

Dell PowerEdge nova generacija










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PORTOROŽ



# DELL Technologies Overview of the Solutions and Product Segments

STORAGE	SERVER	DATA PROTECTION	NETWORKING	CONVERGED & HCI
 <p>PowerVault</p> <p>Unity XT</p> <p>PowerStore PowerMax PowerScale Isilon ECS</p>	 <p>PowerEdge Tower, Rack, Modular, Rugged</p>	 <p>PowerProtect DD</p> <p>PPDP</p> <p>ML-TL-PV-MD</p> <p>PowerProtect Backup Services for SaaS Applications Cyber Recovery Solution Data Protection Suite</p>	 <p>VMware NSX</p> <p>SONIC</p> <p>Pluribus Networks</p> <p>big switch networks</p> <p>veevacloud vmware</p> <p>VERSA NETWORKS</p>	 <p>VxBlock PowerFlex VxRail</p>
CLIENT / DISPLAYS / RUGGED / OEM	SECURITY	DATA & SOFTWARE	CLOUD	SERVICES
	 <p>vmware<sup>®</sup></p> <p>NSX<sup>®</sup> AppDefense<sup>™</sup> SASE Carbon Black Cloud WorkspaceONE</p> <p>Secureworks<sup>®</sup></p> <p>Taegis<sup>™</sup> XDR Red Cloak<sup>™</sup> Counter Threat Unit<sup>™</sup> Cybersecurity Services Emerg. Incid. Resp. Services Proactive Security Consulting</p> <p>PowerProtect Cyber Recovery Solutions CyberSense</p> <p>APEX Cyber Recovery Services</p>	 <p>VMware TANZU</p> <p>LITMUS Edge Platform</p> <p>Streaming Data Platform</p> <p>Storage Analytics</p> <p>CTA &amp; Storage VE</p> <p>CloudIQ / DataIQ</p> <p>AppSync</p> <p>PowerPath</p> <p>VxFlexOS</p> <p>Data Protection</p>	 <p>APEX</p> <p>Data Storage Services</p> <p>Multi-Cloud Data Services</p> <p>Cloud Services w. VMware Cloud</p> <p>Backup Services</p> <p>Cyber Recovery Services</p> <p>DevOps Ready Platforms</p> <p>Infrastructure Services</p> <p>Dell Technologies Cloud Solutions</p> <p>VMware   Microsoft   Google</p>	 <p>Consulting Services Deployment Services Support Services Managed Services Education Services OEM Services Financial Services</p> <p>Dell Technologies Cloud Storage Services</p> <p>VMware Cloud Services on</p> <p>aws Google Cloud Azure</p>



# PowerEdge Servers

Purpose-built | Intelligent | Cyber Resilient | Sustainable



## Purpose-built

Scale AI, Edge &  
Performance Anywhere



## Intelligent

Accomplish more with  
Automation & Improve  
Operational Efficiencies



## Cyber Resilient

Accelerate Zero Trust  
Adoption



## Sustainable

Maximize power  
efficient performance

Subscribe or Consume aaS with APEX

# PowerEdge Servers

Purpose-built | Intelligent | Cyber Resilient | Sustainable

## AI /ML



AI training



Data analytics

## Edge



Telco



Retail



Manufacturing

## CSP



Cloud service providers

## Core



Private DC

Colo  
Datacenter  
Campus



Traditional  
datacenter



Transportation



Banking



Retail

PURPOSE-BUILT

# Accelerate AI Outcomes



PowerEdge XE9680



PowerEdge XE9640



PowerEdge XE8640



**POWERED BY 4<sup>TH</sup> GENERATION INTEL XEON SCALABLE PROCESSORS**

## No-compromise Accelerated AI

- 8x NVIDIA H100 SXM5 700W 80GB NVLink GPUs or
- 8x NVIDIA A100 SXM4 500W 80GB NVLink GPUs
- Full NVLINK interconnectivity
- Air cooled operation (up to 35C)

## Dense Acceleration

- 4x Intel Data Center Max Series GPU with GPU-GPU connectivity
- Dell Smart Cooled DLC GPUs
- 1:1 GPU-I/O enables faster data operations

## Superior Performance

- 4x NVIDIA H100 SXM5 700W 80GB NVLink GPUs
- Full NVLINK interconnectivity
- GPU Direct Storage for fast data intake

# Accelerate at the Edge



## Powerful inside and out

- 1-socket, 2-socket, and multi-node available
- -20c to +65c operating temps
- GPU support



## Expanded portfolio

- Compatible with Dell Edge /Telco Solutions
- New multi-node design XR4000 & XR8000



## Energy flexibility

- 110-240V AC power
- -48V DC power
- Redundant PSUs

**XR7620**



2S/2U

**XR5610**



1S/1U

**XR4000**



Multi-Node  
Xeon D

**XR8000**



Multi-Node  
Xeon SP

PURPOSE-BUILT

# Accelerate Core Modernization



**PowerEdge R760**



**PowerEdge R660**



**PowerEdge R760xa**

**POWERED BY 4<sup>TH</sup> GENERATION INTEL XEON SCALABLE PROCESSORS**



**PowerEdge R960**



**PowerEdge R860**



# Zero Trust adoption



## Reinforce your security

- Confidently deploy servers with built-in cyber-security controls and a **protected supply chain**.
- Safeguard sensitive information at all times using **strong encryption**, flexible key management and new confidential compute technologies.
- End-to-end boot resilience, anchored with **Root of Trust**, ensures a trusted boot cycle to protect, detect and recover from threats.
- Embedded feature set supporting a **Zero Trust** strategy.

