Hewlett Packard Enterprise

NEW DATA PATH SOLUTIONS FOR HPC SIMULATION, AI, AND HIGH PERFORMANCE WORKLOADS

Marc Roskow – HPC Storage Product Management

Lance Evans – HPC Chief Technology Office

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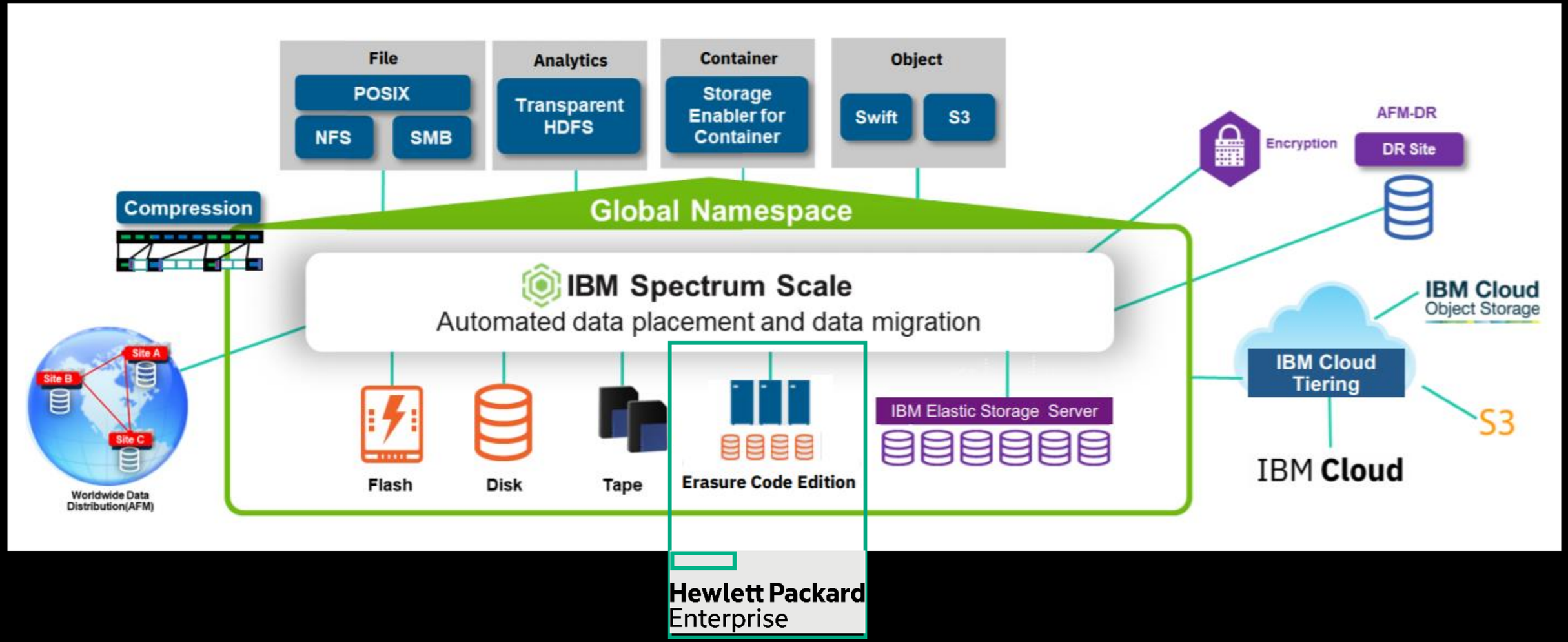
HPE PARALLEL FILE SYSTEM STORAGE: PLACE IN THE ECOSYSTEM

Leverages all surrounding functionality



INTRODUCING HPE PARALLEL FILE SYSTEM STORAGE

Fusion of the leading enterprise parallel file system with the leading industry-standard servers in the HPE factory

