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SCARCITY CREATES VALUE

*– And clarifies the deepening need for
new enterprise storage technologies...*

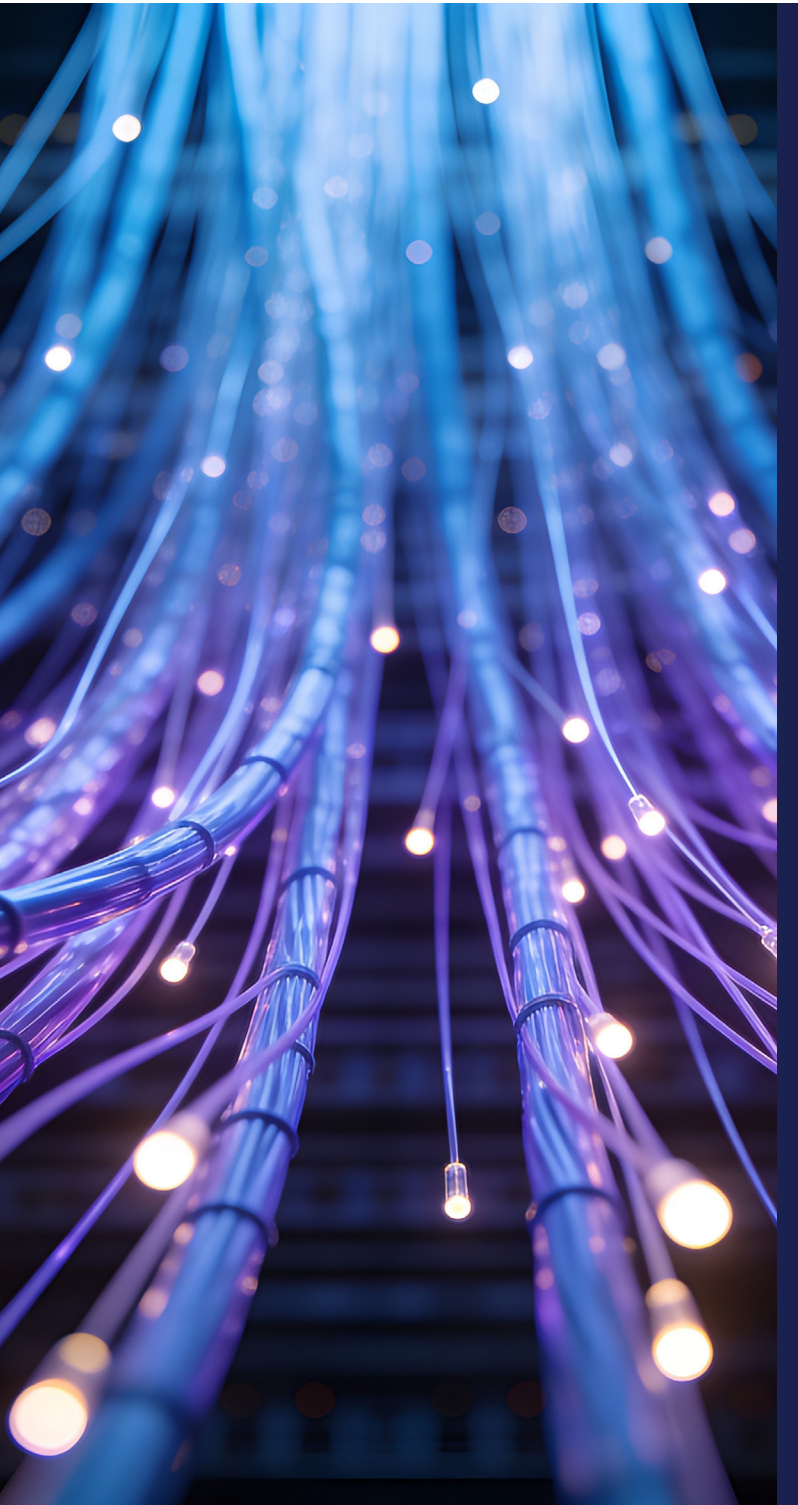
The stupefying SSD and HDD price increases of 1Q26 have created new respect for the enduring value of storage components and have reset the ways in which all future enterprise data management markets will evolve.

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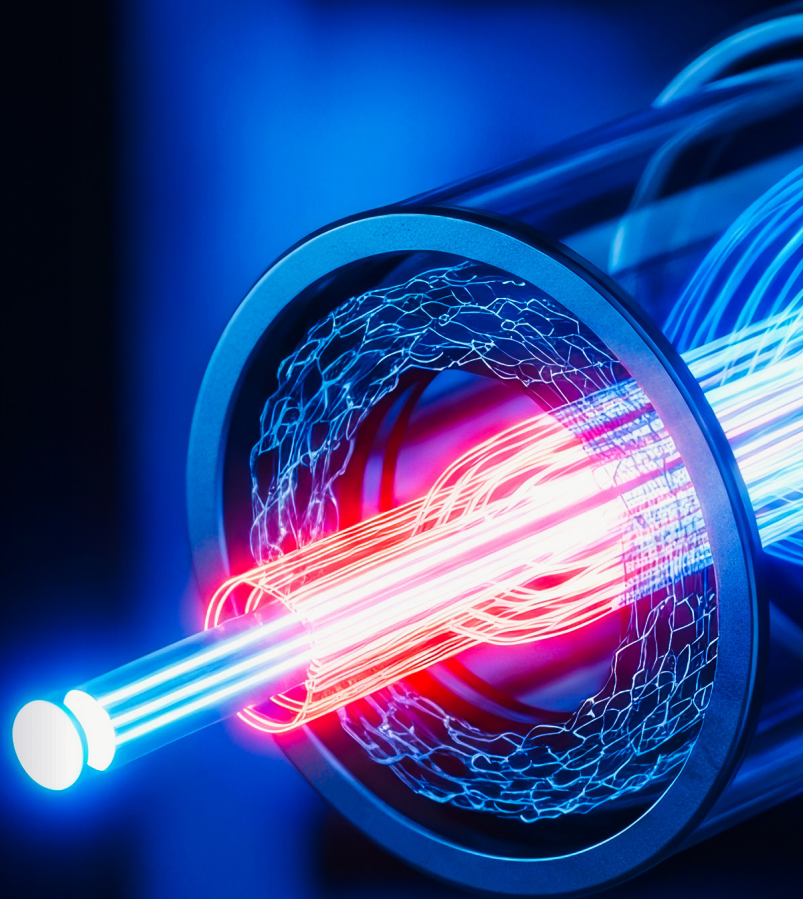
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In the wake of the freakish pricing we saw during 1Q26, in this paper we will re-assess the changing 2026-2050 revenue opportunities in enterprise storage markets by predicting the approximate number of exabytes (EBs) delivered, estimating the evolving vendor average selling prices (ASPs) per terabyte (TB), and determining the user initial integrated average acquisition costs per TB on solid-state-drive (SSD), hard-disk-drive (HDD), tape and emerging technology media.