**91% less time**  
for complete system lockdown  
with iDRAC9 vs. HPE iLO

**NSA recognized**  
Dell customized UEFI  
secure boot

**52% Faster deployment**  
of security configuration templates  
with Dell OME vs. HPE OneView





## Thermals & Smart Cooling design options

- Multi-vector and liquid cooling
- Thermal design capabilities to fit your location



## Energy Efficiency

- Adaptive Closed Loop Control optimizes fan and system power consumption



## Infrastructure Consolidation

- One new PowerEdge can do the work of up to five previous gen servers
- Improved performance per watt

## Get Efficient with PowerEdge

**70% More**  
thermal sensors  
designed in\*



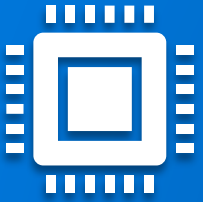
EPEAT Silver &  
Bronze  
registered  
products



ENERGY STAR®  
throughout most of  
the portfolio



# Industry Enabled Technologies Overview



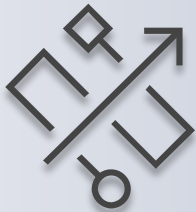
## Next Generation Intel & AMD Processors

- Intel 4<sup>th</sup> Gen Xeon (Sapphire Rapids)
  - ✓ Up to 60 cores/CPU\*
  - ✓ 50% performance increase over Ice Lake
- AMD 4<sup>th</sup> Gen EPYC (Genoa)
  - ✓ Latest 5nm technology with up to 96 high-performance “Zen 4” cores
  - ✓ 1.5X & 1.25X the density and power over Milan



## Memory: DDR5

- DDR5 (4800MT/s)
  - ✓ Latest DRAM technology with higher speed & bandwidth
  - ✓ Greater efficiency with 2 channels per DIMM
  - ✓ Improved RAS features with on-die ECC
  - ✓ Lower power
  - ✓ Enhanced telemetry for temperature reporting and systems management



## PCIe Gen5 Capability

- Doubles throughput compared to PCIe Gen4
  - ✓ Benefits NVMe drives, GPUs, and some networking cards



## EDSFF E3.S NVMe Gen5

- E3.S form factor will be introduced with PCIe Gen5 NVMe drives
  - ✓ Benefits density, thermals, and improved packaging in space constrained servers
- Double the performance over NVMe Gen4

\*Max 60 cores for 4S CPUs, max 56 cores for 2S CPUs

# Dell enabled Technologies Overview



## Next Gen HWRAID (PERC12)

- New gen controller with 2X better performance over PERC11 and 4X better than PERC10
  - ✓ Supports all drive interfaces: SAS4, SATA & NVME
  - ✓ x16 connectivity to devices to take full advantage of PCIe Gen5 throughput



## System Cooling & Efficiency

- Power Manager & Smart Cooling
- High Power Optimized Airflow chassis design to maximize air cooling capabilities
  - ✓ Support for XCC/HBM in air-cooled chassis
- Optional CPU direct liquid cooling (DLC) solutions



## BOSS-N1

- Segregated RAID controller for OS with secure UEFI boot that is rear facing and hot-pluggable
  - ✓ Enterprise-class 2 x M.2 NVMe devices with strong endurance and high quality that provide increased performance over BOSS-S1 with SATA drives



## Data Processing Unit (DPU)

- SmartNIC with hardware accelerated networking and storage that enables customers to save CPU cycles
  - ✓ Improved security, running workloads and security software on different CPUs ("air gap")
  - ✓ Offload hypervisor, networking stack, and storage stack to the DPU making them OS independent



## System Management

- Seamless integration of new 16G servers into your existing processes and tool set
- Complete iDRAC9 support for all components
  - ✓ PERC12, BOSS N-1, PCIe Gen5 devices, UEFI Secure Boot, Smart Cooling, DPU's, and more



## Security

- TLS 1.3 with FIPS certification, SEKM 2.0 with support for NVMe drives and VxRail
- End-to-end threat management with Zero Trust approach
  - ✓ Silicon-based platform root of trust, multi-factor authentication (MFA), inventory and platform component tracking during delivery, tamper protection during shipping

# iDRAC

The integrated Dell Remote Access Controller (iDRAC) delivers advanced, agent-free local and remote server administration.

- Consistent management platform across:-
  - All PowerEdge form factors.
  - 3X PowerEdge generations.
- eHTML5 web interface
- 5000+ element measurements a minute
- AI-driven analysis and rapid issue resolution
- Agentless implementation.
- 24 x 7 monitoring
- iDRAC Direct connection.
- Full remote A/C power cycle.





# OpenManage Enterprise

A simple-to-use, one-to-many systems management console.

- Comprehensive lifecycle management for PowerEdge servers
- Deploy as a secure virtual appliance
- One to many intelligent automation with user-defined policy, template, and baseline
- Comprehensive RESTful API enables customizable automation and solution integration
- Up to 8,000 devices per instance Datacenter / Multisite-scale
- FlexSelect plug-in architecture for new functionality



## SIMPLIFY



Robust, intuitive, management capabilities, regardless of form-factor

## UNIFY



One-to-many management from a single console: built for scale

## AUTOMATE



Automated IT processes for greater efficiency

## SECURE



Design for security throughout the infrastructure lifecycle

# AMD Processor Information

# Dell PowerEdge AMD 4<sup>th</sup> Gen EPYC™ Performance

- 50% more cores
- Up to 121% increased performance
- Up to 55% CPU Performance per Watt improvements
- Up to 60% more storage



# AMD EPYC™ Genoa SP5 Socket

Significant performance, integrated acceleration, and next generation memory and I/O

## COMPUTE Leadership Socket and Per-Core Performance

- Up to 120 “Zen 4” cores in 5nm
- Up to 4 links of Gen 3 Infinity Fabric™, speeds up to 32Gb/s

## INCREASED MEMORY PERFORMANCE Leadership Memory Bandwidth and Capacity

- Up to 12 channel DDR5 memory
- Up to 4800 MT/s
- Option for 2, 4, 6, 8, 10, 12 memory interleaving

