

AI-04542 Datacenter Hardwares

Who are top hard drive vendors in Datacenter? Are they using sas drive or ssd or nvme? What are the top AI server models from Dell and Supermicro? Are SAS drives obsolete in Datacenter? How does modern poweredge servers which uses nvme creates mirroring for redundancy? In the old Poweredge, there were quick swap drive trays?

1. Top Hard Drive Vendors in the Datacenter

The enterprise hard drive market has consolidated into a **triopoly**:

1. **Seagate** (Market leader by volume, known for its Exos series and HAMR density tech)
2. **Western Digital (WD)** (Ultrastar series)
3. **Toshiba** (Enterprise Capacity MG series)

2. SAS vs. SSD vs. NVMe: What Are They Using?

Modern datacenters use a **tiered storage architecture** combining all three, depending on the workload:

- **NVMe (PCIe)**: The standard for **hot storage** (AI training/inference, high-transaction databases, real-time analytics). They interface directly with the PCIe bus, bypassing old legacy controller bottlenecks.
- **SATA/SAS SSDs**: Used for **warm storage** and legacy virtualization nodes where high IOPS are needed, but hyper-dense PCIe throughput isn't strictly required.
- **Nearline HDDs (SATA/SAS mechanical hard drives)**: Used for **cold/bulk storage** (cloud object storage, backup repositories, big data lakes). Mechanical drives still dominate the datacenter by total *exabytes stored* because their cost-per-terabyte (\$/TB) remains far cheaper than SSDs for massive scale.

3. Top AI Server Models: Dell vs. Supermicro

With the explosion of GenAI and large language models (LLMs), server architecture has shifted toward liquid-cooled, high-density GPU nodes:

Dell Technologies

- **PowerEdge XE9680 / XE9780**: Direct liquid or air-cooled 8-way GPU servers supporting NVIDIA HGX (H200, B200, B300).
- **PowerEdge XE9712 / XE8712**: Rack-scale liquid-cooled systems built specifically for NVIDIA GB200/GB300 NVL72 and NVL4 Superchips.
- **PowerEdge XE9785**: High-density AMD-focused AI platform housing 8x AMD Instinct MI355X accelerators.

Supermicro

- **SYS-821GE / SYS-121H Series (NVIDIA HGX B200/B300)**: 8-GPU enterprise flagship systems optimized for LLM training and inference.
- **SuperBlade & NVL72 Rack Solutions**: Custom liquid-cooled racks supporting NVIDIA GB200/GB300 Grace Blackwell Superchips and custom ASIC clusters.
- **SYS-421GE-TNRT**: A popular air-cooled platform designed for PCIe-based GPU cards (NVIDIA L40S, H100 PCIe) targetting mid-sized enterprise AI workloads.

4. Are SAS Drives Obsolete in the Datacenter?

Not obsolete, but actively being phased out in new deployments.

- **For Spinning Disks (HDDs):** High-capacity bulk storage hard drives still commonly use **12G/24G SAS interfaces** alongside SATA because SAS allows dual-porting (connecting one drive to two controllers for hardware path redundancy) and superior error handling via SANs/JBODs.
- **For Solid State Disks (SSDs): SAS SSDs are functionally dead for new designs.** NVMe (specifically U.2, U.3, and EDSFF E3.S form factors) has completely superseded SAS SSDs. NVMe offers significantly lower latency, direct CPU access, and dramatically higher throughput at competitive prices.

5. How Modern Dell PowerEdge Servers Create NVMe Mirroring/Redundancy

Historically, NVMe was connected directly to CPU PCIe lanes, which made classical Hardware RAID impossible without complex software layers. Today, modern Dell PowerEdge servers (15th, 16th, and 17th Generations) handle NVMe redundancy in three primary ways:

A. Hardware NVMe RAID (Dell PERC 11/12/13)

Dell introduced native PCIe/NVMe Hardware RAID controllers (such as the **PERC H755N**, **PERC H965i**, and the **PERC13 H975i**).

- Instead of routing NVMe cables directly to the motherboard, drives connect through a specialized **PCIe switch backplane** wired to the PERC card.
- The PERC card sits on the PCIe bus and manages **Hardware RAID-1 (Mirroring)**, RAID-5, or RAID-10 completely transparently to the OS—just like old SAS controllers did, but at Gen4/Gen5 PCIe speeds.

B. Dedicated Boot Mirroring (Dell BOSS-N1 Card)

For the Operating System boot drive, Dell uses the **BOSS-N1** (Boot Optimized Storage Solution) card:

- It is a dedicated PCIe controller holding two M.2 NVMe SSDs accessible via hot-swappable rear bays.
- It manages hardware **RAID-1 (Mirroring)** natively at the microcode level, isolating the OS entirely from your main data storage array.

C. Software-Defined Redundancy (OS / SDS Level)

In hyperconverged (HCI) or cloud-native setups (e.g., VMware vSAN, Nutanix, Linux Software RAID/mdadm, ZFS, or Ceph), NVMe drives connect **directly to CPU PCIe lanes** with no hardware controller in between. Redundancy and mirroring are calculated at the software/storage-engine layer, which distributes mirrored copies across drives or network nodes.

6. Whatever Happened to the Quick-Swap Drive Trays on Older PowerEdges?

They are still around, but they have evolved significantly:

- **Hot-Swappable Backplanes Remain:** You can still pop open the front latch, pull the lever, and swap a live drive without shutting down the server.
- **From 3.5"/2.5" Universal Trays to Enterprise NVMe Form Factors:** While classic 2.5-inch SAS/SATA caddies (U.2/U.3) are still widespread, modern datacenters are moving toward **EDSFF (Enterprise & Data Center Standard Form Factor)**, such as **E3.S** or **E1.S** ruler drives.
- **Improved Thermal Density:** Modern hot-swap caddies are thinner, airflow-optimized, and built to handle the intense heat generated by Gen5 NVMe drives pulling up to 25 watts per slot.

