMaxOS 5978	PowerMaxOS 5978	The PowerMaxOS 5978 release is the primary storage software that supports the first generation of PowerMax arrays. It can also be installed on legacy VMAX All Flash arrays.
PowerMaxOS 10	PowerMaxOS 10	The PowerMaxOS 10 release is the primary storage software that manages the second-generation PowerMax systems – the PowerMax 2500 and PowerMax 8500. It cannot be installed on previous-generation PowerMax or VMAX systems.
Scale out	Scale out	'Scale out' refers to adding nodes to grow performance.
Scale up	Scale up	'Scale up' refers to adding additional capacity into the PowerMax storage pools.
Unisphere for PowerMax	Unisphere	Unisphere for PowerMax is a graphical user interface that enables management and monitoring of first- and second-generation PowerMax arrays, along with legacy VMAX All Flash, VMAX3, and VMAX 1 or 2 arrays. Unisphere for PowerMax also provides a REST API interface for managing and controlling the storage system.
Usable capacity (in Terabytes)	TBu	This refers to the amount of physical drive capacity available in the array, considering the RAID efficiency of the RAID type in use.

Audience

This guide is intended for all Dell Technologies employees and current and potential customers who are interested in understanding the technologies and features that power the value propositions of the PowerMax 2500 and PowerMax 8500 systems.

Revisions

Date	Description
September 2022	Initial release

We value your feedback

Dell Technologies and the authors of this document welcome your feedback on this document. Contact the Dell Technologies team by email.

Author: Jim Salvadore

Note: For links to other documentation for this topic, see the PowerMax Info Hub.

The PowerMax family

What is the PowerMax family

The PowerMax family represents the flagship products of the Dell Technologies enterprise storage business. It is designed with a multi-node, active/active scale-out architecture using industry standard, end-to-end NVMe components. The platform features inline, global dedupe and compression, providing customers with high storage efficiency even as the system scales. The PowerMax family also provides what many consider to be the gold standard in data services, proven high availability and resiliency, and advanced security that adheres to stringent government regulations and corporate compliance requirements, such as FIPS 140-2. A core strength of the PowerMax family is its ability to consolidate workloads. Customers can use a single PowerMax system for Mainframe and Open Systems block storage, and for file storage services as well.

The PowerMax customer

Since its introduction in 2018, PowerMax has become a vital platform for mission critical applications run by enterprise customers. The PowerMax platform is used by:

- 95 percent of Fortune 100 companies
- The top 10 U.S. banks
- The top 10 global health care companies

Its proliferation in the data center has made PowerMax a vital component not just to enterprise customers, but to the overall global economy. Without PowerMax:

- Trains/Automobiles/Planes probably wouldn't run (PowerMax is used to support the most critical transportation systems such as flight path tracking).
- The US Government would continue to debate but they would not be able to collect taxes or to provide to the nation any services that use tax revenues.
- Stock trading would slow if not completely stop (PowerMax is used to support the critical banking systems around the world that clear all sorts of inter-bank and equity-trading systems).
- Credit card transactions would likely stop working (PowerMax is used for most critical credit card transaction systems).

Why customers choose PowerMax

Customers choose and rely on PowerMax for their most intense and business critical workloads because of its key value propositions: to provide a trusted, proven, intelligent, efficient, secure, scalable, and simple to use enterprise storage platform. These value propositions are key core requirements that IT executives are looking for in building out the current and next-generation data centers that will run their mission critical applications. These executives know that even a small unplanned outage or security breach can cost their corporation 10s – 100s of millions of dollars in lost revenue. As a highly focused customer driven company, Dell Technologies prides itself on being able to provide any IT executive the confidence in their decision to select the PowerMax as the storage platform for their critical business applications.