## ADVANCED I/O Next Generation I/O

- PCIe Gen 5
  - Up to 128 Lanes
- Memory Expansion with CXL™

## WORKLOAD OPTIMIZATION

- Optimized for Mainstream Enterprise, Cloud and HPC
- Core applications and virtualized infrastructure



# Workload Acceleration with 4<sup>th</sup> Gen Intel® Xeon® Scalable Processors

Redefining Performance for Data Centers, the Network, and the  
Intelligent Edge

# 4th Gen Intel® Xeon® Scalable Processors

## 2S PERFORMANCE GENERAL PURPOSE

SKU	CORES	BASE (GHz)	ALL CORE TURBO (GHz)	Max TURBO (GHz)	CACHE (MB)	TDP (Watts)	Maximum Scalability	DDR5 Memory Speed	UPI Links Enabled	Default DSA Devices	Default QAT Devices	Default DLB Devices	Default IAA Devices	Intel SGX Enclave Capacity (Per Processor)	Long life availability	Recommended Customer Pricing (RCP) in \$ US Dollars	Intel® On Demand Capable
8480+	56	2.0	3.0	3.8	105	350	2S	4800	4	1	1	1	1	512GB		\$10,710	✓
8470	52	2.0	3.0	3.8	105	350	2S	4800	4	1	0	0	0	512GB		\$9,359	✓
8468	48	2.1	3.1	3.8	105	350	2S	4800	4	1	0	0	0	512GB		\$7,214	✓
8460Y+	40	2.0	2.8	3.7	105	300	2S	4800	4	1	1	1	1	128GB		\$5,558	✓
8462Y+	32	2.8	3.6	4.1	60	300	2S	4800	3	1	1	1	1	128GB		\$5,945	✓
6448Y	32	2.1	3.0	4.1	60	225	2S	4800	3	1	0	0	0	128GB	✓	\$3,583	✓
6442Y	24	2.6	3.3	4.0	60	225	2S	4800	3	1	0	0	0	128GB		\$2,878	✓
6444Y	16	3.6	4.0	4.1	45	270	2S	4800	3	1	0	0	0	128GB		\$3,622	✓
6426Y	16	2.5	3.3	4.1	37.5	185	2S	4800	3	1	0	0	0	128GB	✓	\$1,517	✓
6434	8	3.7	4.1	4.1	22.5	195	2S	4800	3	1	0	0	0	128GB		\$2,607	✓
5415+	8	2.9	3.6	4.1	22.5	150	2S	4400	3	1	1	1	1	128GB	✓	\$1,066	✓

## 2S MAINLINE GENERAL PURPOSE

8452Y	36	2.0	2.8	3.2	67.5	300	2S	4800	4	1	0	0	0	128GB		\$3,995	✓
6438Y+	32	2.0	2.8	4.0	60	205	2S	4800	3	1	1	1	1	128GB		\$3,141	✓
6430	32	2.1	2.6	3.4	60	270	2S	4400	3	1	0	0	0	128GB		\$2,128	✓
5420+	28	2.0	2.7	4.1	52.5	205	2S	4400	3	1	1	1	1	128GB	✓	\$1,848	✓
5418Y	24	2.0	2.8	3.8	45	185	2S	4400	3	1	0	0	0	128GB	✓	\$1,483	✓
4416+	20	2.0	2.9	3.9	37.5	165	2S	4000	2	1	1	1	1	64GB	✓	\$1,176	✓
4410Y	12	2.0	2.8	3.9	30	150	2S	4000	2	1	0	0	0	64GB	✓	\$563	✓

## LIQUID COOLED GENERAL PURPOSE (-Q)

8470Q	52	2.1	3.2	3.8	105	350	2S	4800	4	1	0	0	0	512GB		\$9,410	✓
6458Q	32	3.1	4.0	4.0	60	350	2S	4800	3	1	0	0	0	128GB		\$6,416	✓

## SINGLE SOCKET GENERAL PURPOSE (-U)

6414U	32	2.0	2.6	3.4	60	250	1S	4800	0	1	0	0	0	512GB		\$2,296	✓
5412U	24	2.1	2.9	3.9	45	185	1S	4400	0	1	0	0	0	128GB		\$1,113	✓
3408U	8	1.8	1.9	1.9	22.5	125	1S	4000	0	1	0	0	0	64GB	✓	\$415	

## LONG-LIFE USE (IOT) GENERAL PURPOSE (-T)

4410T	10	2.7	3.4	4.0	26.25	150	2S	4000	2	1	0	0	0	64GB	✓	\$624	✓
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Intel may make changes to specifications and product descriptions at any time, without notice.

Please visit [intel.com/xeon](https://intel.com/xeon) or contact your Intel representative to obtain the latest product specifications. Intel processor numbers are not a measure of performance. Processor numbers differentiate features within each processor family, not across different processor families. All processors support Intel Virtualization Technology (Intel VT-x).

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## IMDB/ANALYTICS/VIRTUALIZATION OPTIMIZED (-H) - SOCKET SCALABLE

SKU	CORES	BASE (GHz)	ALL CORE TURBO (GHz)	Max TURBO (GHz)	CACHE (MB)	TDP (Watts)	Maximum Scalability	DDR5 Memory Speed	UPI Links Enabled	Default DSA Devices	Default QAT Devices	Default DLB Devices	Default IAA Devices	Intel SGX Enclave Capacity (Per Processor)	Long life availability	Recommended Customer Pricing (RCP) in \$ US Dollars	Intel® On Demand Capable
8490H	60	1.9	2.9	3.5	112.5	350	8S	4800	4	4	4	4	4	512GB		\$17,000	
8468H	48	2.1	3.0	3.8	105	330	8S	4800	4	4	4	4	4	512GB		\$13,923	
8460H	40	2.2	3.1	3.8	105	330	8S	4800	4	4	0	0	4	512GB		\$10,710	
8454H	32	2.1	2.7	3.4	82.5	270	8S	4800	4	4	4	4	4	512GB		\$6,540	
8450H	28	2.0	2.6	3.5	75	250	8S	4800	4	4	0	0	4	512GB		\$4,708	
8444H	16	2.9	3.2	4.0	45	270	8S	4800	4	4	0	0	4	512GB		\$4,234	
6448H	32	2.4	3.2	4.1	60	250	4S	4800	3	1	2	2	1	512GB		\$3,658	
6418H	24	2.1	2.9	4.0	60	185	4S	4800	3	1	0	0	1	512GB	✓	\$2,065	
6416H	18	2.2	2.9	4.2	45	165	4S	4800	3	1	0	0	1	512GB		\$1,444	
6434H	8	3.7	4.1	4.1	22.5	195	4S	4800	3	1	0	0	1	512GB		\$3,070	

