

DATA IS POTENTIAL

Seagate Storage Update

LOC Designing Storage Architecture for Digital Collections

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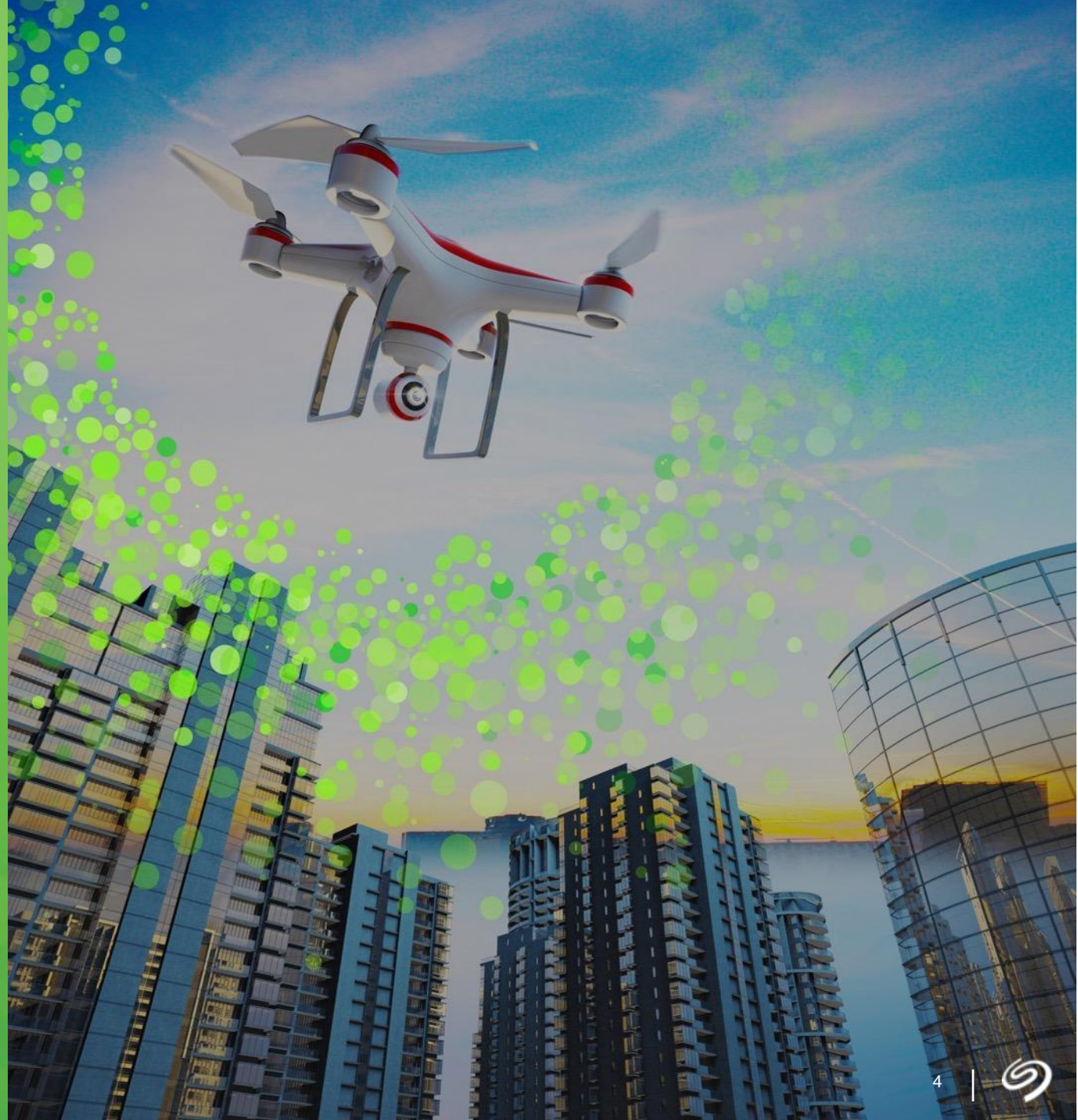