Digital Data Capacity Definitions:

- A zettabyte (ZB) is a thousand exabytes (EBs) – more precisely, 1024EB or 10^{21} bytes
- An EB is a thousand petabytes (PBs) – more precisely, 1024PB or 10^{18} bytes
- A PB is a thousand terabytes (TBs) – more precisely, 1024TB or 10^{15} bytes
- A TB is a thousand gigabytes (GBs) – more precisely, 1024GB or 10^{12} bytes
- A GB is a thousand megabytes (MBs) – more precisely, 1024MB or 10^9 bytes
- A MB is a thousand kilobytes (KBs) – more precisely, 1024KB or 10^6 bytes
- A KB is a thousand bytes – more precisely, 1024 bytes or 10^3 bytes
- A byte is 8 binary digits (bits)
- A bit is a single 0 or 1 of digitized data



CAGR Definition:

Compound Annual Growth Rate (CAGR) delineates expansions or contractions over designated time periods.

Preliminary Expectoration: An Unprecedented Exabyte Crisis

“The only thing new under the sun is the history you don’t yet know about.”

We have often wondered whether the GenAI era changes this age-old adage, coined in ancient texts and massively re-iterated in **Finnegans Wake**. And we have often disparaged the abuse of the word “unprecedented” as it is repeatedly hawked to sell the daily news which “flashes afresh to hold and horrify.”

But the laws of Chaos will surely shape changes in the evolving enterprise storage markets, and within the laws of Chaos there is ample room for the unprecedented to occur in iterative ways. As in the “infinitely-self-similar-but-never-the same” Mandelbrot and Julia sets that reveal the core geometries of nature—from snowflakes to stars, from riverbeds to galaxies—we will see myriad uncertainties and repetitions in the GenAI dataverse.

In the past two years, the unprecedented has, in fact, occurred. But some things may never change. Within the unpredictably turbulent flow of dynamically changing systems, there lies a deeply mysterious order that—in some way, at some scale—will always repeat itself.