## 5G / NETWORKING OPTIMIZED (-N)

8470N	52	1.7	2.7	3.6	97.5	300	2S	4800	4	4	4	4	0	128GB	✓	\$9,520	✓
8471N	52	1.8	2.8	3.6	97.5	300	1S	4800	0	4	4	4	0	128GB	✓	\$5,171	✓
6438N	32	2.0	2.7	3.6	60	205	2S	4800	3	1	2	2	0	128GB	✓	\$3,351	✓
6428N	32	1.8	2.5	3.8	60	185	2S	4000	3	1	2	2	0	128GB	✓	\$3,200	✓
6421N	32	1.8	2.6	3.6	60	185	1S	4400	0	1	2	2	0	128GB	✓	\$2,368	✓
5418N	24	1.8	2.6	3.8	45	165	2S	4000	3	1	2	2	0	128GB	✓	\$1,664	✓
5411N	24	1.9	2.8	3.9	45	165	1S	4400	0	1	2	2	0	128GB	✓	\$1,388	✓

## CLOUD OPTIMIZED IaaS (-P) / SaaS (-V) / Media (-M)

8468V	48	2.4	2.9	3.8	97.5	330	2S	4800	3	1	1	1	1	128GB		\$7,121	✓
8458P	44	2.7	3.2	3.8	82.5	350	2S	4800	3	1	1	1	1	512GB		\$6,759	✓
8461V	48	2.2	2.8	3.7	97.5	300	1S	4800	0	1	1	1	1	128GB		\$4,491	✓
6438M	32	2.2	2.8	3.9	60	205	2S	4800	3	1	0	0	1	128GB		\$3,273	✓

## STORAGE & HYPERCONVERGED INFRASTRUCTURE (HCI) OPTIMIZED (-S)

6454S	32	2.2	2.8	3.4	60	270	2S	4800	4	4	4	4	0	128GB		\$3,157	✓
5416S	16	2.0	2.8	4.0	30	150	2S	4400	3	1	2	2	0	128GB		\$944	✓

Y Supports Intel Speed Select Technology - Performance Profile 2.0 (Intel SST-PP)

Unless noted, all 8400, 6400 and 5400 processors, include support for Intel Speed Select technology (Intel SST) featuring Intel SST Base Frequency (SST-BF), Intel SST Core Power (SST-CP) and Intel SST Turbo Frequency (SST-TF) capabilities.

# PowerEdge MX

 DELL EMC

# Introducing PowerEdge MX

Traditional and transformational workloads on one, adaptable infrastructure.





# PowerEdge MX7000 Chassis (front view)

7U Chassis designed to support at least three future generations of server technologies

## Compute Sleds

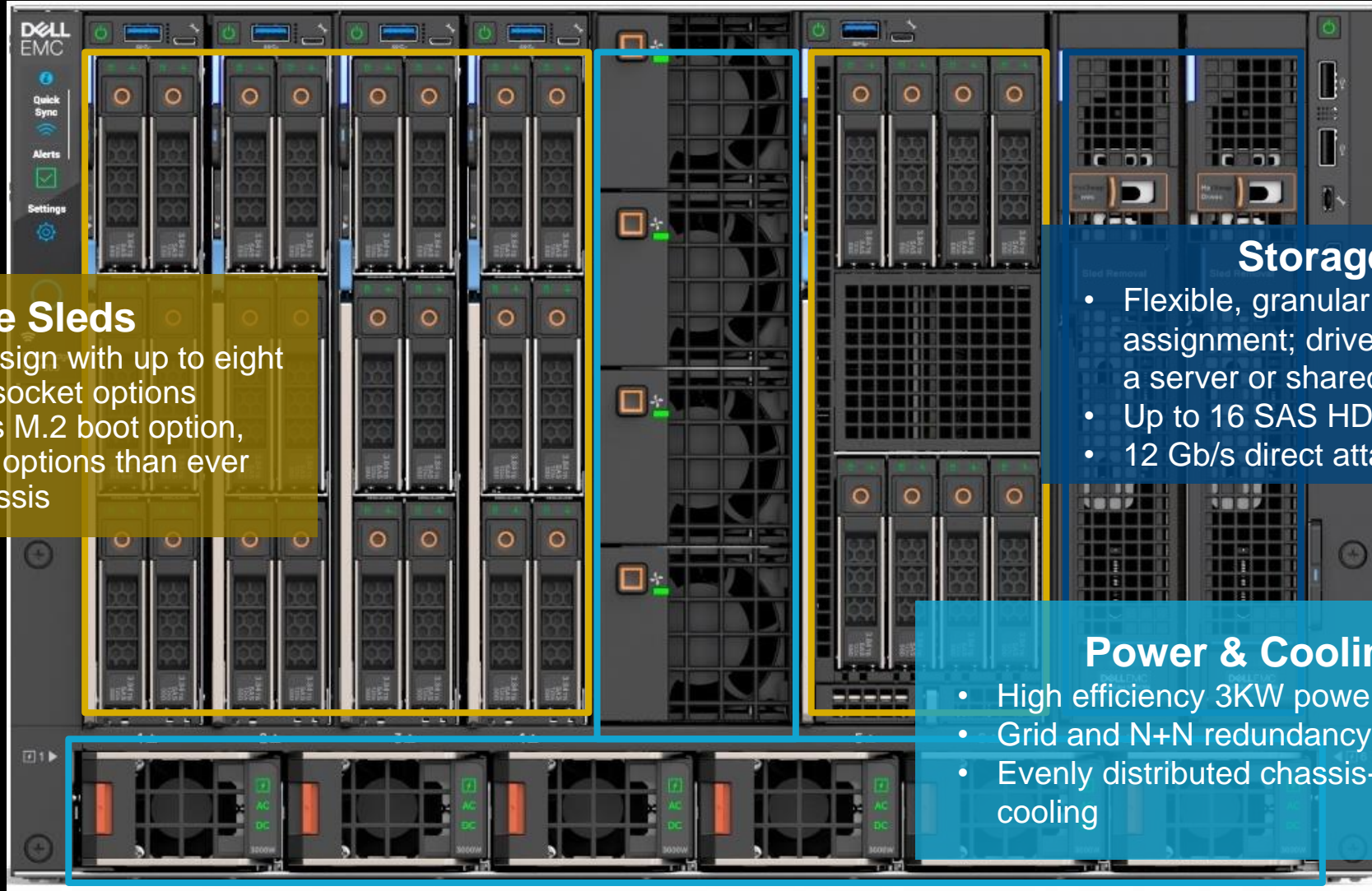
- No compromise design with up to eight 2-socket or four 4-socket options
- Up to 8 drives, plus M.2 boot option, for greater storage options than ever before in large chassis