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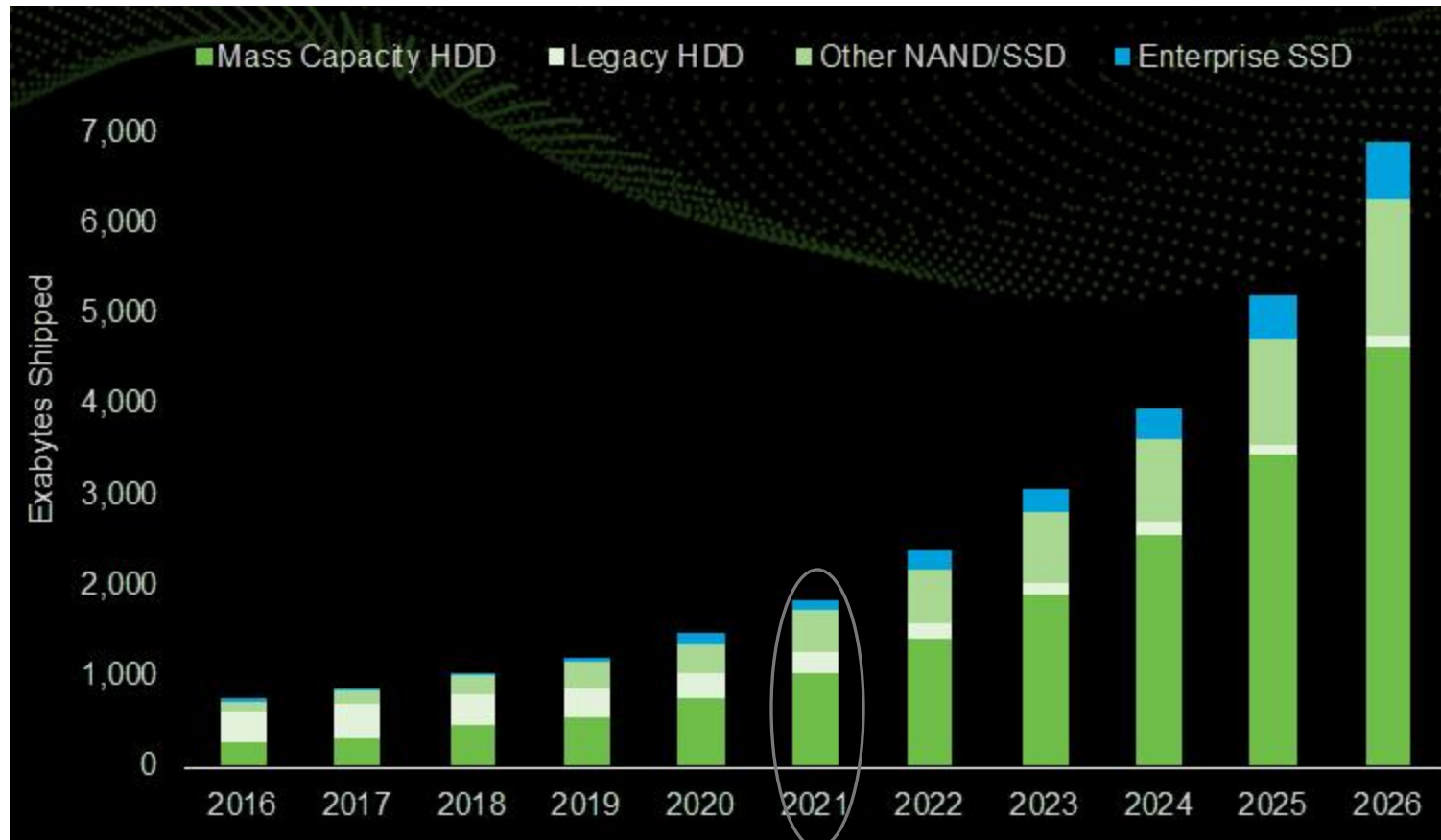


Storage Industry Update



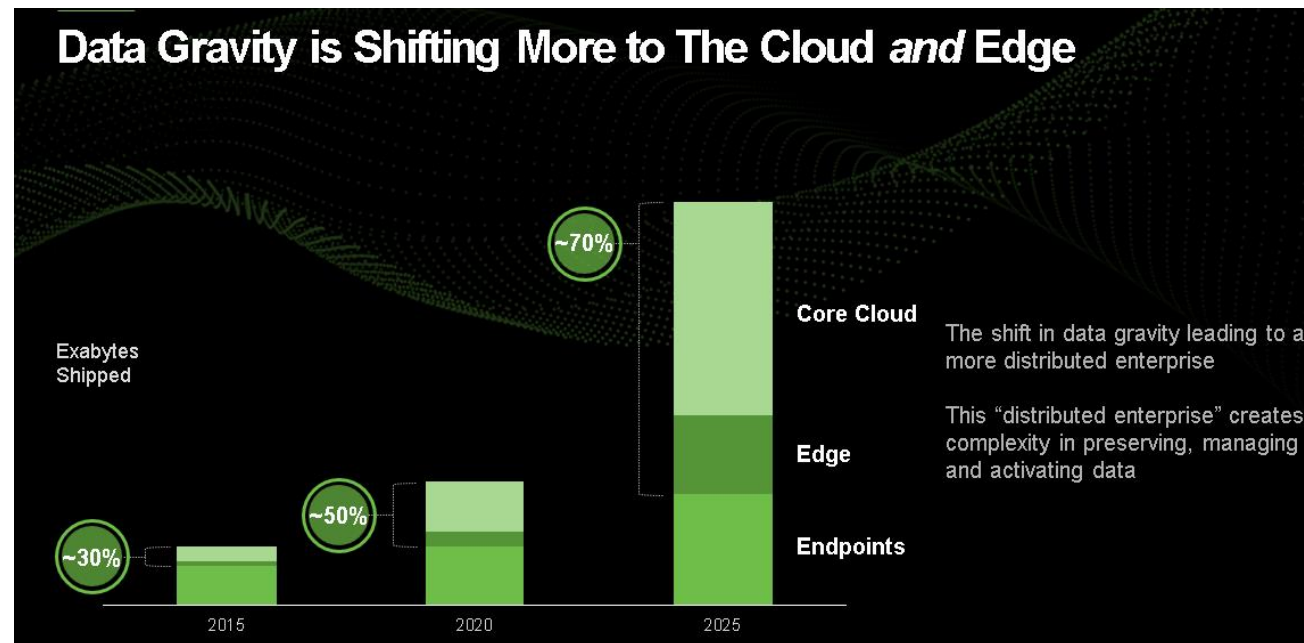
Industry Update

- Hard Disk Drives remain the predominate store of data supplying ~90% of data center capacity
- Hard drive shipments surpassed 1ZB / year in 2020
- NAND continues to grow, but is hampered by covid-related semiconductor constraints



Where are data located?