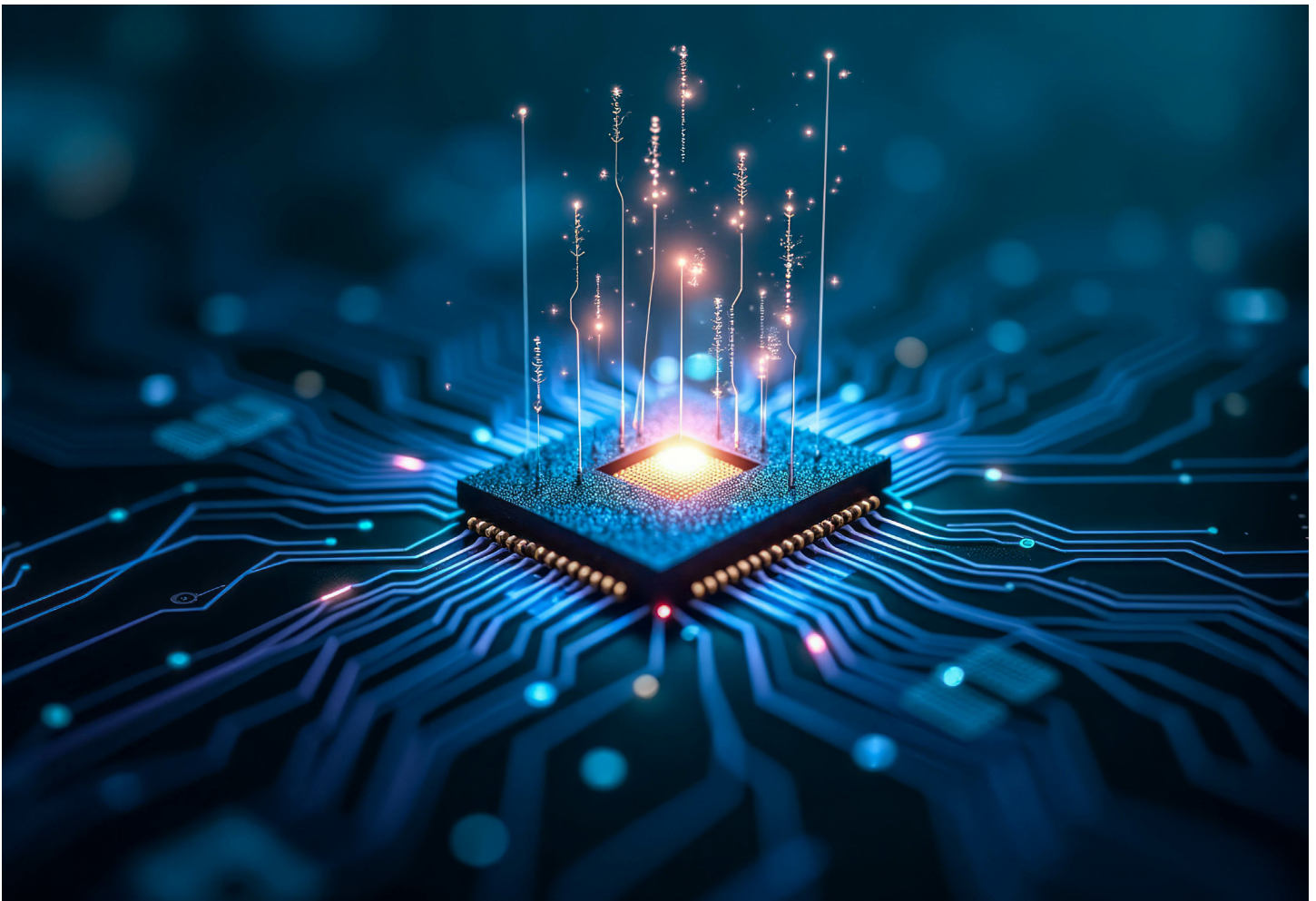
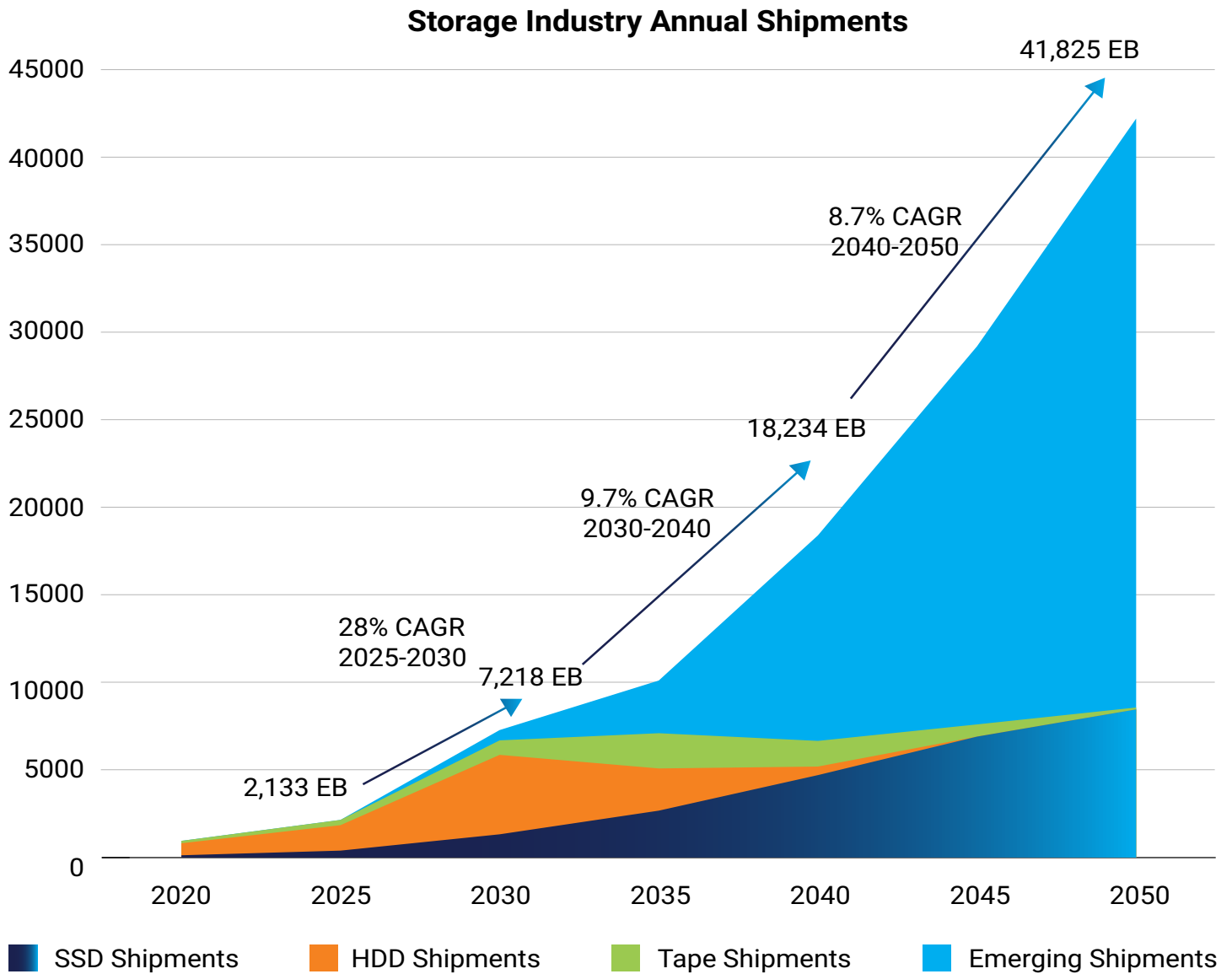
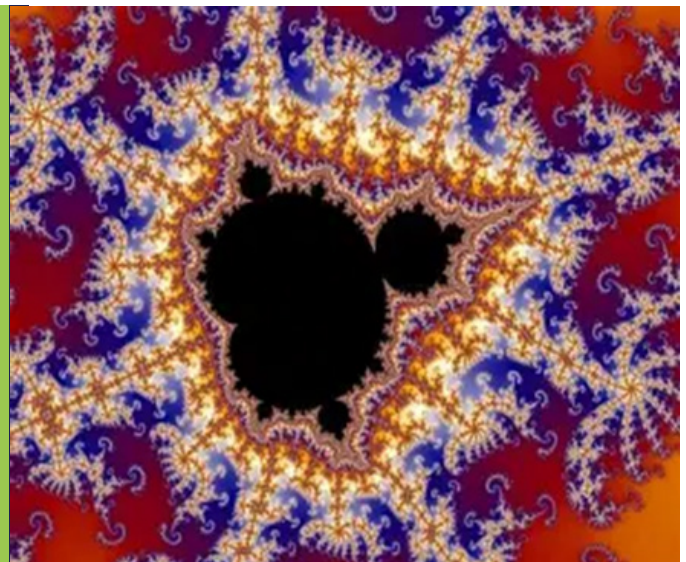


Figure 1: New 2020–2050 Forecasts



Source: Furthur Market Research and Brad Johns Consulting, April 2026

Our forecasts can be seen as a stately, comprehensible graphic... but the actual markets will resemble Mandelbrot and Julia Sets, and embody iteration gone wild...



Recent History

See Appendix for notes relevant to all tables.

Table 1 depicts a ten-year snapshot, with a nine-year history and one-year forecast of enterprise storage shipments and revenue.