## Storage Sleds

- Flexible, granular drive-level assignment; drives can be mapped to a server or shared
- Up to 16 SAS HDDs/SSDs
- 12 Gb/s direct attached SAS

## Power & Cooling

- High efficiency 3KW power supplies
- Grid and N+N redundancy
- Evenly distributed chassis-wide cooling



# PowerEdge MX7000 Chassis (rear view)

## Storage Networking

- Redundant, highly available Fibre Channel or SAS storage fabric for high availability
- SAS extension for optimal storage scalability

## Scalable Networking

- Two redundant general purpose fabrics
- MX Scalable Fabric Architecture for multi-chassis networking
- Future forward design

## OpenManage Enterprise – Modular Edition

- Single layer of management of compute, storage and fabrics
- Redundant modules with fault-tolerant interlinking
- Simple expansion from one to many chassis

## Power & Cooling

- High efficiency 3KW power supplies
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# PowerEdge MX7x0c and MX8x0c Compute

PowerEdge MX Hardware



# PowerEdge MX7x0c compute

High performance with density for exceptional scalability

## Targeted Use Cases

- Dense virtualization, foundation for collaborative workloads
- Foundation for software-defined storage and networking, hyper-converged infrastructure

## HIGHLIGHTS

- Full featured, no compromise compute
- Offering exceptional performance and a rich set of storage options
- Supports several different server node configurations to meet unique requirements





# PowerEdge MX8x0c compute

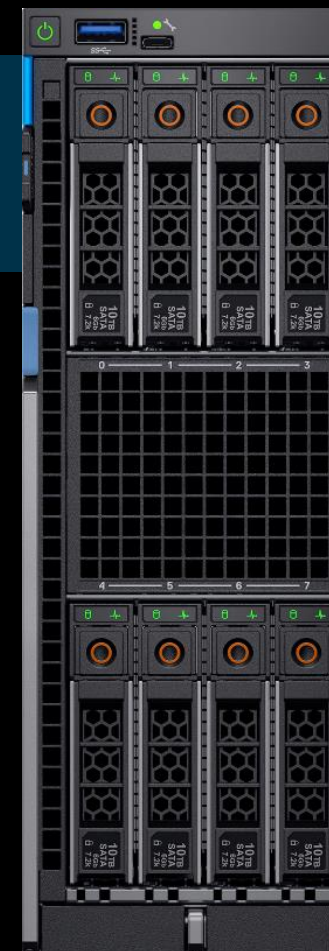
Powerful scale-up server for exceptionally demanding use cases

## Targeted Use Cases

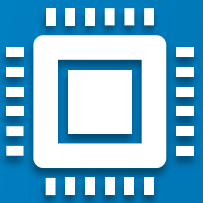
- Database-driven, mission-critical applications
- Big data analytics and performance workloads

## HIGHLIGHTS

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# Industry Enabled Technologies Overview



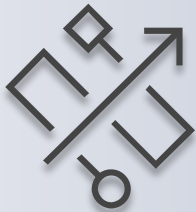
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- Double the performance over NVMe Gen4