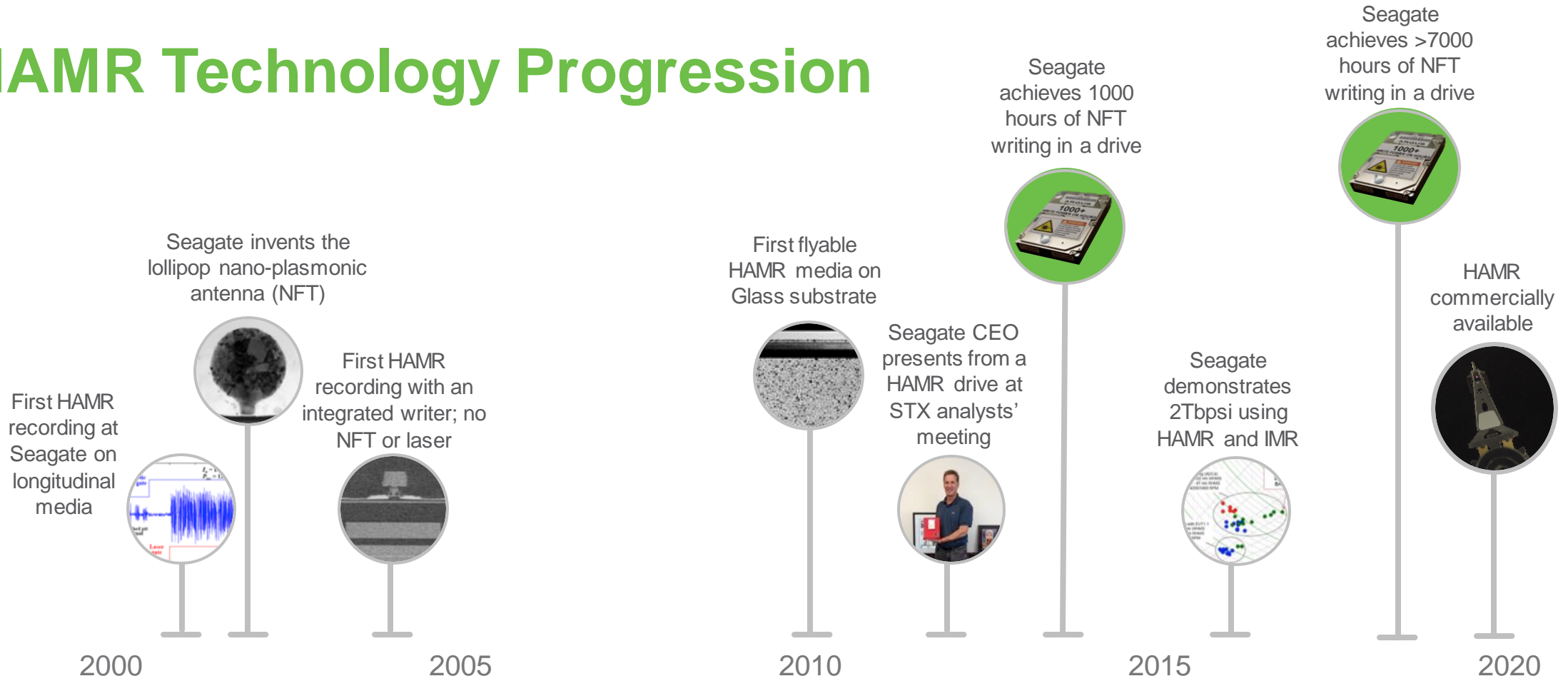
- Data continues to shift to the cloud; however, we are now seeing more data kept at the edge
- Content distribution and the cost & latency of networking are key drivers
- Most of cloud data is stored on large-capacity nearline hard disk drives



