EDSFF - The Future of Enterprise Storage and Beyond

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New Technologies Need a Home

- A form factor provides the fundamental volumetric for innovation—any new storage technology has to start there to make adoption easy
- 2.5in created 30 years ago shipped over 46M units in 2017[*]— Very Extensive Enterprise Infrastructure
  - HDD, Flash, SCM, PATA, SATA, SCSI, FC, SAS, NVMe
- NVMe on PCIe makes the form factor even more important to enable technologies beyond storage
- EDSFF provides the necessary scalability and interoperability to be the form factor for innovation for the next 30 years
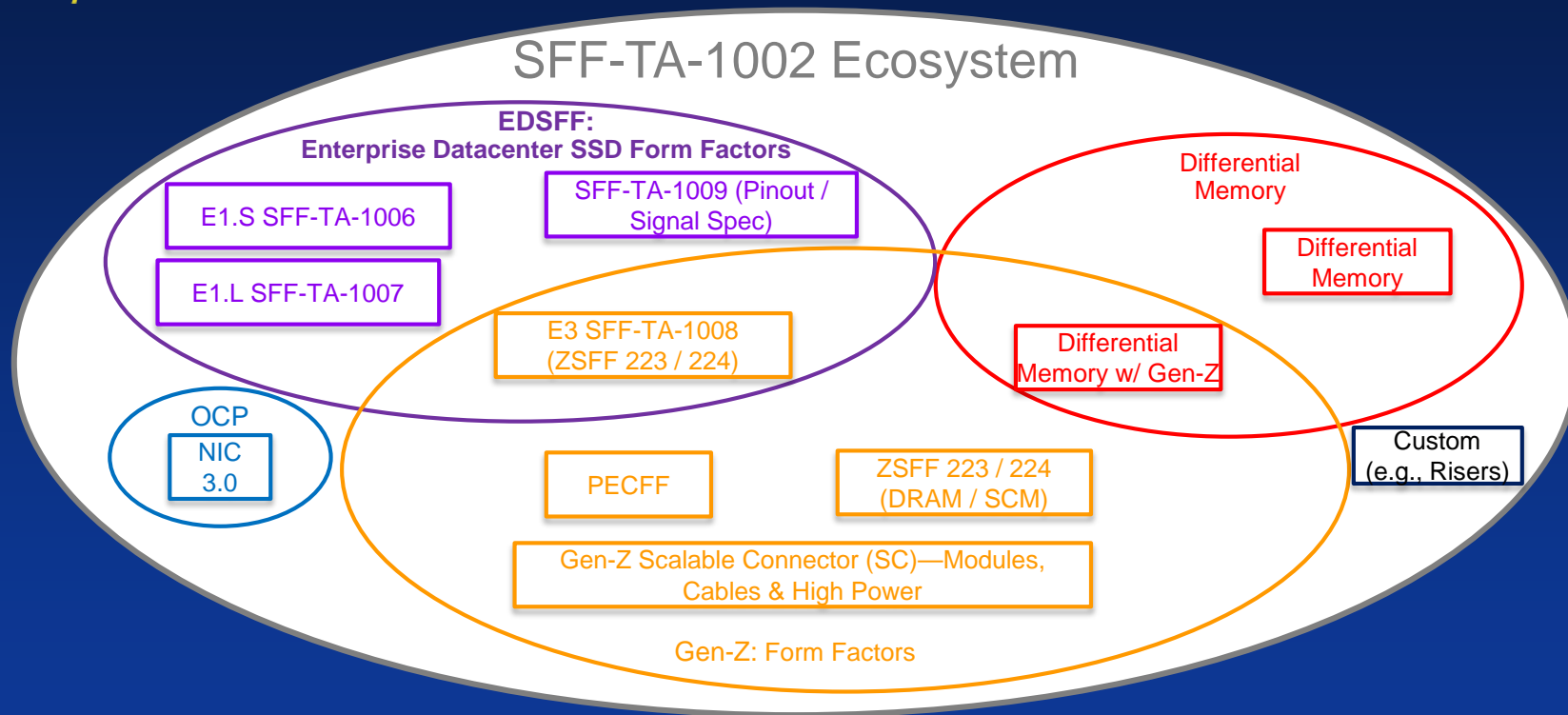
High-Volume Adoption and Interoperability

- Multiple standards using the same mechanicals drives down cost, enabling more adoption—a great feedback loop

- Maintaining pinout electrical compatibility across those standards is critical to eliminating stranded I/O lanes

- Today's servers have lots of stranded I/O, future servers with Differential Memory, Gen-Z, OCP, and EDSFF will be able to tap into unused I/O and cable it where additional drives or memory is needed
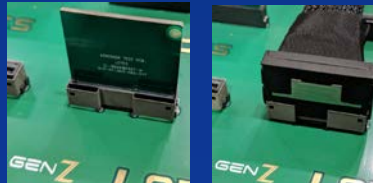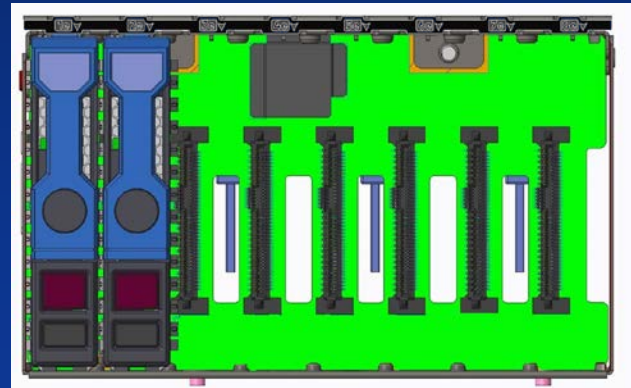
Design Re-use and Airflow Benefits