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DELL EMC PowerEdge

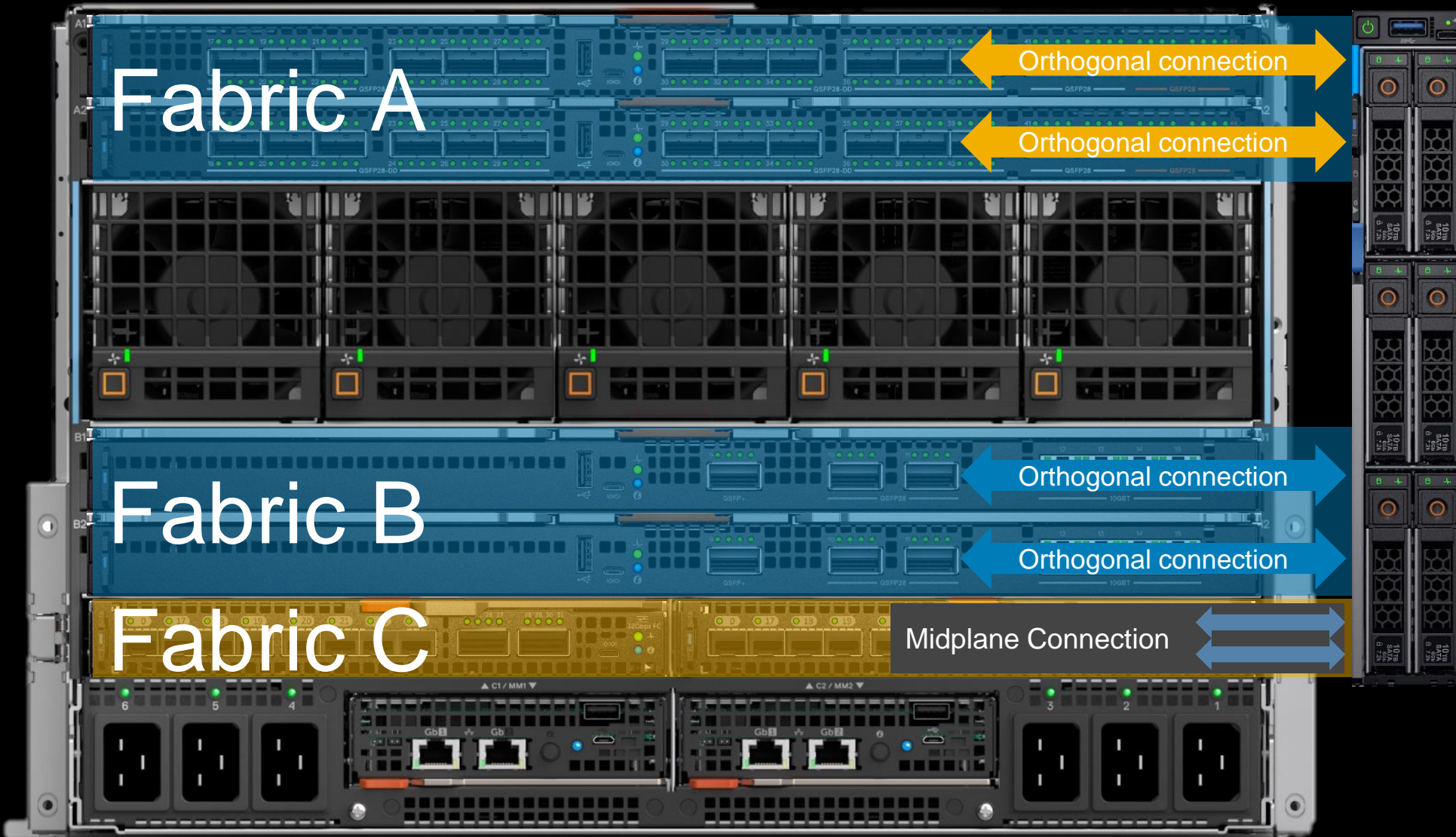


# Networking

PowerEdge MX



# PowerEdge MX internal connections



- Ethernet switch
- **12Gb SAS:** MX5016s SAS switch
- **OR**
- **Fibre Channel:** MXG610s Fibre Channel switch