First-generation PowerMax products

At its launch in 2018, the PowerMax family consisted of two models, the PowerMax 2000 and the PowerMax 8000. The PowerMax 2000 was designed to provide Dell Technologies customers with efficiency and maximum flexibility in a 20U footprint. The

PowerMax 8000 was designed for massive scale, performance, and IOPS density all within a one or two-floor-tile footprint.

The PowerMax 2000 and 8000 have at their foundation the trusted Dynamic Virtual Matrix architecture and internal system software, specifically written for the NVMe platform, called PowerMaxOS 5978. PowerMaxOS 5978 continues to provide industry-leading high availability, I/O management, quality of service, data integrity validation, data movement, and data security within an open application platform. PowerMaxOS uses a real-time, non-disruptive storage hypervisor that manages and protects embedded services by extending high availability to services that traditionally would have run external to the array.

Second-generation PowerMax products

Since their introduction in 2018, PowerMax 2000 and PowerMax 8000 systems have become prolific in the enterprise data center and provide the storage bedrock on which much of the global digital economy is based. However, by 2022, customer demands for increased efficiency, performance, security, and automation have only increased and accelerated. In today's digital economy, unparalleled software innovation, multi-cloud agility, and advancements in workflow automation have given organizations the opportunity to become disruptive and innovate with data. To keep pace with business demands and capitalize on this opportunity, organizations need to accelerate the time between data creation and innovation but face numerous headwinds. Data is growing exponentially and is more diverse and distributed than ever before. In addition, organizations are struggling to break down internal operational silos, protect their IT infrastructure from sophisticated cybersecurity threats, increase developer productivity, and overcome cloud complexity.

To address these challenges, organizations need trusted and innovative enterprise storage that provides unparalleled performance, scalability, and security at scale without compromise. To meet these additional demands, Dell Technologies has added two new PowerMax systems into the PowerMax family – the PowerMax 2500 and PowerMax 8500. Based on NVMe dynamic fabric technology, the new PowerMax systems eliminate traditional storage boundaries in every dimension — performance, scalability, capacity, security — to meet the increasing demands of traditional workloads and next-generation cloud-based applications. At a high level:

- The PowerMax 2500 delivers high performance in a compact package, storing up to 7x more capacity (8 PBe) in half the rack space compared with the previous PowerMax 2000. Along with its high efficiency design, the 2500 supports the full complement of rich data services for open systems, mainframe, file, and virtual environments.
- The PowerMax 8500 delivers outstanding performance at scale for the most demanding mixed workloads requiring predictable performance with always-on availability while delivering up to 18 PBe of capacity to customers. When compared to the previous PowerMax 8000, the 8500 delivers up to 2x faster performance and 50 percent lower response times. Like the PowerMax 2500, the 8500 can easily consolidate open systems, mainframe, file, and virtualized storage to simplify operations, significantly reduce TCO, and increase ROI.

Key design features of second-generation PowerMax systems

At a high level, there are seven main components that comprise the bedrock upon which the new PowerMax systems are built. These are:

- A new more efficient modular storage hardware platform
- A new dynamic NVMe-oF topology
- Persistent Memory (PMEM)
- Flexible RAID
- PowerMaxOS 10
- Intelligent automation
- Cyber resiliency
- Efficient workload consolidation

A new highly efficient modular storage hardware platform

The PowerMax 2500 and PowerMax 8500 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.

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. Drives are side loaded into the DME slots. The side loading architecture provides better air flow for much improved cooling characteristics. This results in a considerably lower watts/GB of capacity ratio, greatly enhancing the overall efficiency of the system, especially at scale.

The second-generation PowerMax platform architecture has also been designed with sustainability and efficiency as a core tenent. As a result, both the PowerMax 2500 and 8500 are the most energy-efficient enterprise-level storage platforms Dell has ever produced. The second-generation platform delivers over 5x the effective capacity per watt consumed (PBe / watt) over the previous PowerMax generation.

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.

