



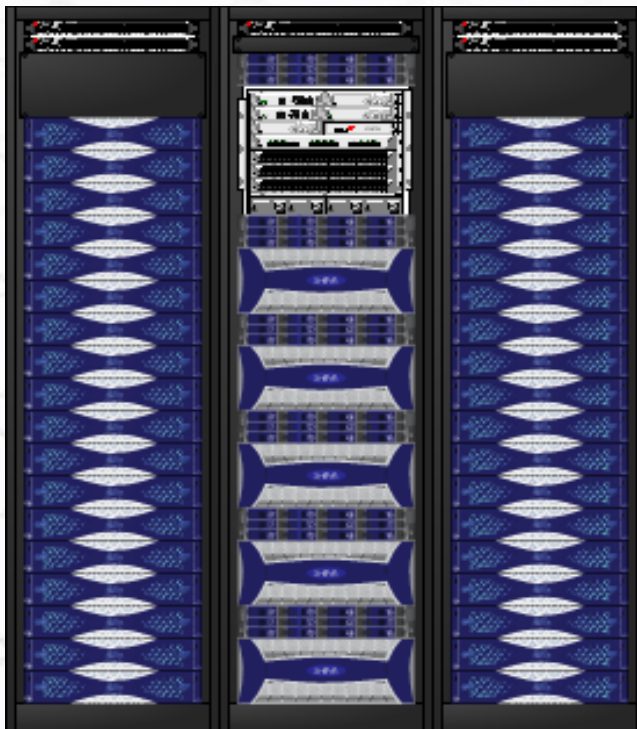
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# WARP Mechanics ZFS Array Lustre User Group 2013

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# WARP Mechanics Ltd.

- Goal: Bring HPC technologies into non-HPC markets
- Current focus: ZFS and Lustre
- Historical customers: Hollywood studios
- Produce ZFS RAID arrays and turn-key HPC systems