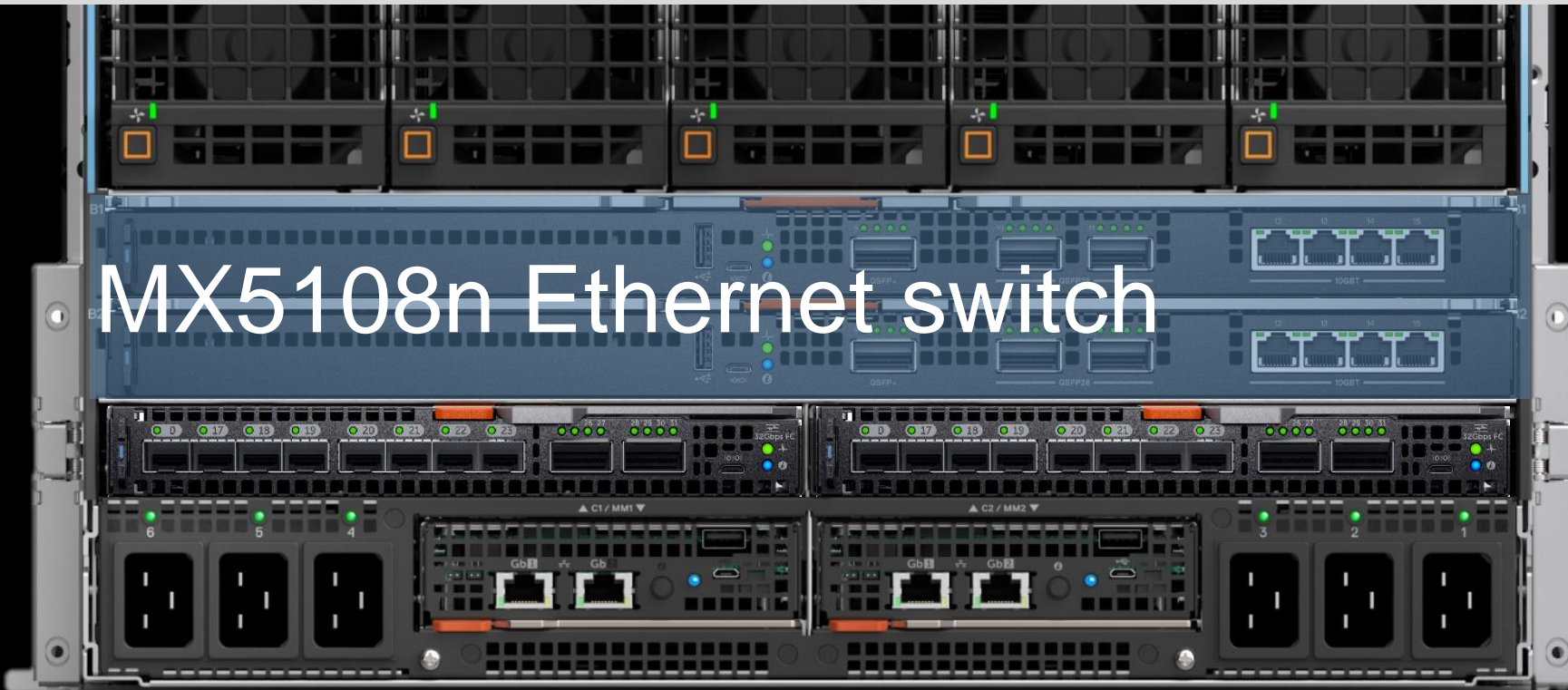
# PowerEdge MX switching modules

8 server-facing 25GbE internal ports

40Gb QSFP+

2 x 100Gb QSFP28

4 x 10GBASE-T



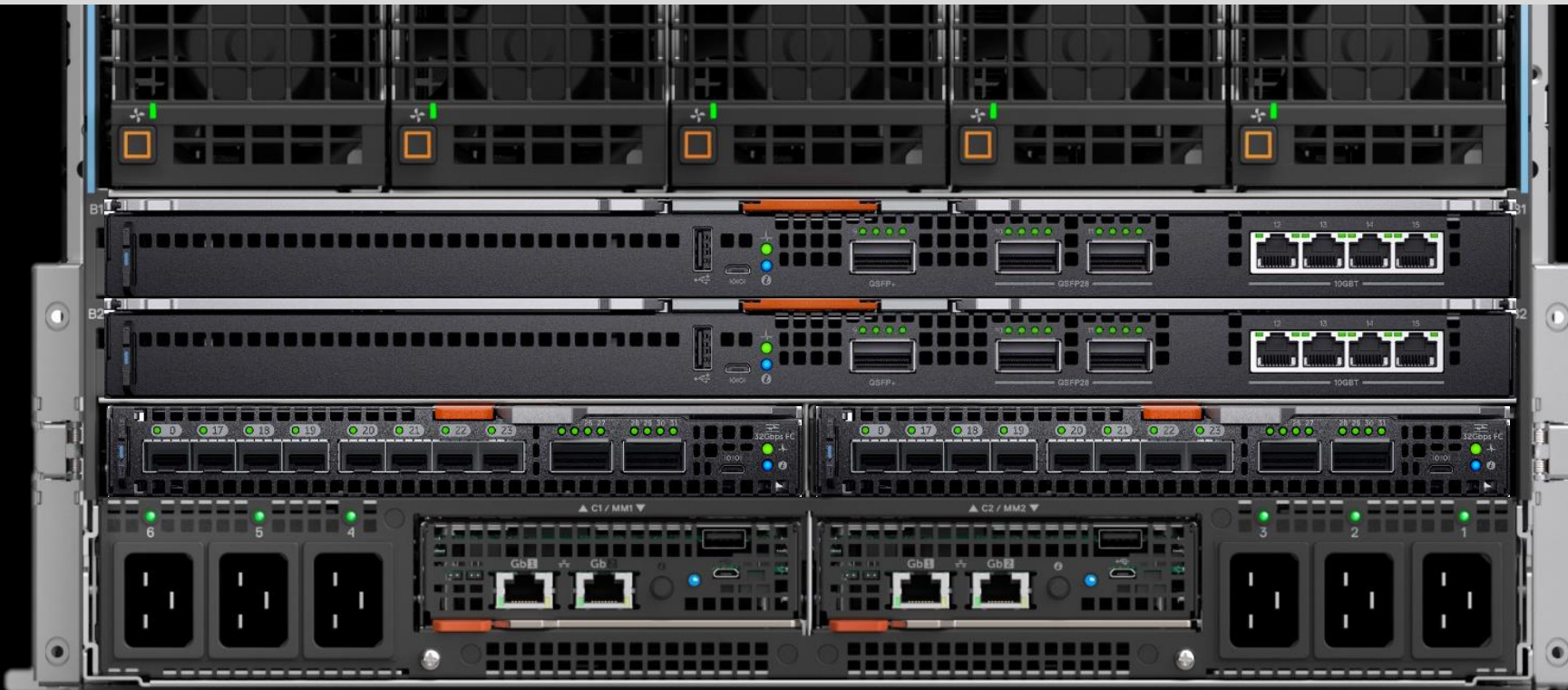
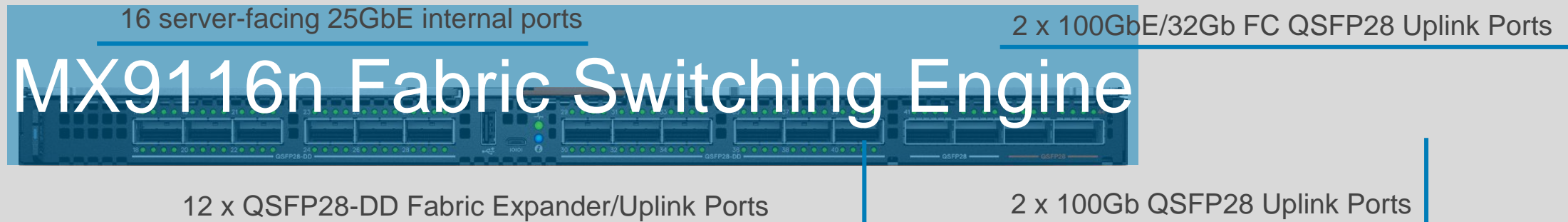
Low cost solution with limited scale and flexibility

Ideal for enterprises requiring basic Ethernet switching with FCoE transit capability

## Performance

- <800ns latency
- 960Gbps switching fabric
- 720 Mpps forwarding capacity

# PowerEdge MX switching modules



High bandwidth converged solution with investment protection for a large fabric

### Performance and Scaling

- 104 servers @ 25GbE with no oversubscription
- <450ns latency
- 6.4 Tbps switching fabric
- 3.248 Bpps forwarding capacity

# PowerEdge MX Scalable Fabric

PowerEdge MX Networking



# PowerEdge MX Scalable fabric architecture

How can multiple chassis behave like a single network?