Recording Technology Update



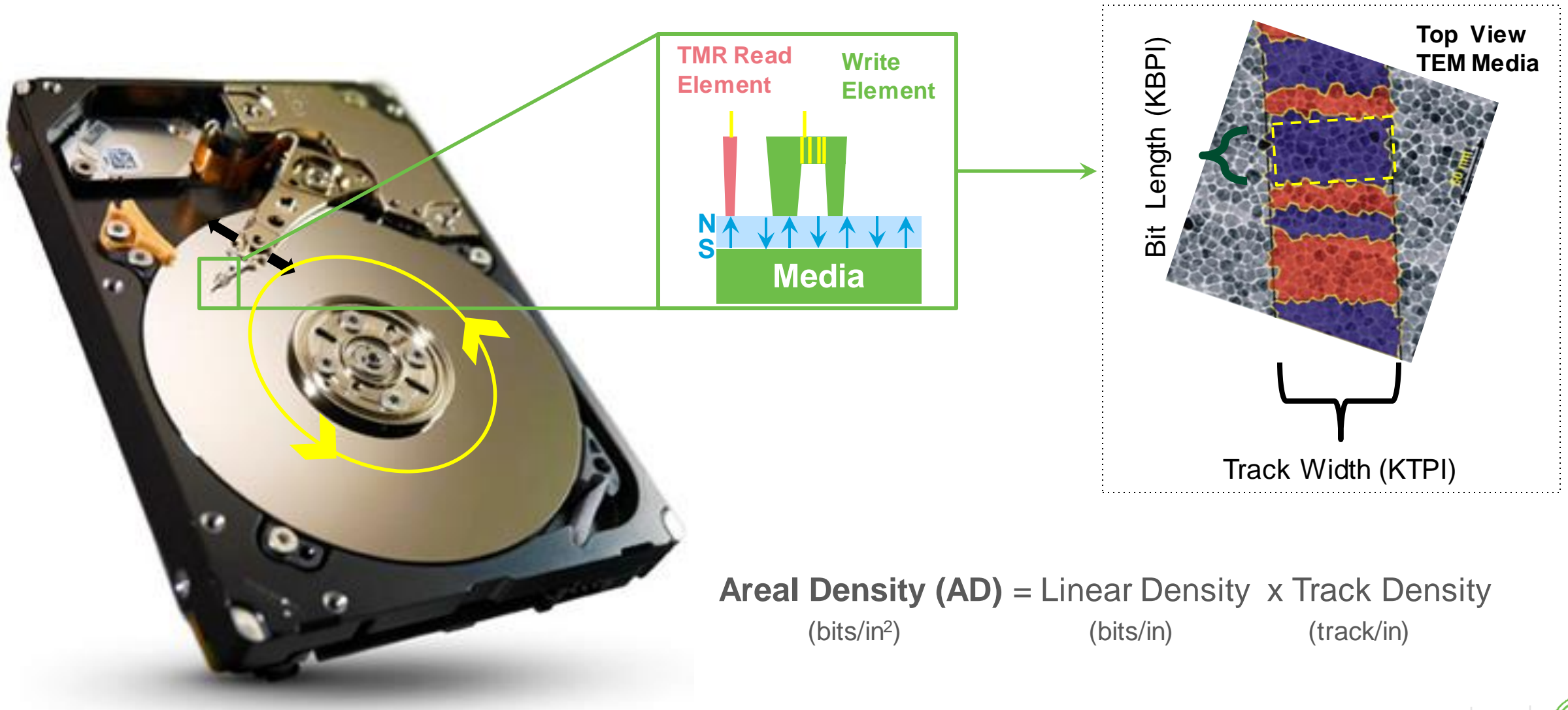
HAMR Technology Progression



20 years of technology development

Areal Density

1.4Tbps product has **track width of 40nm** and an **11 nm bit length**



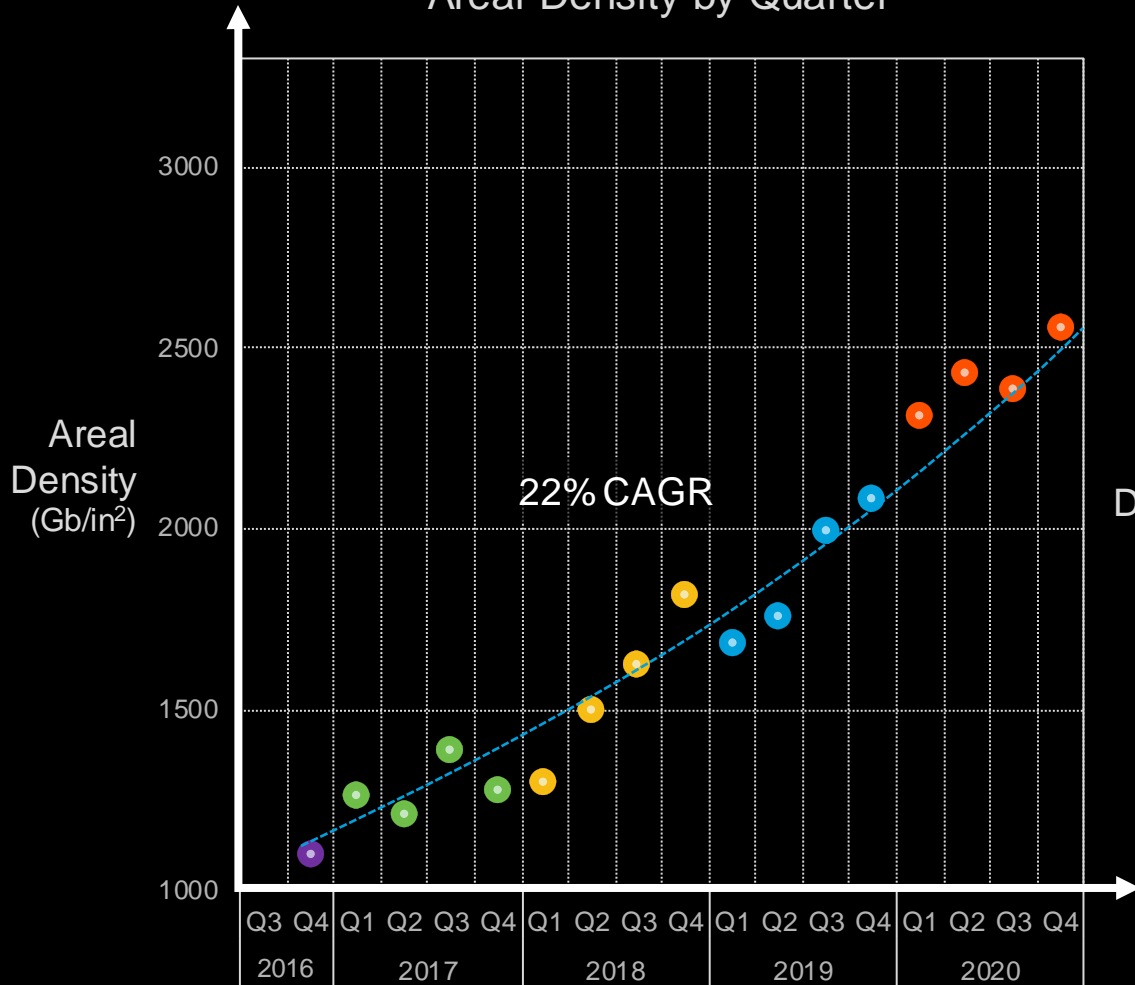
$$\text{Areal Density (AD)} = \text{Linear Density} \times \text{Track Density}$$