Dynamic Fabric

Both the PowerMax 2500 and 8500 are architected using new internal NVMe-oF topologies, featuring NVMe/RDMA using 100 GbE InfiniBand (NVMe/IB) and NVMe/PCIe based fabrics. These new NVMe-oF topologies are referred to as the PowerMax "Dynamic Fabric." The dynamic fabric turns the compute and backend storage elements into individual independent endpoints on a large internal storage area network (SAN). These individual compute and storage endpoints can be placed into shared logical and physical resource pools, to disaggregate the storage and compute resources in the system. In this architecture, all node endpoints can access all storage endpoints in the DMEs using the system's high speed NVMe-oF topologies, creating a true "active/active and share everything" system architecture. This system disaggregation decouples the compute and storage so that they be scaled and provisioned independently of each other to meet application requirements, rather than adhering to strict system architecture requirements. This disaggregated architecture makes the new PowerMax systems:

- Much more efficient regarding resource utilization when delivering the required workload performance and storage capacity for applications, all the while consuming less power
- Much easier to scale up and scale out
- Able to achieve the same high levels of fault tolerance and resiliency without the need for costly additional hardware

Persistent Memory (PMEM)

The second-generation PowerMax system is the first Dell Technologies storage platform to use Persistent Memory (PMEM) DIMMs (Dual In-Line Memory Module). The second-generation PowerMax uses PMEM for these primary purposes:

- Storing system meta data. In the second-generation PowerMax systems, persistent metadata is stored in PMEM. The PowerMax platform generates substantial amounts of dynamic and persistent metadata (pointers, data structures, scatter gather lists, and so on) through its normal operations. This is especially true as systems begin to scale in storage capacity. Efficient metadata processing requires that the CPU have quick access to the metadata. This typically means it needs to be in memory within the root complex of the system. In the previous-generation PowerMax, this metadata was stored in expensive DRAM memory. The use of PMEM for metadata eliminates the need for storing metadata in higher cost DRAM. This greatly improves overall system efficiency and costs, especially as the new systems scale out to multiple petabytes.
- More efficient data vaulting. The data in PMEM is persistent and does not need to be vaulted during shutdowns or other emergency procedures. This results in lower system demands when moving data to the self-encrypting NVMe vault drives. This improves vaulting speed and lowers the keep alive time requirements for the internal battery backup systems.
- Lower cost of ownership. The use of PMEM in the system enables storing more system metadata at a lower $/GB. This allows for significant increases in storage capacity without the added significant cost.
- Reduced system footprint. Because PMEM enables lower system keep-alive times for the battery backup system, it allows for the use of smaller backup batteries. These smaller batteries reduce the overall system footprint by 2U per node pair.

The primary value proposition of the use of PMEM in the second-generation PowerMax systems is that 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

The disaggregation of storage and compute allows the PowerMax 2500 and 8500 to implement a new RAID distribution scheme called Flexible RAID Technology. At a high level, Flexible RAID provides customers with:

- More granularity and configuration options because storage capacity can be added in single drive increments
- Vastly reduced RAID overhead, allowing for much higher capacity using fewer drives, minimizing the need for additional compute nodes
- Higher availability with much faster rebuild times

Flexible RAID provides all compute nodes in the system with active-active access to the storage resources that are distributed across all DMEs in the system. This model reduces the RAID overhead of the system, allowing for much higher system capacity while using fewer drives. This model also improves rebuild efficiency by over 2x when compared to the first-generation PowerMax, as 1 TB can be rebuilt in less than 10 minutes using the Flexible RAID model.

Flexible RAID offers flexible capacity expansion while meeting the availability and reliability numbers of traditional RAID.

Flexible RAID allows the new PowerMax systems to deliver the highest storage performance, resiliency, and efficiency. The technology provides more usable storage capacity by leveraging granular storage media, load balancing, and several RAID protection schemes built around RAID 1, 5, and 6.

