E2: A new high-capacity form factor

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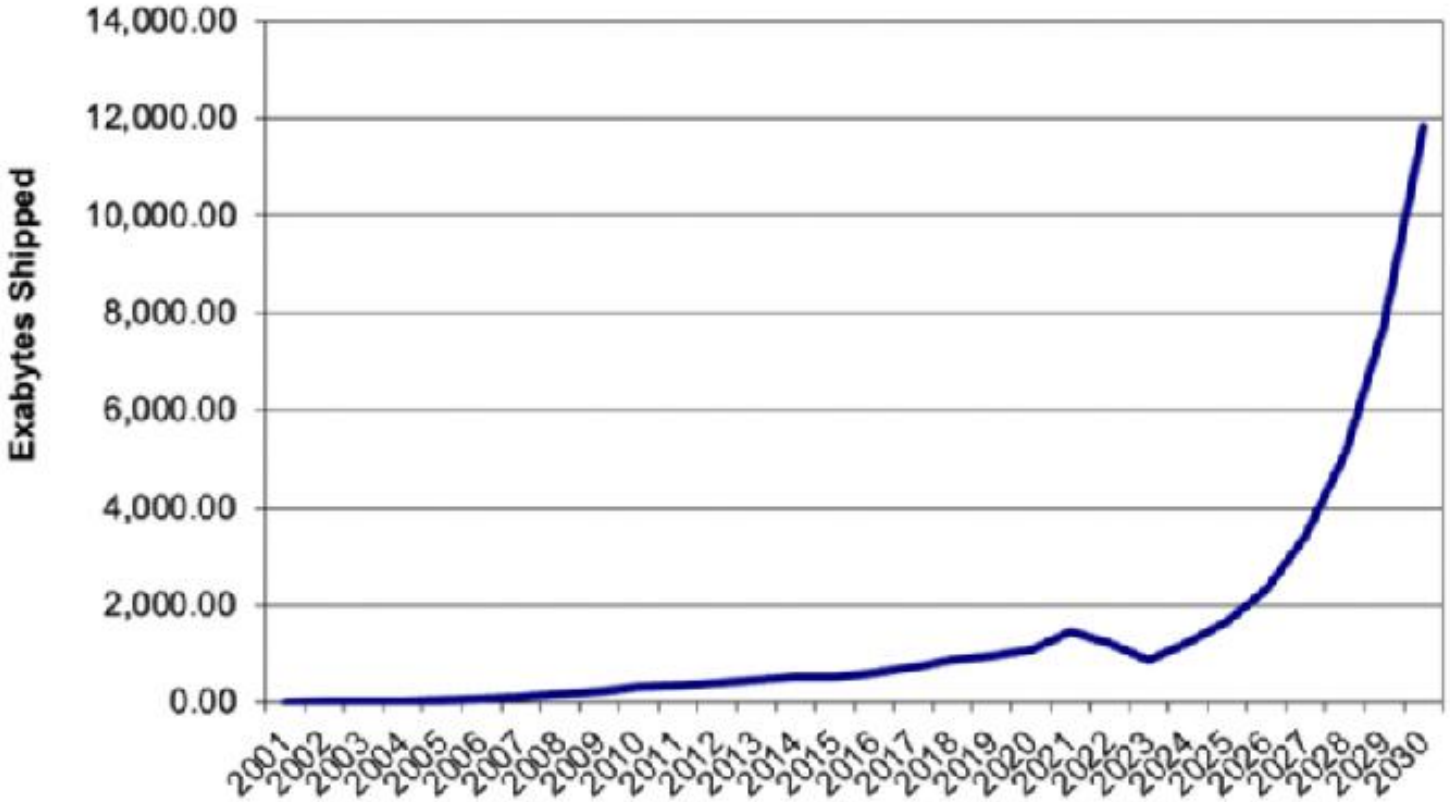
FMS