(bits/in²) (bits/in) (track/in)

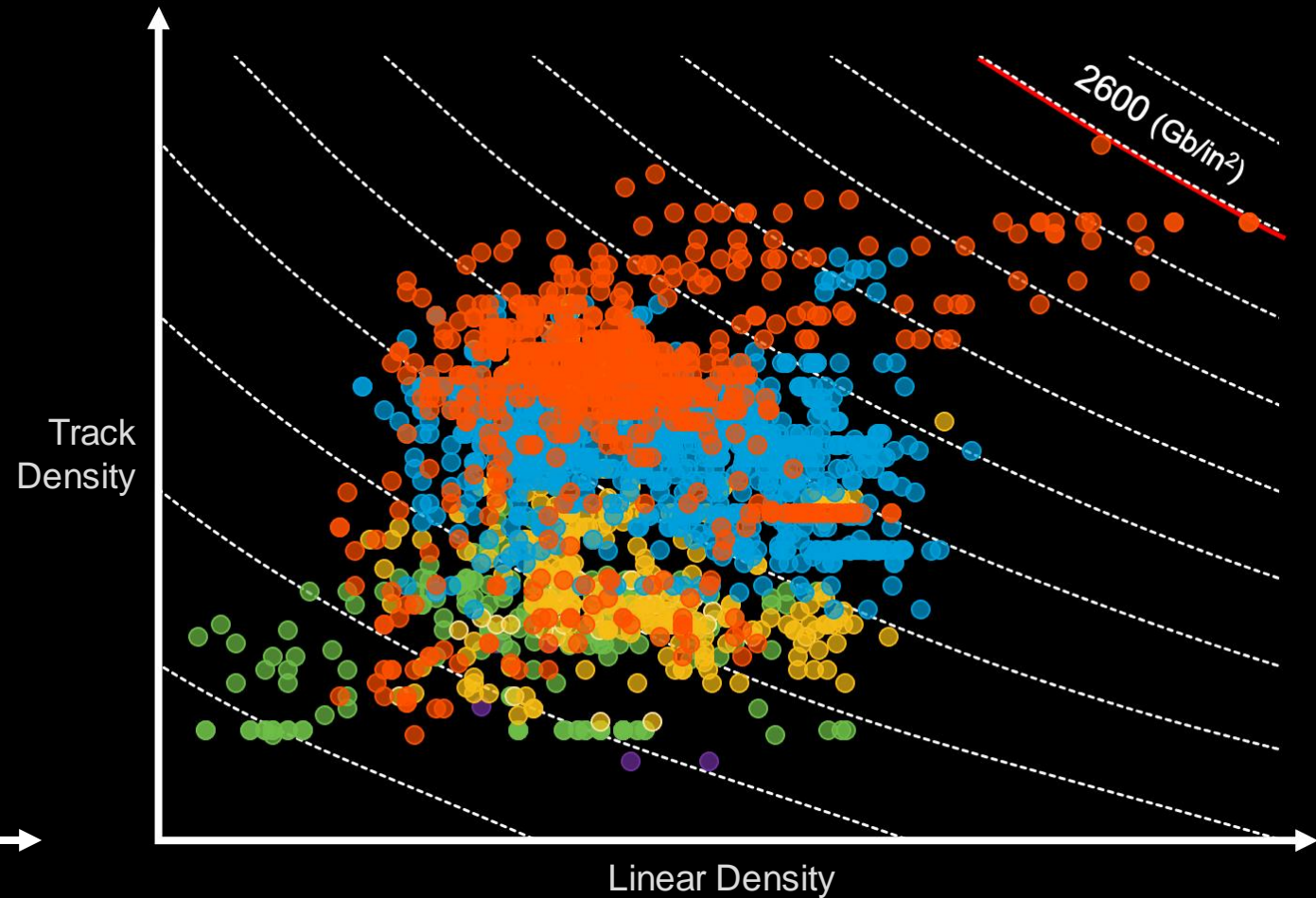


HAMR Areal Density Growth

Maximum Laboratory-Demonstrated Areal Density by Quarter

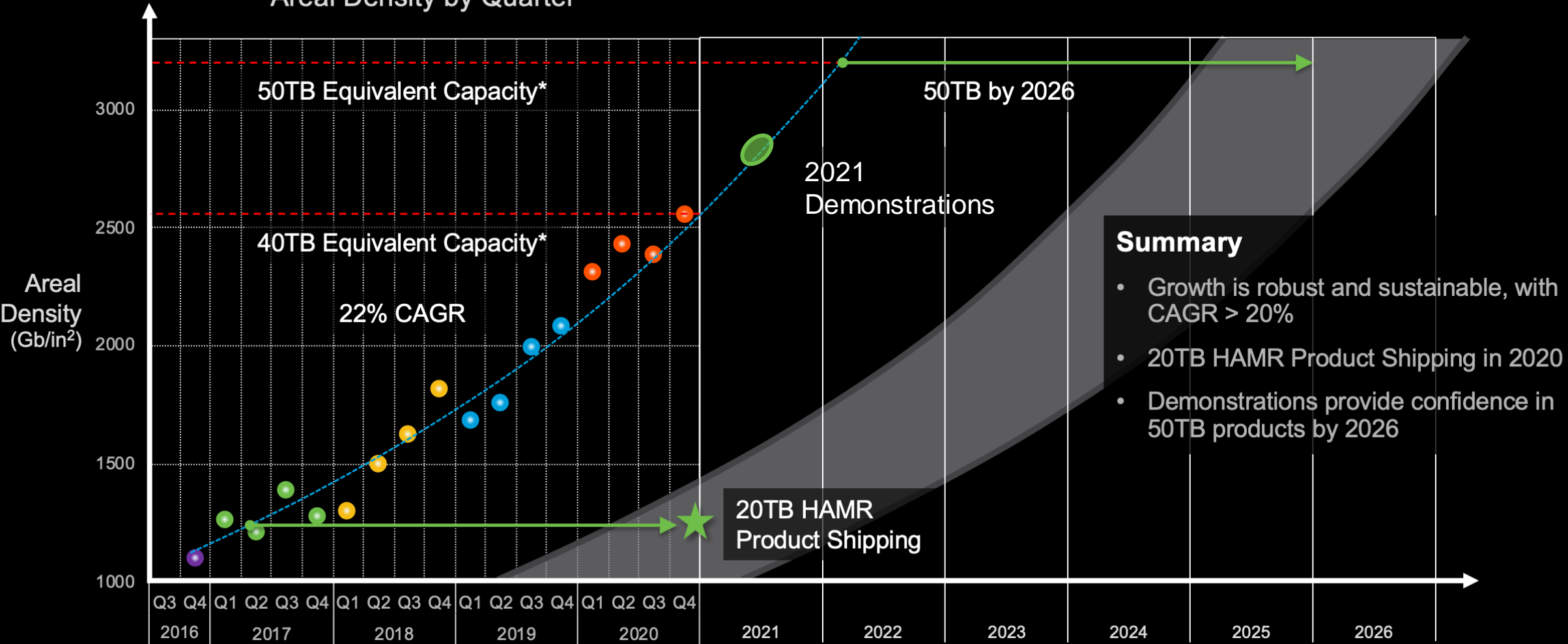


Laboratory Areal Density Demonstrations



HAMR Areal Density Achievements & Projections

Maximum Laboratory-Demonstrated Areal Density by Quarter → Productization



Summary

- Growth is robust and sustainable, with CAGR > 20%
- 20TB HAMR Product Shipping in 2020
- Demonstrations provide confidence in 50TB products by 2026