- **HPE storage with embedded IBM Spectrum Scale ECE file system running on HPE ProLiant DL325 Gen10 Plus servers** for
  - Clusters of HPE Apollo 2000/HPE ProLiant DL rack servers and HPE Apollo 6500 AI solutions
  - Verticals that often reject Lustre as they need enterprise grade storage features (e.g. Financial Service, Life Sciences, etc.)
  - Home directory storage for large HPC solutions where /scratch directories are on Lustre-based Cray ClusterStor E1000
- **Provides high performance parallel data access for compute nodes concurrently** via
  - Native IBM Spectrum Scale client installed on compute nodes
  - NFS/SMB via Cluster Export Services (CES)
- **High speed connectivity to compute nodes** via
  - InfiniBand HDR100/Ethernet 100 Gb
  - InfiniBand HDR/Ethernet 200 Gb
- **Available in All Flash, All HDD or mixed configurations** based on workload profile
- **Provides broad set of enterprise storage functionality** like
  - Enterprise-grade system availability (“5 Nines”) incl. non-disruptive hardware & software upgrades, online expansion/contraction of the file system, etc.
  - Snapshots, compression, data replication, end-to-end data encryption, end-to-end data integrity (from disk to client), audit features for compliance
  - Protocol support beyond POSIX for NFS, SMB, HDFS, Object (S3, SWIFT) and (soon) Nvidia GPUDirect Storage
  - Data life cycle management - policy based data movement and curating and auto-tuning
- **Single price for the HPE storage system** (no file system license per terabyte or per storage drive)
- **Base warranty 3 years** for hardware & 1 year for software – HPE Pointnext Tech Care and HPE Datacenter Care are available

TWO TYPES OF STORAGE SERVERS

Combination of both in the same file system is supported

HPE ProLiant DL325 Gen10 Plus with 16 x SFF slots
[a]

- # of NVMe SSD per server: 3, 4, 6, 8, 10, 12, 14 or 16
- Capacity points of NVMe SSD in TB: 3.84, 7.68 or 15.36
- (2) InfiniBand HDR/Ethernet 200 Gb 1p adapters

HPE ProLiant DL325 Gen10 Plus with 8 x LFF slots
[a]

- # of SAS 7.2K RPM HDD per server: 3, 4, 6, or 8
- Capacity points of HDD in TB: 4, 8, 12 or 16
- (1) InfiniBand HDR100/ Ethernet 100 Gb 2p adapter
- Factory installed 1.6 TB NVMe capacity to serve file system metadata and small files from fast NVMe Flash.

Same configuration rules for both:

At least 4 and up to 32 storage servers in identical configuration in a RAID cluster.

SKU VIEW OF EXAMPLE CONFIGURATIONS ON PREVIOUS PAGE

HPE Parallel File System Storage Installation and Startup Service needs to be ordered with the system

Aa
All Flash File System

11 Flash Storage Servers with

- **1,037 TB usable capacity**
- **260 GB/s Read and 232 GB/s Write bandwidth**

SKU	Description	Qty
R7R36A	HPE Parallel File System 16Flash Bay Svr	11
R7R40A	HPE PFS 15.36TB NVMe RI SC PM1733 SSD	88
R7R46A	HPE PFS IB HDR/EN 200Gb 1p QSFP56 Adptr	22

Aa
Hybrid File System

4 Flash and 10 Storage Servers with

- **1,008 TB usable capacity**
- **101 GB/s Read and 37 GB/s Write bandwidth**

SKU	Description	Qty
R7R36A	HPE Parallel File System 16Flash Bay Svr	4
R7R38A	HPE PFS 3.84TB NVMe RI SC U.3 PM1733 SSD	32
R7R46A	HPE PFS IB HDR/EN 200Gb 1p QSFP56 Adptr	8
R7R35A	HPE Parallel File System 8Disk Bay Svr	10
R7R44A	HPE PFS 16TB SAS 7.2K LFF LP HDD	80
R7R45A	HPE PFS IB HDR100/EN 100Gb 2p QSFP56 Adptr	10
R7R37A	HPE PFS 1.6TB Flash Metadata Store	10

Aa
HDD File System

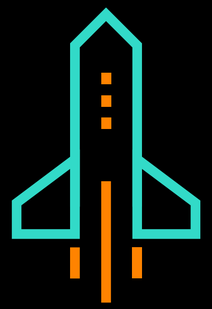
11 HDD Storage Servers with

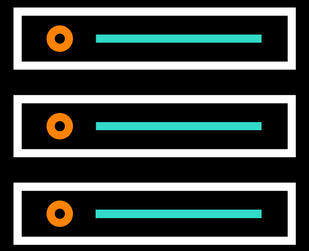
- **1,046 TB usable capacity**
- **7.1 GB/s Read and 5.4 GB/s Write bandwidth**

SKU	Description	Qty
R7R35A	HPE Parallel File System 8Disk Bay Svr	11
R7R44A	HPE PFS 16TB SAS 7.2K LFF LP HDD	88
R7R45A	HPE PFS IB HDR100/EN 100Gb 2p QSFP56 Adptr	11
R7R37A	HPE PFS 1.6TB Flash Metadata Store	11