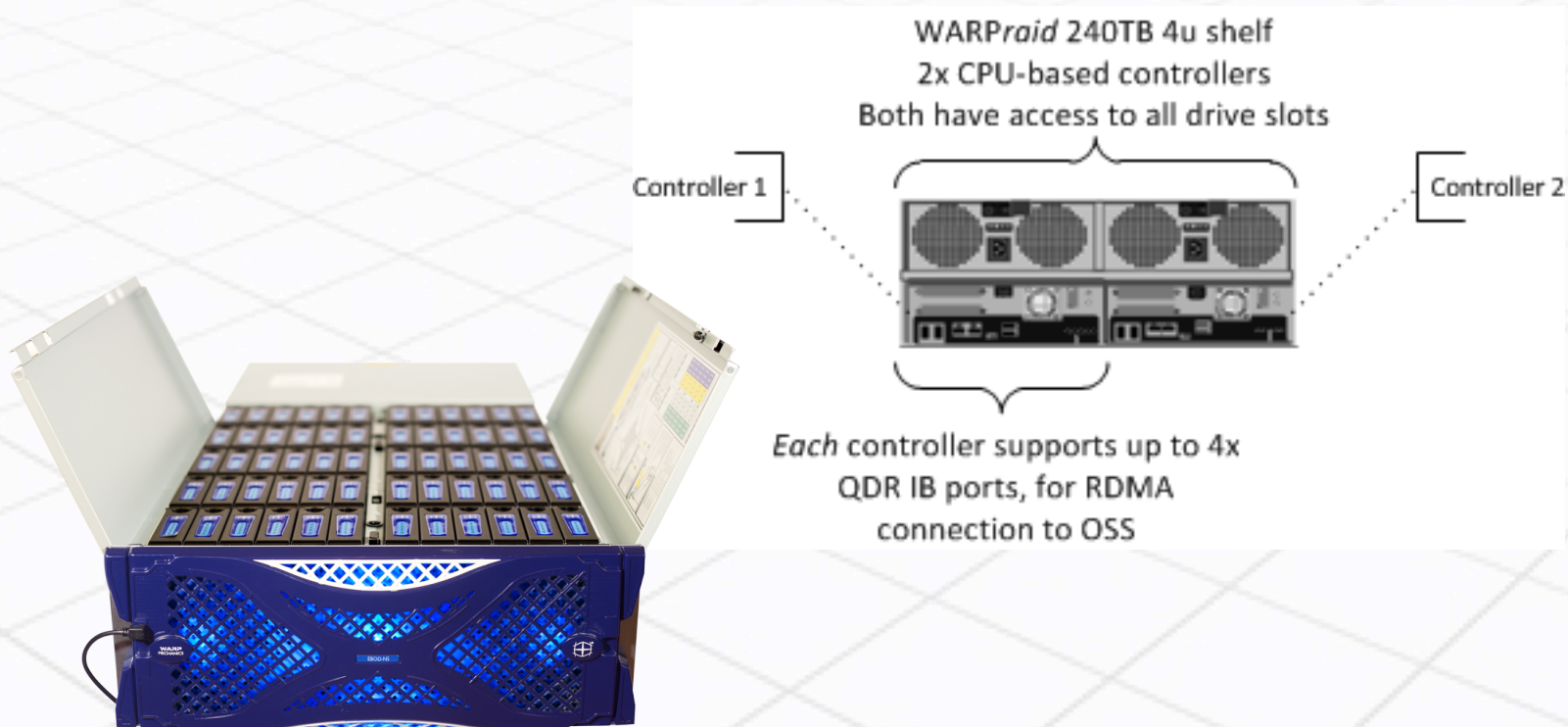
# Primary Value: ZFS Array

- OEM-quality hardware with ZFS controllers
- RAID and NAS modes
- Available as self-contained storage shelf or full system
- 1/10/40 GbE, 8/16 GbFC, QDR/FDR IB