Table 1: A Ten-Year Snapshot, Depicting a Nine-Year History and One-Year Forecast of Enterprise Storage Vendor Shipments and Revenue, 2017-2026

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
SSD										
Vendor Enterprise SSD Uncompressed Shipment Estimates (EB)	29	52	66	109	149	173	120	251	329	535
YoY Change %	61.1	77.9	28.7	64.0	36.9	16.0	→ (30.5)	108.7	31.2	62.6
Vendor Enterprise Uncompressed SSD Direct Revenue Estimates (\$M)	\$12,973	\$14,861	\$9,424	\$16,601	\$20,353	\$20,741	\$8,173	\$26,891	\$32,890	\$163,888
YoY Change %	55.2	14.5	(36.6)	76.2	22.6	1.9	(60.6)	229.0	22.3	→ 398.3
Vendor Uncompressed Enterprise SSD Direct Blended ASP/TB (\$)	\$447.36	\$288.00	\$141.92	\$152.45	\$136.51	\$119.96	\$68.00	\$107.22	\$99.97	\$306.33
YoY Change %	(3.7)	(35.6)	(50.7)	7.4	(10.5)	(12.1)	(43.3)	57.7	(6.8)	206.4
The effects of overproduction are always ruinous...and scarcity will always create value...										
HDD										
Vendor Enterprise HDD Uncompressed Shipment Estimates (EB)	267	394	490	680	959	942	1,039	1,085	1,439	1,753
YoY Change %	22.5	47.6	24.2	38.9	41.0	→ (1.8)	10.3	4.4	32.7	21.8
Vendor Enterprise Uncompressed HDD Direct Revenue Estimates (\$M)	\$8,935	\$10,915	\$10,737	\$11,326	\$13,035	\$12,887	\$13,755	\$14,077	\$20,598	\$27,180
YoY Change %	(0.6)	22.2	(1.6)	5.5	15.1	(1.1)	6.7	2.3	→ 46.3	32.0
Vendor Uncompressed Enterprise HDD Direct Blended ASP/TB (\$)	\$33.46	\$27.70	\$21.93	\$16.66	\$13.59	\$13.68	\$13.24	\$12.98	\$14.31	\$15.50
YoY Change %	(18.8)	(17.2)	(20.8)	(24.1)	(18.4)	0.6	(3.2)	(2.0)	10.3	8.3
TAPE										
Enterprise Tape Compressed Shipment Estimates (EB)	136	125	134	136	190	207	228	265	299	350
YoY Change %	9.7	(8.1)	7.2	1.5	39.7	8.9	10.1	16.2	12.8	17.1
Enterprise Tape User Spend Estimates (\$M)	*	\$1,162	\$1,066	\$1,048	\$1,172	\$1,068	\$1,132	\$1,296	\$1,459	\$1,776
YoY Change %		-	(8.3)	(1.7)	11.8	(8.8)	6.0	14.4	12.6	21.7
Estimated Tape User Initial Integrated Compressed Average Acquisition Cost/TB (\$)		\$9.30	\$7.96	\$7.71	\$6.17	\$5.16	\$4.97	\$4.89	\$4.88	\$5.07
YoY Change %		-	(14.4)	(3.1)	(20.0)	(16.3)	(3.8)	(1.5)	(0.2)	4.0
*Tracking of Tape user revenue begins 2018.										
Total Compressed Enterprise EB Shipped	438	581	703	947	1,328	1,356	1,411	1,650	2,133	2,745
YoY Change %	20.4	32.7	21.0	34.6	40.3	→ 2.2	4.0	17.0	29.2	28.7
Uncompressed SSD % of Total EB Shipped	7.9	10.7	11.3	13.8	13.5	15.3	10.2	18.2	18.5	23.4
Uncompressed HDD % of Total EB Shipped	61.0	67.8	69.6	71.8	72.2	69.4	73.6	65.7	67.5	63.9
Compressed Tape % of Total EB Shipped	31.1	21.5	19.1	14.4	14.3	15.3	16.2	16.1	14.0	12.8

SSD and HDD vendors sell directly to hyperscalers (such as AWS), OEMs (such as Dell), and distributors (such as TD SYNnex). Users purchase cloud services from hyperscalers or smaller Internet Service Providers (ISPs) and integrated products from OEMs or distributors.

Source: Furthur Market Research and Brad Johns Consulting, April 2026

2022-2023

Table 1 documents several unprecedented and consequential developments, which the bullets below place in historical perspective:

- *In 2022 and 2023, enterprise EB shipments expanded by only 2% and 4%, respectively. From 2000-2021, there were no years of sub-5% expansion; in fact, there were no years of sub-10% expansion.*
- *SSD EB shipments declined by 31% in 2023 and HDD EB shipments declined by 2% in 2022. From 2000-2021, SDD and HDD year-over-year EB shipments never declined.*
- *From 2020-2025, total enterprise EB shipments expanded by a relatively tepid 18% CAGR despite increases of 34% in 2020, 41% in 2021, and 29% in 2025. Enterprise shipments expanded by more than 1000% 2000-2010 and by a 29% CAGR 2010-2020.*
- *The unanticipated downturns in demand from mid-2Q22 through 4Q23 caused unprecedented surplus inventories throughout the supply chain.*

In the wake of precipitous price erosions and an unprecedented 61% decline in enterprise SSD revenue in 2023, all NAND fab expansions—by all four major fab owners acting in concert: Kioxia/SanDisk, Micron, Samsung, and SK Hynix—were halted and, for the first time in history, the fab owners deliberately ran some of their factories at less than 100% capacity to prevent adding to the surplus inventories.

If any semiconductor plant is designed to produce, say, 100,000 wafers per month (WPM), it must, once operational, produce 100K WPM, irrespective of evolving demand; anything less than 100% production is enormously costly to the fab owner. After construction has begun, it takes at least two years to complete a new NAND fab and an additional six months to tune it to cost-effective 100% utilization; of course, it is impossible to precisely predict what actual demand will be more than two years into the future, which is why the semiconductor industry suffers such costly cycles of supply:demand imbalances when bringing new facilities on line.