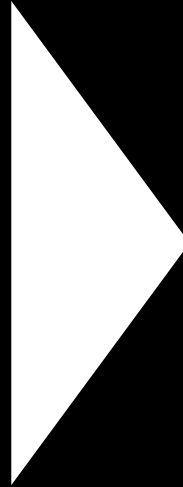
## Legacy Modular Solutions

Ethernet switches in each chassis = **Latency**

Multiple hops for east-west traffic = **Latency**

Excessive cabling = **Cost**

Multiple switches to manage = **Cost**



## Best-in-class Multi Chassis Ethernet

Aggregate 50GbE to **400GbE**  
bandwidth in each server\*

**<600ns** “any-any” latency

**No** oversubscription

Scales up to 10 chassis, 80 compute sleds

8x25Gbps over a single cable

Cost effective, low TCO



# PowerEdge MX Fabric Expander Module

16 server-facing 25GbE internal ports

2 x QSFP28-DD Uplink Ports



Scales fabric bandwidth  
across multiple chassis

**No Switching**  
**No OS**  
**<75ns latency**

Connects to FSE through  
QSFP28-DD ports

# PowerEdge MX Scalable Fabric Architecture Topology

LAN

SAN

Fabric Switching Engine

All switching happens here

**NO** switching happens here  
**NO** operating system here  
**Very** low latency

Fabric Expander Module

Fabric Expander Module

Chassis 1

Chassis 2

Chassis 10

DELL EMC PowerEdge

# PowerEdge MX Scalable Fabric Architecture Topology

Chassis 1:

Slot A1: FSE

Slot A2: FEM



Chassis 2:

Slot A1: FEM

Slot A2: FSE



Chassis 3:

Slot A1: FEM

Slot A2: FEM



Chassis 10:

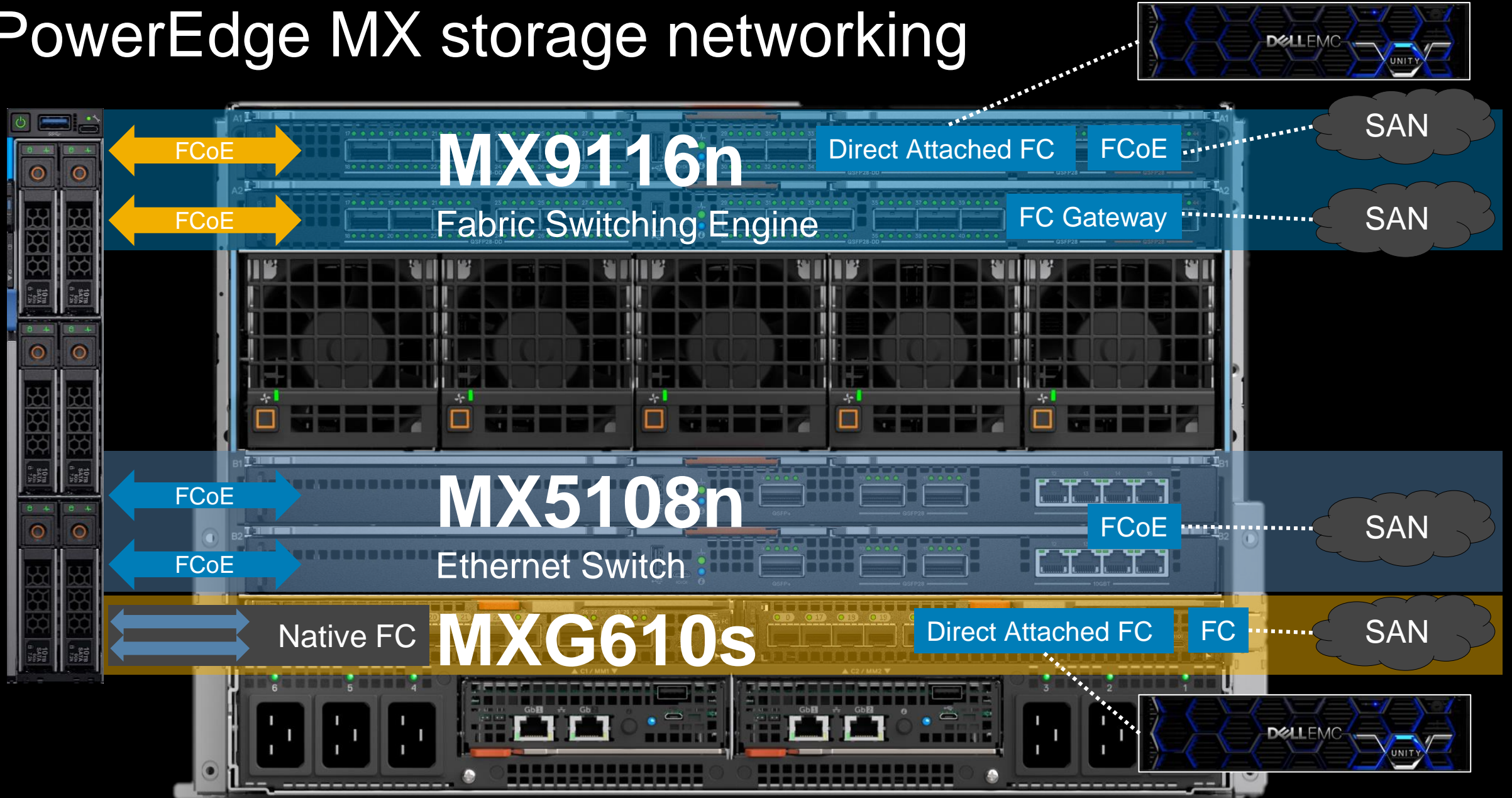
Slot A1: FEM

Slot A2: FEM





# PowerEdge MX storage networking







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