- Much smaller connector allows backplane design to be leveraged for both 1U for 2U servers for E1.S and E3
- Greatly reduces 2U airflow impedance—lower cost cooling
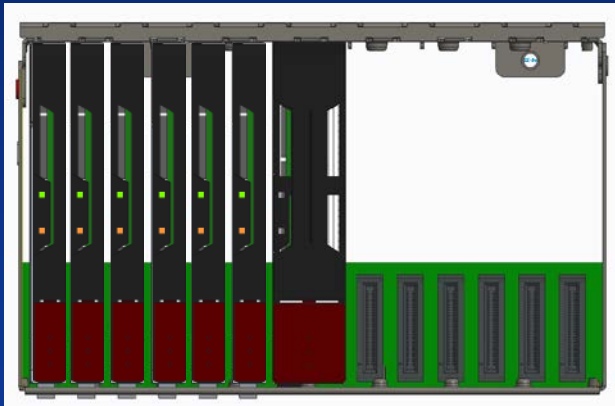
E3 Single-wide (7.5mm)   E3 Double-wide (16.8mm)
Up to x8 SFF-TA-1002 connector

2.5" U.3 (x4 SFF-8639 connector)
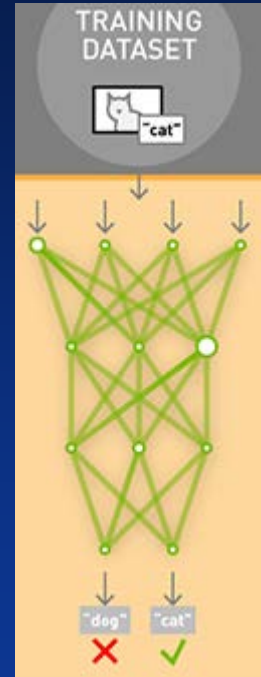
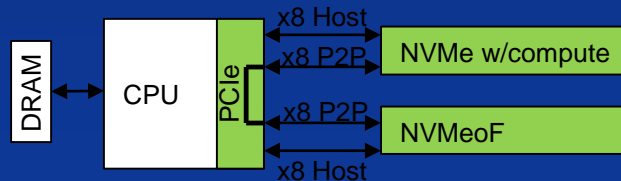# E3 Customer Benefits

- Leverage same chassis designs, supports drop-in cage and backplane for easy transition
  - E3 short (104.9mm) fits in same depth of 2.5" SFF
  - E3 long (142.2mm) fits in same depth as 3.5" LFF

E3.S drive cages / U.3

- Optimized design for Flash resulted in 50% capacity bump over 2.5" U.2/U.3 drives

- Slim connector enables 4 rows of drives in 1U for 20 drive sweet spot
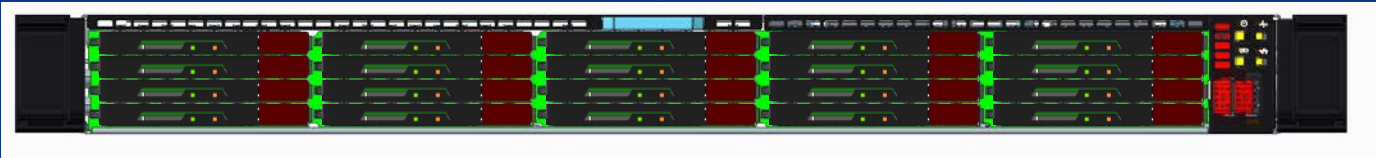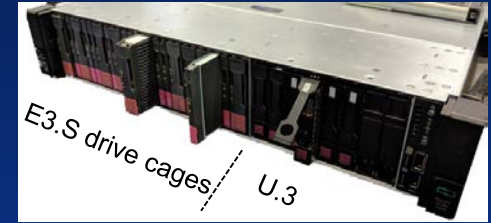
Emerging Enterprise Use Cases

- Compute in Storage (Data-centric accelerators)
  - E3 76x104/142(mm) can fit large footprint FPGA, GPGPU and TPUs for Neural Network Deep Learning
  - E3 single/double wide (7.5/16.8mm) interchangeability allows a single module with high-speed inter-device links and independent host PCIe connections—no external cabled connections required
- Wide x16 interface provides bandwidth for future P2P traffic enablement without limiting host I/O

TRAINING DATASET

"cat"

"dog"   "cat"

DRAM ↔ CPU — PCIe

x8 Host
x8 P2P → NVMe w/compute
x8 P2P → NVMeoF
x8 Host

How E3 Enables Future Innovation

"Dark Flash"

- Up to 70W of power to light up enough die to saturate interface—eliminates the dark flash problem
- Common PCIe physical layer enables the same E3 "drive bay" to be used for multiple device types:
  - Block-based NVMe Flash or SCM SSD
  - PCIe device (FPGA, NIC, GPU, GPGPU, Smart NIC)
    - Enables hot-plug and/or easier serviceability
  - Gen-Z Memory Semantic devices
    - DRAM modules, persistent memory, accelerators, messaging
- Most exciting is what we haven't thought up yet, so go innovate!

Thank You