KEY DATES FOR NEW HPE PARALLEL FILE SYSTEM STORAGE

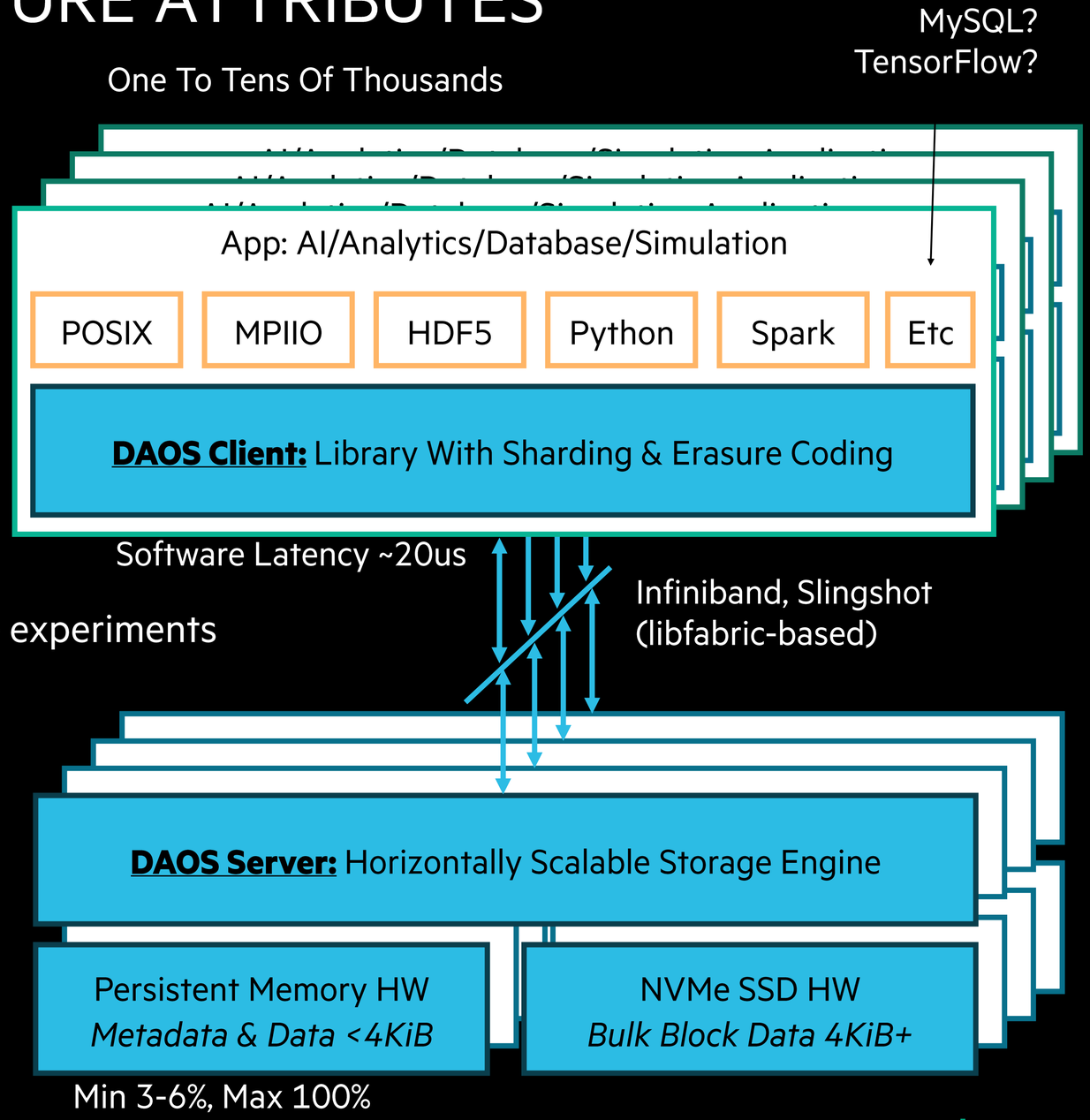
a **April 6, 2021**	a **May 17, 2021**	a **August 2, 2021**
Announcement/ launch	GA/Volume shipments	Larger drives, Higher HDD density, etc.