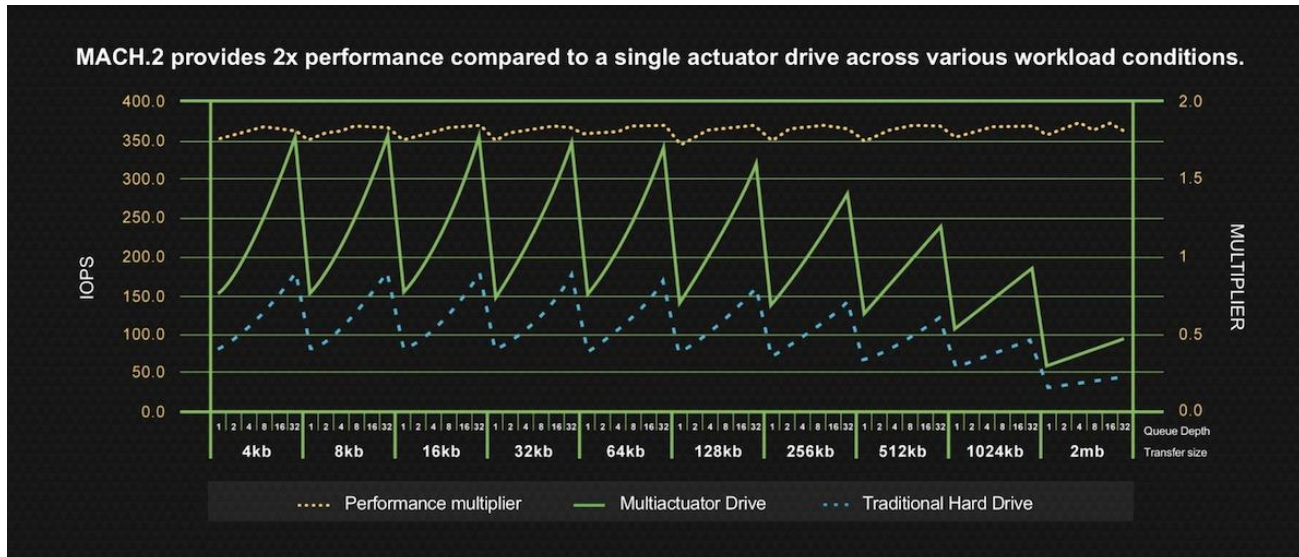
*Conventional-Magnetic Recording (CMR), 9-Disc Platform

Dual Actuator



Update: Dual-Actuator Hard Drives

- SAS & SATA Dual-actuator drives are now **shipping in-volume** with good marketplace reception
- These drives are essentially two drives in one package
 - Each actuator is an independent LUN
 - Double key performance metrics
 - Tradeoff of a small loss of capacity (18TB vs. 20TB) versus conventional (typ. one fewer disk)



Interfaces



The NVMe HDD is Born ...