PowerMaxOS 10

The new PowerMax systems run a completely redesigned version of PowerMaxOS called PowerMaxOS 10. The latest PowerMaxOS 10 software builds on decades of software innovation to provide trusted, intelligent, secure storage for the most demanding mission-critical workloads while simplifying operations. The newly designed PowerMaxOS 10 brings forth new enhancements that make the PowerMax 2500 and PowerMax 8000 far more efficient at managing cache memory resources than the previous-generation PowerMax. This has allowed for a significant reduction in the amount of required DRAM cache for these systems, lowering overall supply chain dependencies, and reducing the customer's total cost of ownership (TCO) long term.

Intelligent automation

Being able to intelligently automate storage administration tasks has become a paramount requirement for the modern data center, especially as storage infrastructure scales up and out. All modern storage platforms need to provide customers with the ability to use a REST API that provides access to the storage system so they can build automation scripts and playbooks using automation 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.

Another core automation feature that applies to both the PowerMax 2500 and PowerMax 8500 is optimized workload placement. In a storage infrastructure with multiple PowerMax arrays, the systems will send information to Unisphere about storage usage and utilization. As a user provisions storage either manually through Unisphere or in an automated way using scripts, the user can allow the system to determine which PowerMax storage array is best suited to support the new workload.

The second-generation PowerMax also simplifies the storage provisioning for stateful applications on Kubernetes containers. Using an orchestration tool such as RedHat OpenShift, a user can select the PowerMax-SRDF storage class and embed it in a create stateful set code snippet. Upon running this code snippet, the user creates a complete storage environment on the PowerMax array, including remote replication for the stateful application.

Cyber resiliency

Data is the life blood of the modern connected world. Cyberattacks and breeches in which data is stolen, altered, and rendered unusable can cost corporations many millions of dollars in lost revenue. The new PowerMax systems have been designed to provide our customers the highest levels of data protection and cybersecurity in the industry.

The Dell cybersecurity model aligns with the National Institute of Standards and Technologies (NIST) cybersecurity framework and is centered on the following principles:

- **Identification and protection**

  The best cyber security strategies begin with prevention. The PowerMax is purpose-built to prevent unauthorized access to system resources. Each model incorporates intrinsic security features and comprehensive access controls to safeguard company data. These features include:

  - Hardware root of trust (HWRoT) represents the foundation on which all secure operations of PowerMax depend. HWRoT contains the keys used for cryptographic functions and enables a secure boot process, preventing system boot if firmware is tampered with.
  - Firmware updates require a digital signature before updates can be applied.
  - Hardware-based data encryption through FIPS 140-2 level 2 certified self-encrypting drives (SEDs) ensures protection in case a drive is removed from the system.
  - Secure access controls and tamper proof audit logs protect from unauthorized access through secure logs of all events on PowerMax.
  - Multi-factor authentication for Admin Access (MFA) provides two-factor authentication to management access using RSA SecureID.

- **Detection and response with CloudIQ**

  Dell CloudIQ is a powerful application used to track system health through pattern recognition and advanced analytics. Through 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.

- **Recovery**

  Both first- and second-generation PowerMax systems use secure immutable snapshots to provide the industry's most granular cyber recovery at scale, maximizing data recovery from a cyberattack. Administrators can set snapshot policies for up to 65 million secure snapshots to optimize recovery point objectives (RPO) and minimize data loss. Several options also exist for native cyber recovery from a secure vault for open systems and mainframe storage on PowerMax.

Efficient workload consolidation

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

PowerMax is the only platform in the industry in which a customer can run mainframe, open systems block, and file workloads natively on the same system without the use of gateways or third-party solutions. The ability to run mainframe workloads natively along with OS block and file is available on both the PowerMax 2500 and 8500, and on the PowerMax 8000. The PowerMax 2500 and 8500 are the only storage platforms in the industry which provide a guaranteed 3:1 data reduction ratio for mainframe workloads.

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 users with up to 512 TB of usable capacity which can be carved up into 64 TB file systems.