HPE DAOS REFERENCE ARCHITECTURE ATTRIBUTES

- Low latency, highly concurrent data path software
  - Intel DAOS 2.0
  - Client libraries for KV, object
  - Direct app integration for HDF5, MPI-IO, Spark, Python,
  - POSIX via IO library, preloaded intercept library, or FUSE
- Hardware
  - Based on Proliant DL-380 or 360 Gen10 Plus
  - SSD plus persistent memory in ratios (100% + 6%)
  - Infiniband HDR, Slingshot 11 interconnect options
  - Possible server-side accelerators for computational storage experiments
- Supporting software
  - HPCM for cluster management
  - Distributed scripting for SW configuration
  - Core cluster and software control
- Installation model
  - Onsite via compliant BOM, cookbook, scripts
  - Factory integration prior to arrival using similar tools



WHAT IT IS

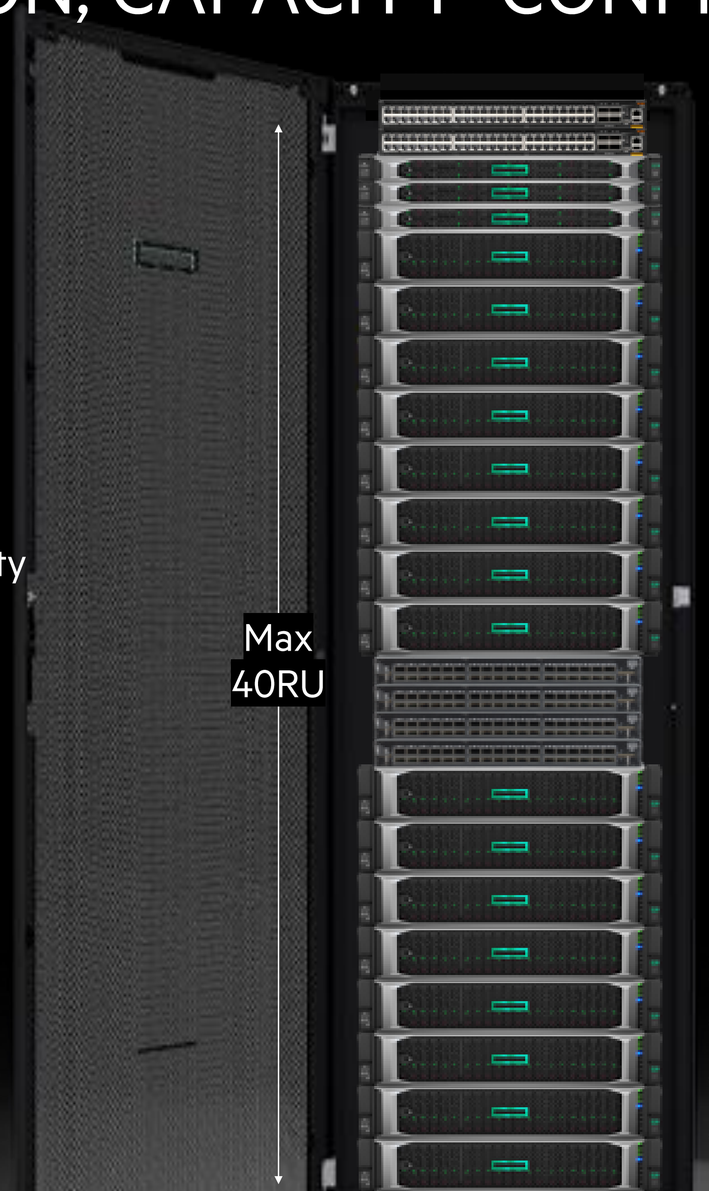
HPE DAOS REFERENCE ARCHITECTURE BENEFITS

- Differentiated high-performance applications
  - Large shared file/object performance at scale
  - Tiny parallel KV,object, graph projects
  - Random searches across arbitrarily sized datasets
  - Concurrency of multiple users, untuned IO, without interference
  - Develop on laptop, deploy on exascale
  - Highest performance and concurrency at any IO size
- Exposes emerging hardware speeds
  - Achieve full bandwidth of media to client applications
  - Drive media queue depths to operational limits
  - Low latency for reduced time to results in complex query sequences
  - Parallelism of client-side erasure coding

WHAT PROBLEMS IT SOLVES

REFERENCE IMPLEMENTATION, CAPACITY CONFIG

- Unbundled Repeatable Solution Delivery Method
  - Qualified hardware and software BOMs
  - HPCM cluster management software
  - Light installation / configuration scripting packages
  - Reference doc set: for field or factory integration
  - Customer system administration skills required
- Single-Rack Solution Maximums (Capacity Config):
  - 16x DL-380 Gen10 Plus; 128TiB pmem, 2PB raw capacity
  - 4x 200Gb Switches (Mellanox or Slingshot)
  - ~1,400GBps/700GBps raw read/write throughput
  - ~100M/50M read/write OPS
- DAOS Solution Milestones
  - Build it yourself from available HPE SKUs in June
  - Repeatable BOMs, scripts, instructions in October
  - Full Productization In planning phase, target late 2022
- Support
  - Select early POC customers assisted by engineering
  - Official support offering with productization



