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Обзор индустрии хранения данных и продуктового портфеля

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Data Creation Growth



2020–2025 DataSphere (ZB) with Growth (%)



Source: IDC Worldwide Global DataSphere Forecast, 2021–2025

Source: Data Age 2025, sponsored by Seagate with data from IDC Global DataSphere, Nov 2018

The amount of data that is actually stored, or utilized storage, is expected to grow at a 20.4% CAGR, from 3.5ZB in 2019 to 8.9ZB in 2024

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Significantly Larger SSDs & HDDs Are Needed



- 15x bit shipment growth forecasted
- Majority on HDD; SSD share growing
- Tape growing, relative share shrinking

Media	Bits CAGR (2020-2030)	ASP CAGR (2020-2030)	Revenue CAGR (2020-2030)
SSD	38%	-14%	18%
HDD	30%	-10%	17%
Таре	26%	-12%	11%

- 5x revenue growth forecasted
- Majority revenue in SSD, share growing
- Revenue outgrowing ASP decline

Where to store it all?

THE FUTURE OF THE STORAGE HIERARCHY

By 2025 the Tiered Storage Hierarchy Will Evolve



- Multi-layer photonic storage
- Synthetic DNA-based storage systems
- Quartz glass media
- Holographic storage
- Quantum storage

- · A new Deep Archive storage paradigm will be required.
- Longest life media (100+ years), minimal remastering effort and environmental footprint.
- Random and sequential access needed for mass storage.
- Purchase price ~\$1.0 \$/TB, negligible TCO.

Until these are ready for production, we'll have to use SSD, HDD and tape

BY: HORISON, INC.



A TARANA AND A TARANA



a Western Digital brand

SanDisk® a Western Digital brand

Leading Portfolio Breadth and Depth

Solutions to capture, preserve, access and transform data



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POWERFUL PATENT PORTFOLIO

24,950		
15,089		
14,285		
5,188	Western Digital.	
4,581		
4,353		
4,000		
3,454	TAIWAN SEMICONDUCTOR FACTORY	
3,403		
3,379		
2,608		Total Issuer
2,378		
1915	HPE _{PLC} .	Patents, vv v
682	PURE	
414		
207		
207		

Western Digital Ultrastar[®] and OpenFlex[™] Products

A complete data center storage toolkit

Powering the Data Revolution



1 One MB is equal to one million bytes, one GB is equal to one billion bytes and one TB equals 1,000GB (one trillion bytes) when referring to storage capacity. Actual user capacity may be less due to operating environment.

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NVMe is Growing in the Data Center

PB growth in NVMe outpacing SAS/SATA

Enterprise Flash TAM (PB)



Source: Western Digital Market Analysis Q2'20





Use Mode	Performance	Mainstream
Interface/Protocol	PCIe / NVMe	PCIe / NVMe
Target Replacement	SAS SSDs	SATA SSDs
Workloads	Compute Intensive or Mixed	Read Intensive or Mixed
Servers	HPC, High-end	Mid-range
Applications	Mission Critical, ML/AI, Scientific, Financial, SQL/NoSQL	Most common, Software defined storage

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8 Drive NVMe RAID5 - Random IOPs Performance



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8 drives, RAID 5, QD: 32, Q: 32, Fio 3.19

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10 Million IOPS Challenge!



20*DC SN640 Drives + RAIDIX ERA delivers 10.3M IOPS Rand Read 3.75M Mixed 1.4M Writes

RAIDIX Efficiency: >90% of single drive read performance (QD 32, Q: 128)

CPU Utilisation: Plenty of power in reserve – for more I/O just add more drives!

Ultrastar® HDDs Enable Data Center Scale

Leading capacities can lower TCO



Ultrastar DC HC560

20TB CMR Paris-D

Technology

Lower TCO

TCO

OptiNAND[™]

Leverages Paris-C platform

- Proven 9D mechanics
- Capacity leadership through:
 - OptiNAND™
 - 2nd generation ePMR

OptiNAND™ technology increases ADC

Enables added capacity above head and media gain



Industry leading capacity per platter HDD

New OptiNAND™ Technology

Discover the intelligent architecture of flash-enhanced drives



Ultrastar HDD Portfolio

Built for the Data Center





Ultrastar and OpenFlex Platforms

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Ultrastar® Data60/102 Hybrid Storage Platform

• 4U 60-bay and 4U 102-bay JBOD family:

- Compact 4U60 with depth of less than 36" (890mm)
- Dense 4U102 with over 2.0PB in 4U (20TB SMR HDDs)
- Up to 24 SSDs for a flash data acceleration tier
- 100% WDC-designed with innovations
 - IsoVibe[™] and ArcticFlow[™]
 - Dramatic reliability improvements 62% reduction in HDD returns*
 - Backed by a 5-year limited warranty
- Enterprise grade, big data storage use cases
 - Backup, archive, email
 - Disaggregated storage for SDS environments



Ultrastar® Data Family Innovations

Measured reduction of 62% in drive return rate*

Same HDDs, vs. similar WDC JBOD without IsoVibe[™] & ArcticFlow[™]

IsoVibe patented vibration isolation technology

- Vibration Isolated HDD carrier/slot & fans
- Over 60% lower vibration
- Performance is maintained, even when all the drives are working hard

ArcticFlow thermal zone cooling technology

- Lower temperatures, improved reliability, energy savings
- Projected 13% fewer drive failures
- \$1,500 in energy savings per enclosure
- Serviceability maximizing "cold aisle" access
 - Rack mounted top cover
 - Top-load drives, tool-less carrier



* Based on observed drive return data, does not change product specifications and does not constitute a warranty

OpenFlex™ Data24 NVMe-oF JBOF

NVMe[™] storage shared over Ethernet fabric

- Enables servers to share NVMe flash storage as if it were local
 - Up to 368TB in 2U 24-bay enclosure
 - Dual Port SSDs
 - Uses low latency fabric to fully utilize IOPs and capacity
 - Provides more efficient use of large capacity SSDs
 - Realizes the performance promise of NVMe
- Provides industry-leading connectivity options
 - Fan out to six connections without a switch
 - Balanced design to eliminate over-subscription and maintain NVMe advantage
 - Architected for extensibility with future enhancements
- Disaggregates NVMe storage for open composability
 - Allows multiple hosts concurrent access at low latency
 - Leverages mature standard NVM Express over Fabrics 1.0a
 - Provides open composability



OpenFlex Data24 NVMe-oF Storage Platform

Deployment options



OpenFlex Data24 NVMe-oF JBOF

Fabric Connect Compute Nodes **Ethernet Fabric** 100GbE Links

OpenFlex Data24 NVMe-oF JBOF

100GbE Links

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