Meanwhile, after losing virtually all the PC OEM and consumer memory markets to SSDs and flash modules (total HDD shipments declined from a high of 643 million units in 2010 to less than 200 million units in 2025), Seagate, Toshiba and Western Digital—the three remaining HDD makers—were deeply involved in the process of aligning their future

production with diminishing unit-volume demand. The HDD makers began to concentrate their efforts almost exclusively on the profitable manufacture of high-end, business-critical/nearline enterprise HDDs, which consume more read/write (R/W) heads (10-20 heads per drive) than the lower capacity consumer-class and mission-critical HDDs (2-10 heads per drive). Like NAND fabs, after construction has begun, it takes at least two years to complete a new R/W head fab and an additional six months to tune it to cost-effective 100% utilization.

It can cost billions of dollars to enhance existing NAND or HDD head fabs. A new NAND fab can cost between \$20 billion and \$30 billion. A new HDD head fab can cost more than \$2 billion.

2024-2025, 1Q26

The 2024-2025 GenAI-generated sudden surge in demand was unprecedented and largely unanticipated. Global supply scarcities became acute during 2H25, generating an unprecedented development: Never before had core memory (SRAM, DRAM), NAND flash modules, NAND consumer-grade and enterprise-grade SSDs, and enterprise-grade HDDs been in such severe, simultaneous and ongoing shortage, and prices for these key components began to increase in unprecedented ways.

By 4Q25, major hyperscale and OEM customers had begun to believe that the SSD and HDD makers were actually operating at maximum capacity, and that increasing this capacity would be a measured and gradual process, and not only because it takes more than two years to bring a new NAND fab or HDD R/W head fab on line. The drive makers were acting with considerable and uncharacteristic caution in expanding production capacity.

Table 2 depicts unprecedented (and freakish) recent pricing trends. Because of aggressive SSD pricing 1Q25-3Q25, the ASP/TB for the year was \$97.97, but the 4Q25 price rose to more than \$150 (up over 40% from the 2024 average), and the 1Q26 price rose (incredibly) to more than \$330. The market is obviously still fluid, but it now seems certain that most if not all the major direct customers of the SSD vendors will be paying more than twice as much for bare bones drives in 2026 (and perhaps through 2Q27) as they did during 4Q25. It also seems certain that most if not all the major direct customers of the HDD vendors will be paying more than \$15.00/TB for the remainder of 2026 (and perhaps through 2Q27).

Table 2: Freakish Pricing Trends, 1Q26

	2022	2023	2024	4Q25	1Q26
Vendor Direct Customer Bare-Bones Enterprise SSD Uncompressed ASP/TB (\$)	\$119.96	\$68.00	\$107.22	\$150.31	\$338.96
Change %		(12.5)	57.7	40.2	125.5
Vendor Direct Customer Bare Bones Enterprise HDD Uncompressed ASP/TB (\$)	\$13.68	\$13.24	\$12.98	\$13.95	\$15.85
Change %		(3.2)	(2.0)	7.5	13.6
Enterprise Tape Enduser Fully Integrated Compressed Average Acquisition Cost/TB (\$)	\$5.16	\$4.97	\$4.89	\$4.88	\$5.07
Change %		(3.8)	(1.5)	(0.2)	3.9

Source: Furthur Market Research and Brad Johns Consulting, April 2026

What's Next? Revised Forecasts

Table 3 details a quick-reference summary of 2010-2050 shipments and forecasts. See Appendix for revised forecast assumptions and revised user spend analyses. Tables 4-7 in the Appendix depict granular annual details of 2010-2050 shipments and forecasts.

Table 3: Quick-Reference Summary, Enterprise Storage Histories and Forecasts, 2010-2050