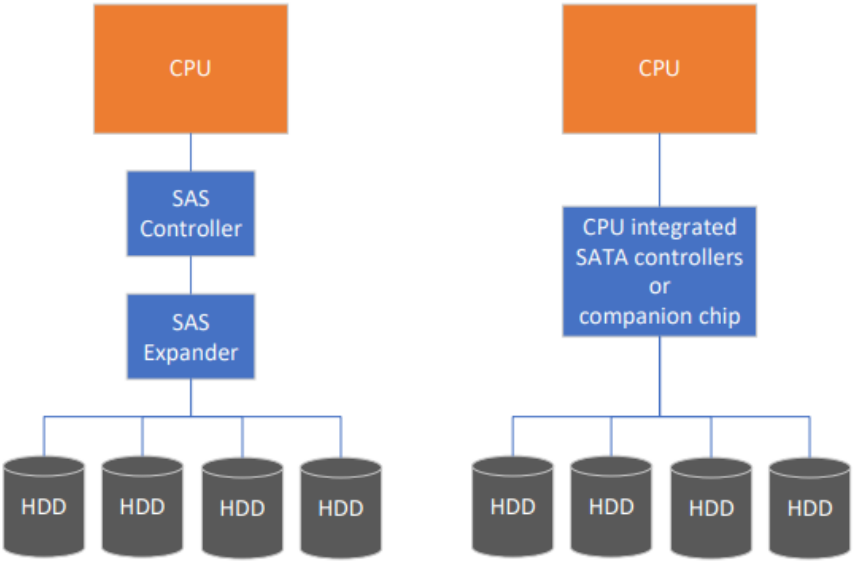


Seagate Announced the first NVMe HDD at OCP last November

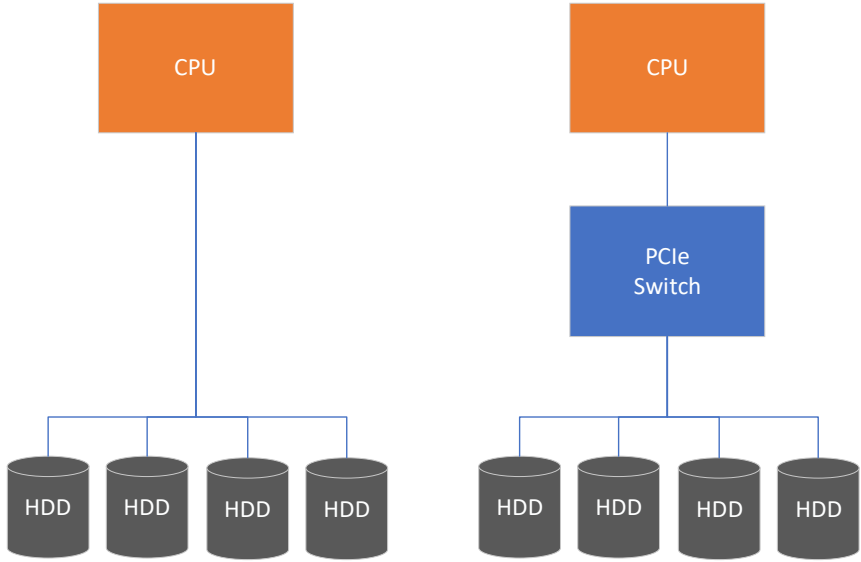
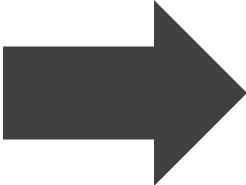
- SOC Native NVMe port w/ Tri-Mode (SAS, SATA & NVMe) Transceivers
- Proven 3rd gen design leveraged from SSD SOC HW-IP block & FW
- EDUs available to key customers Sept-2022 with single port/lane
- CDUs will be available in Mid-2024 in Single and Dual-Port SKUs