The following sections describe some specific PowerMax second-generation mainframe and file enhancements.

Mainframe enhancements

- Mainframe workloads can now be run on the entry class PowerMax 2500 system.
- The first storage platform in the industry to offer full Mainframe data reduction. Mainframe workloads are guaranteed a 3:1 data reduction ratio on both the PowerMax 2500 and PowerMax 8500.
- Full end-to-end 32 Gb FICON support using the same I/O module as 32 Gb Fibre Channel. Specialized FICON I/O modules are no longer needed.
- Full hardware support for 64 Gb zHyperlink.

File enhancements

- New redesigned 64-bit containerized microservice architecture
- Supports up to four file servers on PowerMax 2500 and up to eight file servers on 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 for traditional and transactional file workloads
- Full data service integration for SRDF/S and SRDF/A, TimeFinder Snap, service levels, data reduction, D@RE, and nondisruptive upgrades
- Single I/O module for use with file, iSCSI, and NVMe/TCP

PowerMax first- and second-generation comparisons

The following table provides a comparison of the various PowerMax products for open-system-critical and mainframe-critical features:

Table 1. PowerMax family critical-feature comparison

Feature	PowerMax family			
	2000	2500	8000	8500
Active/active, scale out, scale up architecture	Yes	Yes	Yes	Yes
Disaggregated storage architecture	No	Yes[1]	No	Yes
ML optimized data reduction	Yes	Yes	Yes	Yes
64 million snapshots	Yes	Yes	Yes	Yes
SRDF/A MSC	Yes	Yes	Yes	Yes
SRDF/Metro SmartDR	Yes	Yes	Yes	Yes
Non-disruptive migration	Yes	Yes	Yes	Yes
Proactive/predictive analytics	Yes	Yes	Yes	Yes
Anytime Upgrades	No	Yes	No	Yes
Zero trust architecture	No	Yes	No	Yes
Self-encrypting drives	No	Yes	No	Yes
Single drive upgrades	No	Yes	No	Yes
NVMe/TCP support	No	Yes	No	Yes
64-bit file support	No	Yes	No	Yes
Mainframe data reduction	N/A[2]	Yes	No	Yes

Summary

The PowerMax 2500 and PowerMax 8500 are the most secure, performant, efficient, and scalable storage systems in Dell Technologies history and represent a significant leap forward regarding enterprise storage architecture. They represent the latest additions to the family of enterprise storage products on which much of the global economy depends.

[1] PowerMax 2500 uses NVMe/IB for node communication when the system is comprised of two node pairs. All PowerMax 2500 node pairs come with a single 48 slot NVMe/PCIe attached DME.

[2] PowerMax 2000 does not support mainframe.

References

Dell Technologies documentation

The following Dell Technologies documentation provides other information related to this document. Access to these documents depends on your login credentials. If you do not have access to a document, contact your Dell Technologies representative.

- PowerMax 2500 and 8500 Product Documentation
- PowerMax Data Sheet
- PowerMax Spec Sheet
- White papers on PowerMax Info Hub:

Part #	Title
H13904	Dell Embedded NAS Technical Overview
H13936	Dell PowerMax: Data at Rest Encryption
H18472	Dell PowerMax: Data Protector for z Systems (zDP) Best Practices
H15201	Dell PowerMax: Data Protector for z Systems (zDP) Essentials
H16856	Dell PowerMax: Embedded Management
H16124	Dell PowerMax: GDPS and Advanced Copy Services Compatibility
H17064	Dell PowerMax: Reliability, Availability, and Serviceability
H17108	Dell PowerMax: Service Levels for PowerMaxOS
H19254	Dell PowerMax: Data Reduction
H19219	Dell PowerMax 2500 and 8500: TimeFinder SnapVX Snapshots and Clones
H19071	Dell PowerMax: Cyber Security for Mainframe Storage
H19070	Dell PowerMax Cyber Security