Question

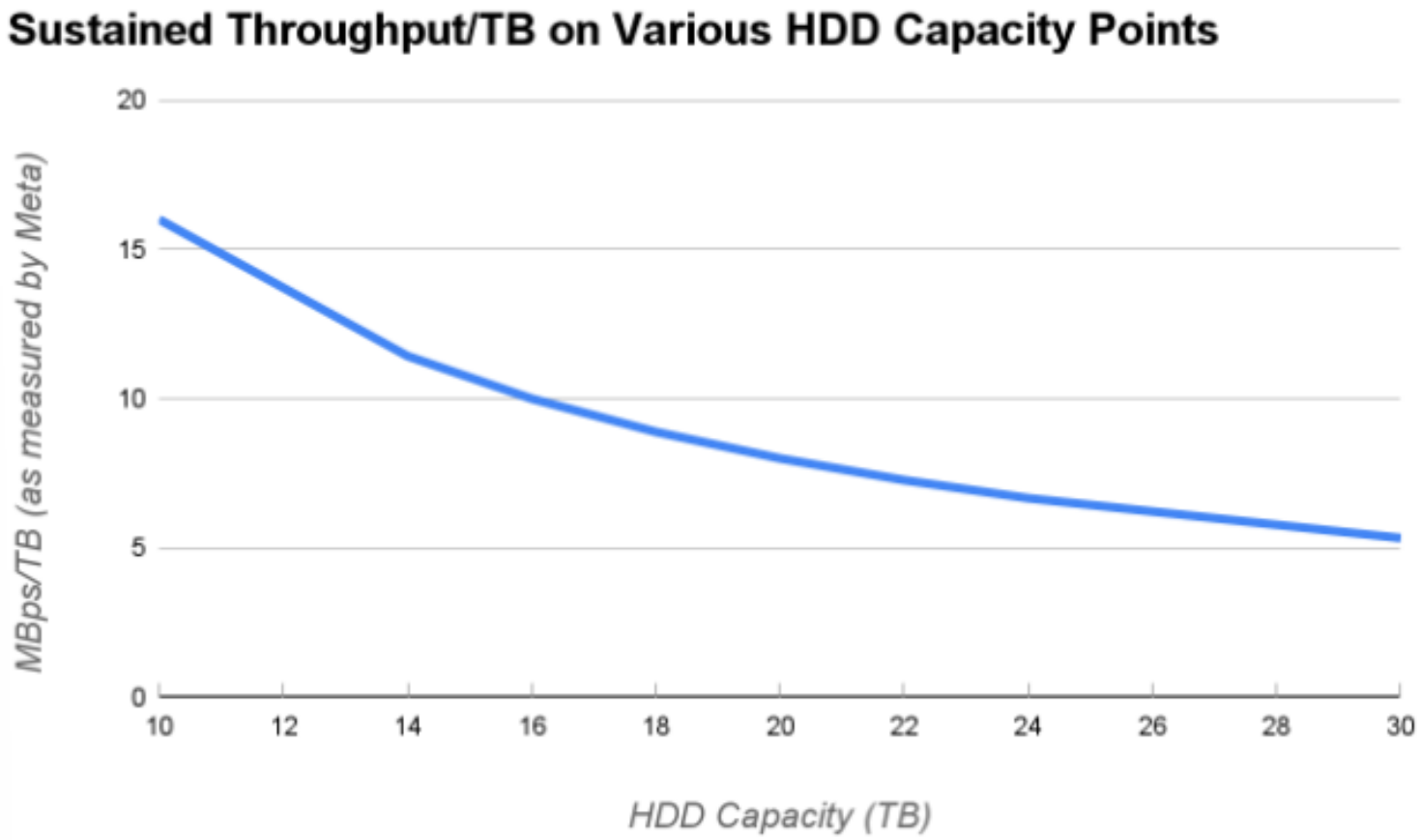
How much HDD Capacity is predicted to ship by 2030?