The Future - Simplified



Today
SAS/SATA HDD



Tomorrow
NVMe HDDs



Sustainability



Moving Forward with Seagate: Fast Facts

Product Circularity



Resale

362K HDDs refurbished—
extended life



Material Harvesting

3000 HDDs built with
harvested components



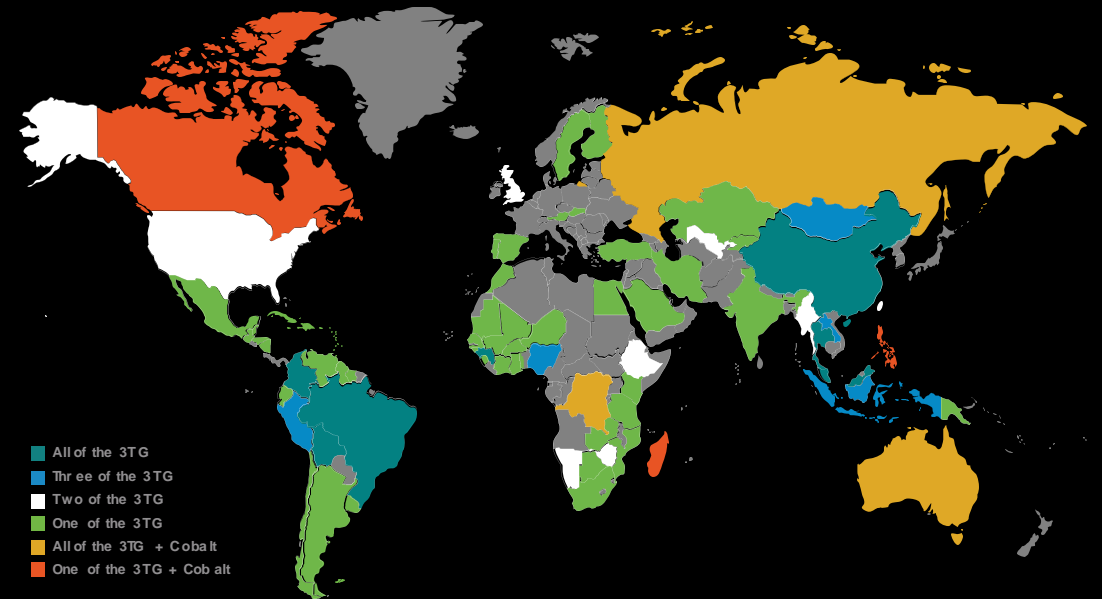
Material Recycling

1660 Kgs of rare earth
material recycled

We actively work with customers on circularity initiatives, reducing our impact, reusing materials, and creating proof points

Conflict Materials

Seagate requires 100% of the 3TG comes from sources that are certified to not contribute to human rights abuses. Seagate's entire product portfolio was validated as "DRC conflict-free."

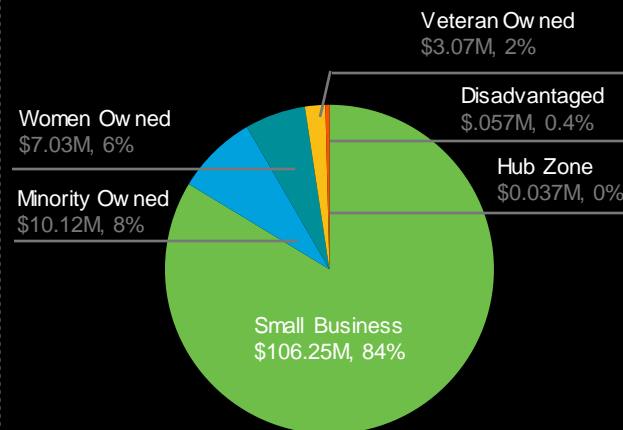


Product/Data Security

To protect customers' and employees' data, we certify through ISO product security certifications such as ISO20243



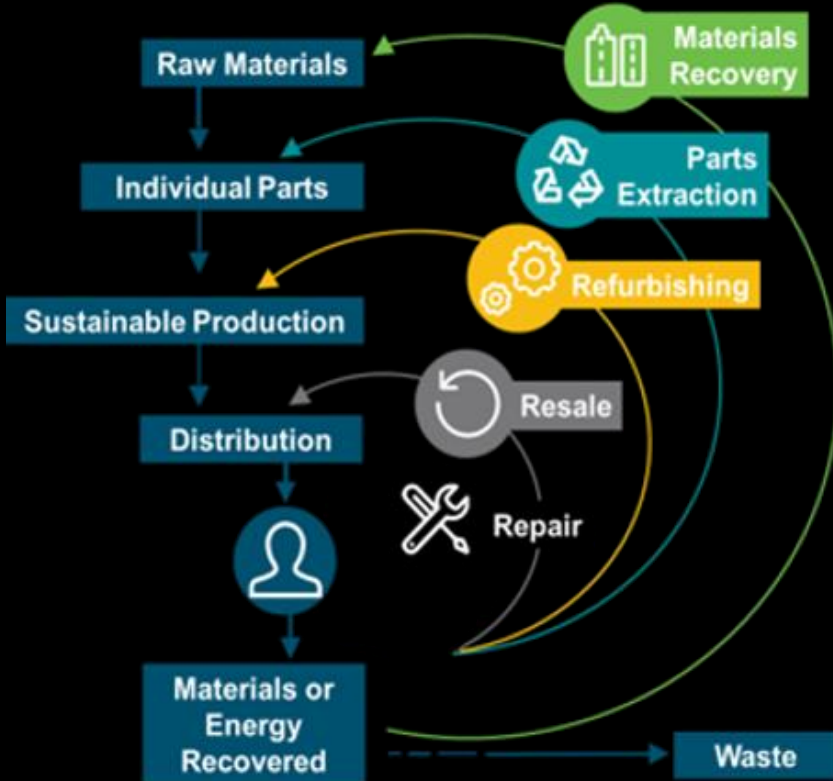
Supplier Diversity



To encourage diversity in our supplier base, Seagate contracts regularly with diverse suppliers who qualify and successfully compete for our business; there is great value in minority-owned businesses

Success with Circularity

Our track record of engaging customers with sustainable processes



Parts Extraction

Design for Parts Recovery

- ✓ Demonstrated reuse of components
- ✓ 3K VCMA reintegrated into drives and shipped
- ✓ Quantified eco-benefits/journal published

Repair

Online Reman or Repair

- ✓ Customer teams engaged
- ✓ Support of industry standards
- ✓ Zero-touch / Minimal capacity loss

Material Recovery

Efficient Use of Raw Materials

- ✓ Recycled 1.66 tons of scrap magnets in FY20
- ✓ Recycling aluminum from used HDDs
- ✓ Mapping of post-consumer content in HDD

Resale **Refurbish**

Returned Device Recertification/Resale

- ✓ Recovering 1M+ drives per year
- ✓ Expanded resale channel
- ✓ Data sanitation and Product Buy Back Program

Conclusion



Summary

- Covid's many disruptions have not affected data storage demand
- HAMR areal growth is proceeding
- Dual-actuator drives have grown in popularity - different flavors are emerging
- New NVMe interface drive announcement
- Increased focus on reuse and recycling in the industry