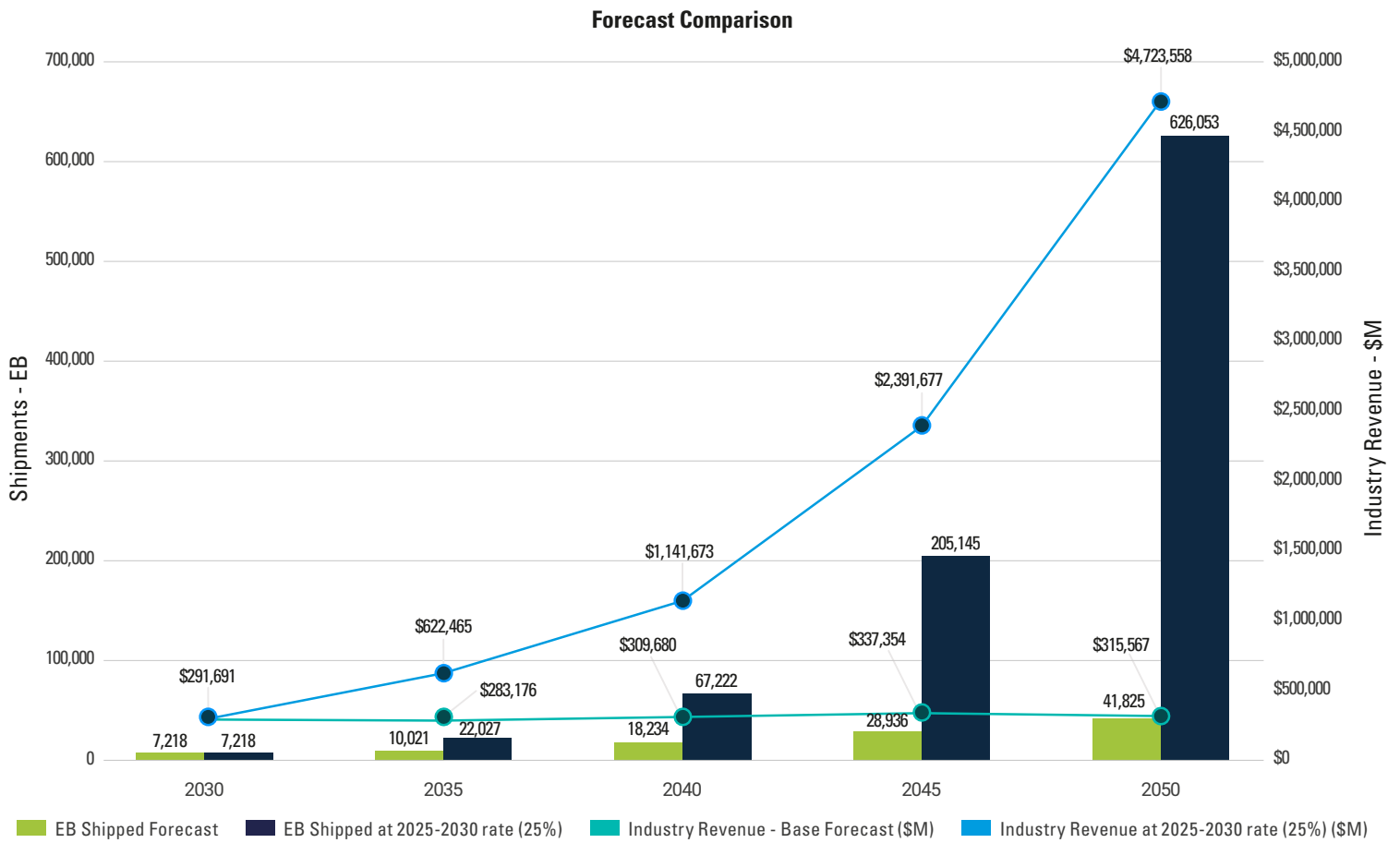
	2010	2015	2020	2025	2030	2035	2040	2045	2050	
Vendor Enterprise SSD Compressed Shipment Estimates (EB)	0.2	13	131	395	1,318	2,657	4,668	6,848	8,387	
Estimated SSD User Spend, 85% Markup Over Vendor Revenue (\$M)	\$1,839	\$11,624	\$30,713	\$60,847	\$221,617	\$243,129	\$283,927	\$311,745	\$281,994	
Estimated SSD User Initial Integrated Compressed Average Acquisition Cost/TB (\$)	\$7,662.15	\$880.57	\$235.02	\$154.12	\$168.20	\$91.51	\$60.82	\$45.52	\$33.62	
Vendor Enterprise HDD Uncompressed Shipment Estimates (EB)	46	157	680	1,439	4,496	2,388	484	0	0	
Estimated HDD User Spend, 50% Markup Over Vendor Revenue (\$M)	\$10,047	\$14,285	\$16,988	\$30,897	\$64,614	\$29,814	\$5,649	\$0	\$0	
Estimated HDD User Initial Integrated Uncompressed Average Acquisition Cost/TB (\$)	\$218.41	\$90.98	\$24.99	\$21.47	\$14.37	\$12.48	\$11.67	\$0.00	\$0.00	
Enterprise Tape Compressed Shipment Estimates (EB)	30	98	136	299	821	1,995	1,453	690	108	
Estimated Tape User Spend (\$M)	Tracking begins 2018		\$1,048	\$1,459	\$2,455	\$2,327	\$746	\$271	\$43	
Estimated Tape User Initial Integrated Compressed Average Acquisition Cost/TB (\$)			\$7.71	\$4.88	\$2.99	\$1.17	\$0.51	\$0.39	\$0.40	
Vendor Enterprise Emerging Shipment Estimates (EB)	Tracking begins 2026				583	2,981	11,629	21,398	33,330	
Estimated Emerging User Spend (\$M)					\$3,005	\$7,906	\$19,358	\$25,338	\$33,531	
Estimated Emerging User Initial Integrated Average Acquisition Cost/TB (\$)					\$5.15	\$2.65	\$1.66	\$1.18	\$1.01	
Total Compressed Enterprise Shipment Estimates (EB)	76	269	947	2,133	7,218	10,021	18,234	28,936	41,825	
SSD % of Total Shipments	0.3	4.9	13.8	18.5	18.3	26.5	25.6	23.7	20.1	
HDD % of Total Shipments	60.3	58.5	71.8	67.5	62.3	23.8	2.7	0.0	0.0	
Tape + Emerging (Active Archive) % of Total Shipments	39.3	36.6	14.4	14.0	19.5	49.7	71.7	76.3	79.9	
Total Compressed Enterprise Active Installed Base Estimates (EB)	252	851	3,031	7,878	23,221	45,948	82,576	171,513	306,545	
Total Enterprise User Spend Estimates (\$M)	Tracking begins 2026		\$48,749	\$93,202	\$291,691	\$283,176	\$309,680	\$337,354	\$315,567	
Total Estimated User Initial Integrated Compressed Average Acquisition Cost/TB (\$)			\$51.50	\$43.70	\$40.41	\$28.26	\$16.98	\$11.66	\$7.54	
SSD % of Total Spend			63.0	65.3	76.0	85.9	91.7	92.4	89.4	
HDD % of Total Spend			34.8	33.2	22.2	10.5	1.8	0.0	0.0	
Tape + Emerging (Active Archive) % of Total Spend			2.2	1.6	1.9	3.6	6.5	7.6	10.6	
Alternate 2030-2050 Shipment Scenario at 25% Annual Expansion, Mimicing the 2025-2030 Forecast CAGR (EB)						22,027	67,222	205,145	626,053	
						EB Delta to Current Forecast	12,006	48,988	176,209	584,228
Even at 1/2 the Acquisition Costs Detailed Above, Alternate 2030-2050 Scenarios Are Clearly Unsustainable...	Alternate 2030-2050 User Spend Scenario (\$M)					\$622,465	\$1,141,673	\$2,391,677	\$4,723,558	
						\$ Delta to Current Forecast	\$339,289	\$831,993	\$2,054,323	\$4,407,991
Alternate 2030-2050 Active Installed Base Scenario at 25% Annual Expansion, Mimicing the 2025-2030 Forecast CAGR (EB)						74,046	225,972	689,615	2,104,539	
						EB Delta to Current Forecast	28,098	143,396	518,102	1,797,994

SSD and HDD vendors sell directly to hyperscalers (such as AWS), OEMs (such as Dell), and distributors (such as TD SYNEX). Users purchase cloud services from hyperscalers or smaller Internet Service Providers (ISPs) and integrated products from OEMs or distributors.

Source: Furthur Market Research and Brad Johns Consulting, April 2026

Figure 2 graphically depicts the scenarios summarized in Table 3.