Source: Coughlin Associates Digital Storage Technology Newsletter https://tomcoughlin.com/product/digital-storage-technology-newsletter/

Problem

Performance concerns driving need for MB/s per TB performance



Source: Meta blog: A case for QLC SSDs in the data center https://engineering.fb.com/2025/03/04/data-center-engineering/a-case-for-qlc-ssds-in-the-data-center/

Solution: capacity tier SSDs

- High capacity QLC SSDs help solve this problem
  - Higher capacity, better performance/TB, and better power/TB than HDDs
- The challenge: SSD vs. HDD cost to meet capacity needs
- Reducing cost: higher capacity/SSD
  - Reduces number of non-NAND components per rack
  - Reduces number of SSDs per rack
  - Reduces number of control nodes per rack

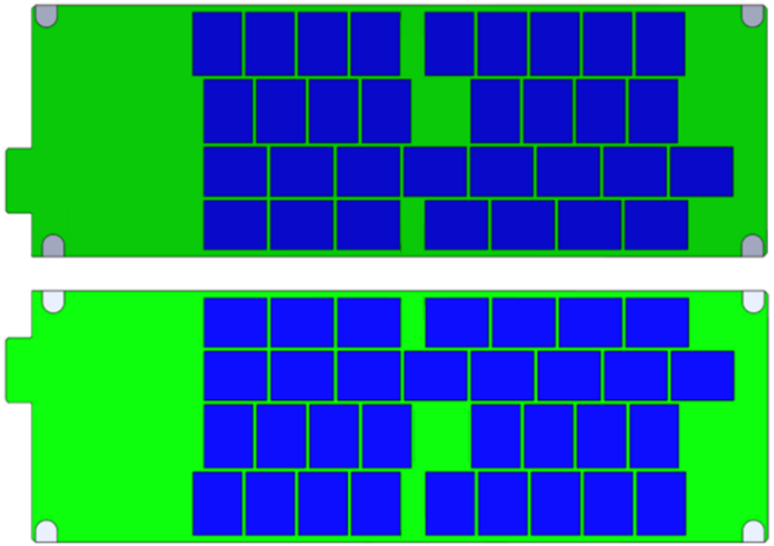
Choices and tradeoffs

Option	Pros/Cons
Current form factor Double the NAND die per package (using E3.S, E3.L, E1.L)	+ Use existing form factors - Higher cost (compounding yields) - Thermals
New form factor Move to 64 NAND packages (E2)	+ Cheap + Thermally efficient - New form factor
Thicker form factor Move to 64 NAND packages (using E3.L 2T)	+ Use existing form factors but new thickness - Higher cost (multiple PCBs plus internal cabling) - Consumes more front panel area - Thermals