2x Aruba 8360 Mgmt Switches max

3x HPE Management Servers max:

- DL-325 Gen10 single-socket

4x 200GbE Switches (optional):

- Mellanox QM8700 (72 uplinks max)
- HPE Slingshot 1 (80 uplinks max)

16x max HPE DAOS Server Cfg each:

- DL-380 Gen10 Plus (Ice Lake)
- 16x Gen4 NVMe SSD 122TB ttl
- 16x Optane Memory 8TiB ttl (6.7%)
- 2x 200Gb NIC

HOW TO GET IT

REFERENCE IMPLEMENTATION, PERFORMANCE CONFIG

- Unbundled Repeatable Solution Delivery Method
  - Qualified hardware and software BOM
  - HPCM cluster management software
  - Light installation / configuration scripting packages
  - Reference doc set: for field or factory integration
  - Customer system administration skills required
- Single-Rack Solution Maximums (Performance Config):
  - 32x DL-360 Gen10 Plus; 64TiB pmem, 1PB raw capacity
  - 4x 200Gb Switches (Mellanox or Slingshot)
  - ~1,400GBps/700GBps raw read/write throughput
  - ~200M/100M read/write OPS
- DAOS Solution Milestones
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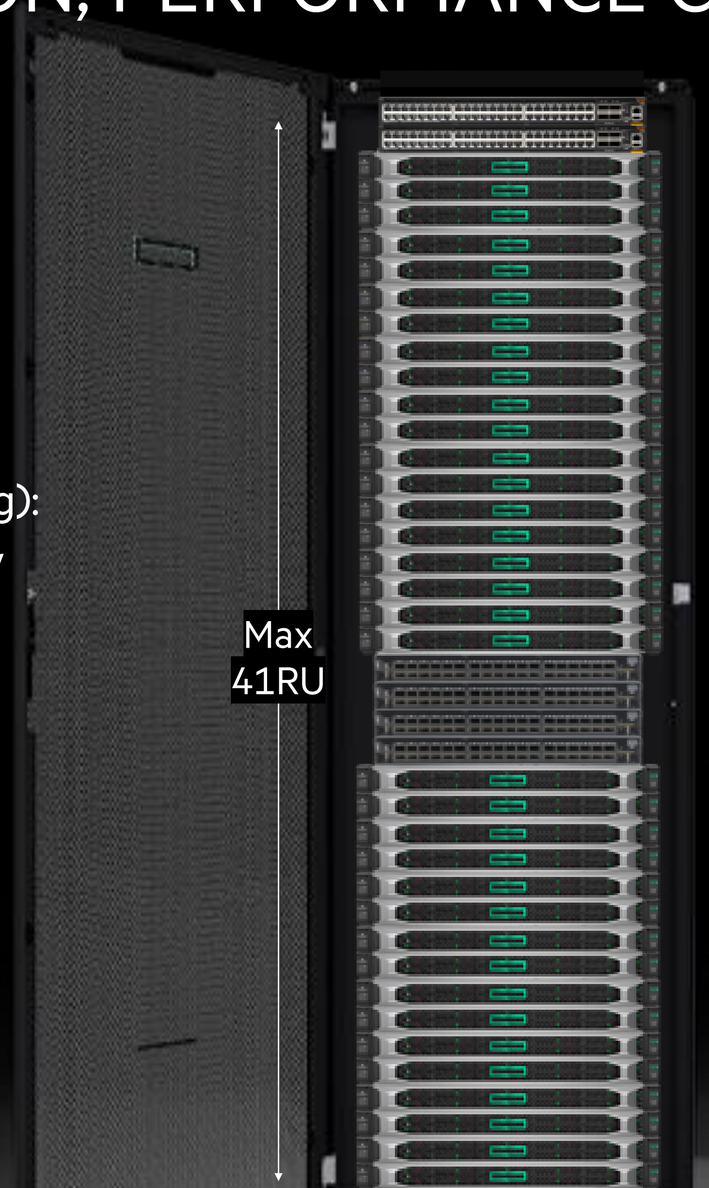

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32x max HPE DAOS Server Cfg each:

- DL-360 Gen10 Plus (Ice Lake)
- 8x Gen4 NVMe SSD 30TB ttl
- 16x Optane Memory 2TiB ttl (6.7%)
- 2x 200Gb NIC

HOW TO GET IT

Hewlett Packard Enterprise

THANK YOU

Q&A after the next presentation