Figure 2: Comparative Shipment and Revenue Scenarios of 25% Growth Estimates vs Current Forecasts, 2030-2050



Source: Furthur Market Research and Brad Johns Consulting, April 2026

At the core of our revised forecasts are changes in assumptions regarding vendor ASP/TB and user Cost/TB, in complex conjunction with estimates of the delivery of new technologies and the industry’s ability to produce them in massive volume.

In our new forecasts, substantive changes include:

- Total enterprise zettabytes shipped expand from 7 in 2030, to 18 in 2040, and to 42 in 2050 (vs. 6, 21, and 57, respectively, in our prior forecast).
- Total enterprise zettabytes in the active installed base grow from 23 in 2030, to 83 in 2040, to 307 in 2050 (vs. 20, 81, and 143, respectively, in our prior forecast).
- Most importantly, total enterprise user spend increases from \$292B in 2030, to \$310B in 2040, to \$316B in 2050 (vs. \$102B, \$107, and \$148, respectively, in our prior forecast), largely due to the freakish 2025-2026 price increases, which we believe will reset future vendor ASP/TB and user Cost/TB metrics.

Despite lower growth estimates, the shipped and active enterprise zettabytes remain staggering in their immensity, and will require the creation and deployment of new enterprise storage technologies.



III Current Market Conditions

In the past, a surplus of supply relative to demand lasted one to three quarters. The recent surpluses lasted six quarters (from late 2Q22 through 4Q23). In the past, a dearth of supply relative to demand lasted one to three quarters. The current lack of supply relative to evolving demand has already lasted almost three quarters and seems destined to last for at least another five quarters (3Q25 through 2Q27).

There are colossal differences of opinion regarding the ability, not to mention the **willingness**, of the SSD and HDD makers to invest adequately to build to a feasible—but uncertain, and possibly profitless—storage demand of staggering dimensions.

“Profitless” has recently been removed, at least temporarily, from that “equation” of concern: SSD margins have again

increased to more than 60%, and reported HDD margins have soared to more than 45% (yet another unprecedented development).

These profits will be needed. As previously mentioned, it can cost billions of dollars to enhance existing NAND or HDD head fabs. A new NAND fab can cost between \$20 billion and \$30 billion. A new HDD head fab can cost more than \$2 billion. The NAND fab owners will have to invest hundreds of billions of dollars to achieve enterprise SSD shipments that exceed 5ZB/year, and the HDD makers will surely have to spend several billion dollars to achieve HDD shipments that exceed 4ZB/year. At the moment, in the wake of the unprecedented 2022-2023 and 2024-2025 developments, the SSD and HDD executives are exercising enormous fiscal restraint.

Dave Mosley, Seagate’s CEO, said during the earnings call announcing the company’s December 2025 (FY2026, CY4Q25) financial results:

- Our nearline [HDD] capacity is fully allocated through calendar year 2026, and we expect to begin accepting orders for the first half of calendar year 2027 in the coming months. Further out, demand visibility is strengthening based on the long-term agreements in place with major cloud customers through calendar 2027. **Additionally, multiple cloud customers are discussing their demand growth projections for calendar 2028, underscoring that supply assurance remains their highest priority. We will continue to meet strengthening demand through our strategy to maintain supply discipline and satisfy exabyte growth through areal density and advancements, and without increasing unit production volume...**
- ...I think what people have to keep in mind is that we were [already] fairly tight all throughout manufacturing... **it’s a good problem to have actually, running manufacturing quite tight... [ramping future manufacturing volume] won’t be as fast as maybe we’ve done some ramps in the past, but it’ll be very profitable...** [our bold, for emphasis]

R/W heads have become the most crucial gating components in limiting HDD production volumes, and currently we see no drive maker willing to spend the billions of dollars necessary to materially increase head manufacturing capacity. All the drive makers seem to share the same strategy: Maintain supply discipline and meet exabyte growth through areal density advancements without increasing unit production volume. This strategy will likely lead to consistently inadequate near-term future supplies relative to demand, with lucrative impacts on HDD corporate profits.

In various market studies since 2022, we have repeatedly expressed our concern that the combined might of the HDD and SSD industries would be insufficient to meet evolving demand. We have also repeated our bold prediction that “the coming exabyte crisis is going to make the Thai floods look like a mini-event.”

The 2022-2023 downward spiral in demand made this concern and prediction seem grossly exaggerated and improbable, but recent events have deepened doubts about the maximum production capabilities of the SSD and HDD makers. The HDD makers managed to recover from the October 2011 Thai floods—which literally, and overnight, wiped out about 60% of the HDD industry’s production capabilities—in less than six months. Because of the long lead times and expense of bringing new NAND fabs or new HDD R/W head fabs on line, we simply may not be able to overproduce relative to demand for at least two years.

In our market study, *The Impacts of Generative AI on Enterprise Data*, published in August 2024, we warned:

- Because of the inordinate corporate losses incurred—especially by the SSD industry—during the 3Q22-4Q23 downturns in demand and ensuing precipitous price declines, the drive makers are more excruciatingly aware that “the results of surplus production are always ruinous,” and they are much more determined to increase manufacturing capacity in concert with actual increases in demand. Of course they will in some degree fail in this endeavor; actual changes in demand are impossible to predict, and “as soon as a drive maker can ramp production to meet an apparent increase in demand, the demand dissipates,” often with the kinds of disastrous fiscal consequences we saw 3Q22-4Q23. **From a drive maker’s perspective, allocations and tight supplies are always more lucrative than surpluses, and [the drive makers] are now adding capacity with much greater circumspection. With the advent of potential GenAI data growth, many clients suspect [as did we] that there may be severe shortages of enterprise-grade storage media on multiple fronts in the future.**

While demand continues to swell, the SSD and HDD makers continue to add capacity with unprecedented reserve and caution, which will surely lessen the likelihood of supply exceeding demand for several more years.

What began by accident and miscalculation can be prolonged by design.

IV Tape and Emerging Technologies to the Future

As evolving needs for enterprise exabytes expand in the midst of SSD and HDD supply shortages, the opportunities for tape and emerging storage technologies will be huge.

Tape (now) and emerging (beginning 2H26) can deliver seamless S3 ease of integration and immediate availability of immensely cost-effective, power-efficient exabytes, which means that—especially now, during the first phases of an enduring “exabyte crisis”—demands for tape and emerging technologies should soon expand greatly.