A new form factor is the best path forward to address the capacity problem

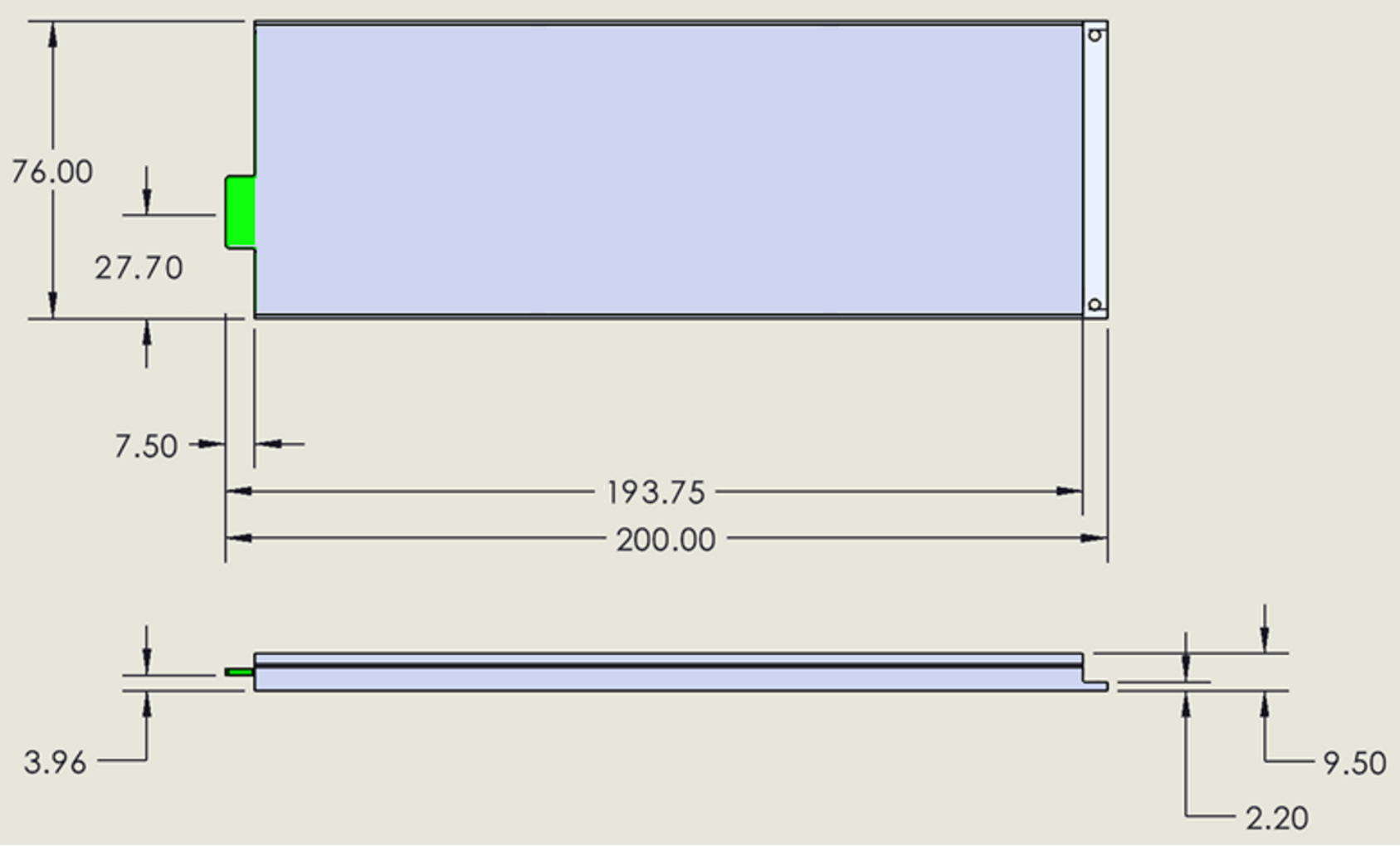
Goals of E2

- 64 NAND packages
- NVMe, PCIe, EDSFF (don't invent something drastically new)
- Leverage what has already been done when possible



Form Factor	E2	E3.S/L 1T	E1.L 9.5	E1.S 9.5
Protocol	NVMe	NVMe	NVMe	NVMe
Transport	PCIe	PCIe	PCIe	PCIe
Connector	SFF-TA-1002	SFF-TA-1002	SFF-TA-1002	SFF-TA-1002
Pinout/electricals	SFF-TA-1009	SFF-TA-1009	SFF-TA-1009	SFF-TA-1009
Number of packages	64+	16-48	32-48	8-16
Enclosure Length	200mm	112.75/142.2mm	318.75mm	118.75mm
Enclosure width	76mm	76mm	38.4mm	33.75mm
Enclosure thickness	9.5mm	7.5mm	9.5mm	9.5mm
Connector alignment	E3 Aligned	E3 Aligned	E1 aligned	E1 aligned
Latch/Carrier	E1 Style	E3 Style	E1 Style	E1 Style
EMI/ESD	E1 style	E3 Style	E1 style	E1 style

Dimensions



Spec development

Specification went from concept to publication in 2 months!

Source: https://members.snia.org/document/dl/55771

Date	ID	Title	Status
2025-06-16	SFF-TA-1042	Enterprise and Datacenter 2U Form Factor (E2)	Published 1.0, 2025-06-16

Source: https://www.snia.org/sff/specifications

Prototype development

Micron E2 SSD prototypes

Prototype chassis

For more information

- SFF-TA-1042 enterprise and data center 2U Form Factor (E2)
  - https://members.snia.org/document/dl/56434
  - Join SNIA to participate in this and other specifications
- Visit the Micron booth (#107) to see the prototype E2 and chassis
- Look for future product announcements from Micron on E2