A High Density NVMe JBOF Storage in 1U Chassis

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Lightning Overview

• 2U 30(U.2) or 60(M.2) NVMe SSDs
• Flexible Choice of Various SSDs Form Factors
• Tool-less and Modularized Design for Easy Maintenance
• Ultra-high IOPS and microsecond grade latency
Evolution from Lightning to Thunder

Physical designed as a 1U 19"
Thunder Key Features

• 1U 24 hot-pluggable U.2 NVMe with two x16 PCIe Gen3 Uplinks supported
• PSU & Cooling redundancy, tool-less drawer for Easy SSD Maintenance
• Flexible SSD resource reassignment
• Excellent system performance
Block Diagram with Dedicated Host

With 1 Host

- 1 host access 24 NVMe SSDs through two PCIe x16 with two re-timer cards
Each host accesses up to 24 NVMe SSDs by flexible NVMe SSD reassignment. The dynamic partitioning provides for users to allocate SSD pools dynamically.
Manageability of BMC

USB, I2C, Ethernet OOB (Out-of-band)

Monitor
- Temperature
- Voltage
- Power Consumption

Control
- Fan Speed
- LED
Flexible IOM for Front / Rear Cabling

Front View

Rear View

IOM for Front cabling

IOM for Rear cabling
Physical connection with Thunder

19" OCP Server

Out-band BMC Management

19" Generic Server

External PCIe x16 Cable

Standard low profile OCP PCIe-retimer Card

External PCIe x16 cable

IOM

Standard low profile OCP PCIe-retimer Card
High Key Performance

- Disk IO Performance
  Throughput, IOPS

- IO-Watt Performance (Performance/Price)
  IOPS / Watt

* The measurement in SAS JBOD and SATA JBOF system were based on two miniSAS HD x4 connection
** The measurement in NVMe JBOF system was based on PCIex16 connection
5X Throughput + 854X IOPS

- **Actual Throughput**
  - READ : 13.2 GB/s
  - WRITE : 12.0 GB/s

  Theoretical PCIe Gen3 x16 = 15.754GB/s (128b/130b)

- **Actual IOPs**
  - READ : 2329K IOPs
  - WRITE : 803K IOPs
Significant IO-Watt Performance

IOPS (per PCIe Switch) = 2329k
IO-Watt = (IOPS x 2) / (Power Consumption)
= 2329k x 2 / 450W
= 10351

NVMe JBOF < 450w
Wiwynn’s High Density NVMe Storage

- Service more CSPs with same Lightning DNA
- Flexible PCIe cabling for Cold/Hot aisle
- Tool-less drawer for Easy SSD Maintenance
- Redundant PSUs and Cooling design
- Flexible SSD resource reassignment
- Excellent System Performance
  - $26\text{GB/s}$ Throughput
  - $4,658\text{K IOPS}$
  - $10,351\text{ IOPS/Watt}$