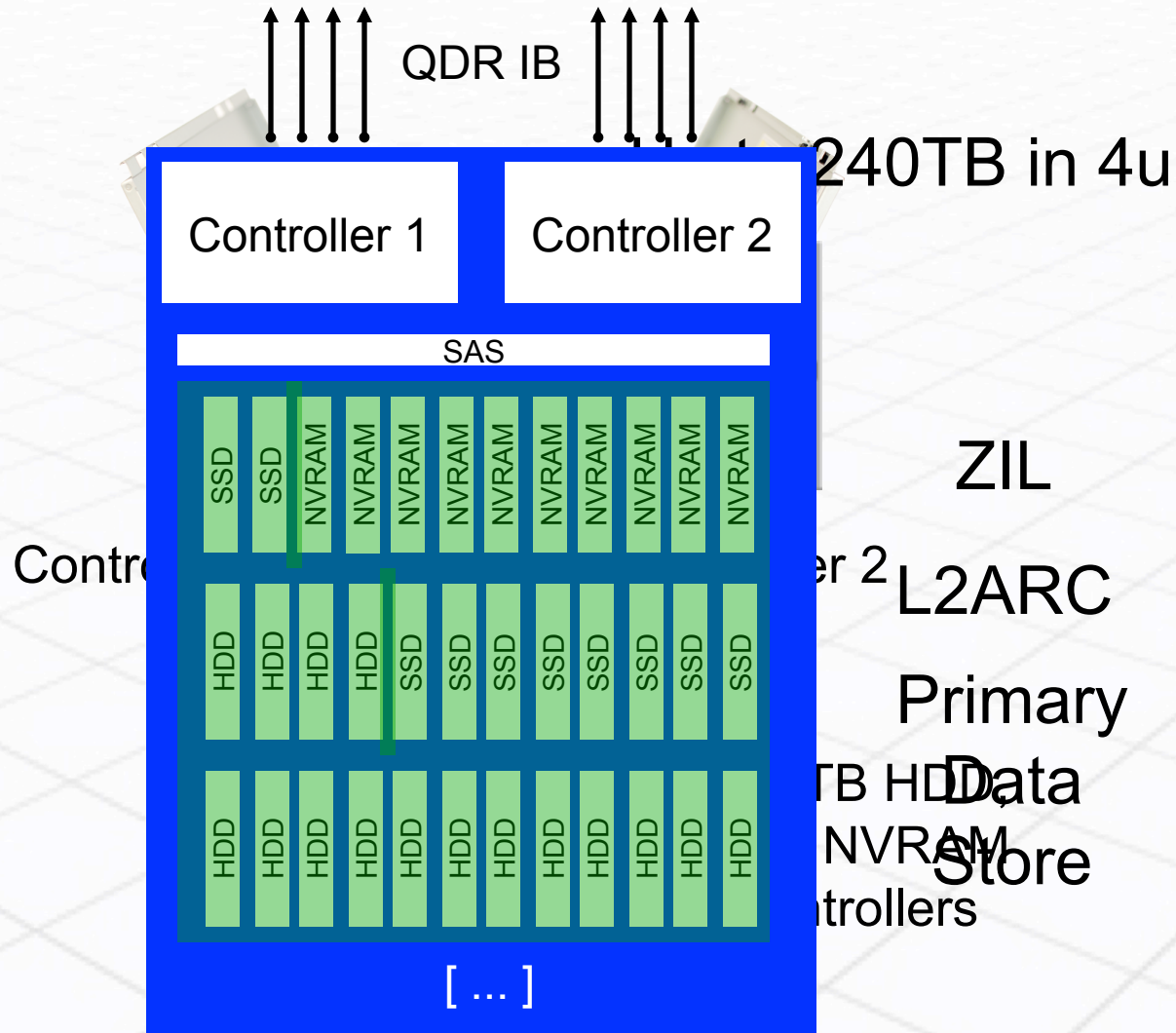


# Example ZFS RAID Implementation

- 4u allows 240TB HDD, or 120TB SSD, or a hybrid balance of HDD+SSD+NVRAM
- Footprint includes 2x PCIe g3 Sandy Bridge controllers



# Example Implementation (cont.)



# Do more with less $\neq$ OEM storage

- WARP 39810 Storage Matrix
  - MSRP starting from **\$60,000**  $\rightarrow$  **~\$0.25/GB**
  - Maximum density - **240TB** raw *per 4u shelf*
  - Up to **2.4PB** raw per standard cabinet
- WARP 39820 Hybrid Matrix
  - MSRP starting from **\$120,000**  $\rightarrow$  **~\$0.50/GB**
  - 10TB SSD cache + NVRAM write accelerators
  - Balance cost vs. performance - 200TB raw
- WARP 39830 Memory Matrix
  - MSRP starting from **\$600,000**  $\rightarrow$  **~\$0.60/IOPS**
  - SSD performance & high capacity - **120TB** raw *of pure SSD*
  - Up to **1.2PB** raw per standard cabinet
  - Sustains **>10 gigabytes/s**, or **>1M IOPS**



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# Questions?



# Expandable / flexible system

- The 39800 series supports numerous cost/performance configurations, interface types, advanced software features, and storage protocols
  - Starting at ~\$0.25 per GB for archival HDD
    - About a quarter million USD per PB
  - Starting at ~\$0.50 per GB for hybrid HDD+SSD+NVRAM
    - About a half million USD per *fast* PB
- Same 4u “building block” is the basis for numerous large scale WARP storage systems



# Robust Logistics, Service; Support

- Delivered via major partners
  - Sanmina -- \$6 Billion+
  - Hyve Solutions -- \$10 Billion+
- Supported by WARP Mechanics plus escalation
  - Intel / WhamCloud Lustre
  - Nexenta ZFS

# WARP Mechanics Approach

- How a ZFS RAID array connects to OSSs and cluster fabric
- Example shows two OSS / RAID HA pairs