But will they? Tape adoption has certainly been hampered by a simple aversion to change, exemplified by this classic definition of conservatism: “If it is not necessary to change, it is necessary not to change.”

All of the major tape library suppliers (BDT, IBM, HPE, Quantum and Spectra Logic) now offer an easily integrated object storage AWS S3 Glacier interface, removing the most strident IT management objections—which, in addition to time-to-data performance concerns, include the costs of re-training their staff to configure and support a new technology—to integrating tape in their infrastructures. All viable IT departments can already support S3.

The cost benefits of tape have long been clear. We estimated that, in 2020, the 5-year cost per terabyte for an SSD system was 16.4x and for an HDD system was 2.4x the 5-year cost for a tape system. In 2035, we project the 5-year cost per terabyte for an SSD system will be at least 33x and for an HDD system will be at least 8x the 5-year cost per terabyte for a tape or emerging technology system.

The power efficiencies of tape are far more compelling. From 2020 through 2025, we estimated that the combined SSD and HDD installed base of bare bones drives would draw 25,267 megawatts. By staggering contrast, we estimated that the “active archive” installed base of tape infrastructures—including all rack, cooling, and robotic power requirements—would draw only 211 megawatts, less than 1% of the power required just to drive the bare bones SSDs and HDDs, irrespective of other integration requirements. We seriously doubt these power draw ratios can much change in coming years. In fact, this power draw ratio will increase in favor of tape and emerging enterprise storage infrastructures.

There are already a multitude of CO² emission compliance regulations in place throughout the world (with much stricter regulations in Europe) and growing scarcities of total available energy for datacenters in many small communities and metropolitan areas. Healthy ecosystems have become more crucial considerations in all IT purchasing decisions, and many data center managers will soon be forced—by upper-level management edict or by compliance regulations—to use tape and various enterprise emerging technologies as ultra-low-cost, sustainable storage alternatives.

It may be increasingly a question of what is available. If additional capacity is needed quickly, and if SSD and HDD capacities cannot be quickly procured, then tape and emerging technologies may be the only available options.



V Forecast Analysis, Inconclusive Conclusions

No one foresaw the spectacular 4Q25-1Q26 market developments, but in the wake of such astounding price increases, future SSD ASPs/TB will surely decline as markets modulate and new, higher density technologies emerge. Our downward ramps of 2027-2030 SSD pricing may be too aggressive, and yet our current estimate of a \$109.10 ASP/TB in 2030 is still 9% higher than the \$99.97 actual ASP/TB in 2025, and 2% higher than the \$107.22 actual ASP/TB in 2024.

For years we have predicted that, although storage prices to customers will always (eventually) decline on a per-bit basis, the expense to produce the bare bits of advanced technologies on enterprise-grade media—and resale prices to customers—will decline at slower rates during the 2020-2050 than in the 2000-2020 time period, and maximum available capacities will be limited.

Our new forecasts more deeply reflect this prediction, with materially higher long-term ASP floors and significantly higher integrated system costs, leading to total user spend of \$316B in 2050 (vs. \$147B in our prior forecasts). The impacts of 2025-2026 pricing dynamics demand a recalibration of 2026-2050 user initial integrated Costs/TB.

User spend may more than double, and yet our new forecasts decrease our prior enterprise EB CAGR shipment scenarios, from 12.6% (2030-2035) and 13.2% (2035-2040) to 6.8% and 12.7%, respectively, and from 11.6% (2040-2045) and 9.8% (2045-2050) to 9.7% and 7.6%, respectively. Despite these reassessments, our estimates of enterprise EB shipments still increase to 18ZB in 2040 and 42ZB in 2050, mostly buoyed by emerging storage technologies after 2035.

We have also repeatedly predicted that, even with transformative new technologies, we cannot possibly maintain the historic greater-than-25% annual growth rates we saw 2010-2021.

Look carefully at the green bold italic numbers in Table 3 in the main text body, and Tables 6 and 7 (in the Appendix), which delineate the difference between our current forecasts and a 25% annual growth scenario from 2030 to 2050.

Carefully consider that logical assumptions based on hard facts (a 25% annual growth scenario, which is less than the actual 29% 2010-2021 CAGR) can lead to monstrous conclusions—namely, to shipments of 67ZB (vs. 18ZB) in 2040 and 626ZB (vs. 42ZB) in 2050, with associated user spend of **\$1.1 trillion** and **\$4.7 trillion**. Even if we divide our user Cost/TB forecasts by half, the trillion-fold “conclusions” remain “monstrous.”

Many pundits believe the 4Q25-1Q26 events portend precisely these levels of shipments and user spend. In our view, to say these levels of shipments and user spend are absurd is an understatement of vast dimension.

You Don't Need to Plow a Field with a Ferrari

With the advent of new GenAI requirements, the enterprise storage industry has great expectations, and—to coin a term first used by Geoffrey A. Moore—is likely now approaching the “Peak of Inflated Expectations.” Historically, such peaks have been followed by a “Trough of Disillusionment.” Many GenAI companies and applications will not survive this trough.

More and more users will realize that, despite the impacts of GenAI and its expansive high-speed need to summon and scrutinize increasingly gigantic chunks of data, not all data will need to be accessed and analyzed simultaneously. As one of our interview clients remarked last year: “Even with GenAI, you don't need to plow a field with a Ferrari”—in most cases, oxen will suffice.

We reiterate our firm convictions that:



More than 70% of enterprise data will not have any enduring need for the performance of SSDs and HDDs, but will have greatly expanding needs for low-cost Sustainability, Immutability, and Security (SIS), attributes the active-archive technologies have been designed to deliver.



Huge numbers of HDDs and a significant number of SSDs are managing and, during the near term, likely will continue to manage far too many of the active-archive workloads at far too great a cost per terabyte while consuming an inordinate share of available energy.

In 2025, we estimate that, of the total 2,133 enterprise exabytes shipped, SSDs accounted for 18.5% (329 exabytes, compressed), HDDs accounted for 67.5% (1,439 exabytes, uncompressed), and tape accounted for 14.0% (299 exabytes, compressed). We believe that less than 30% of those exabytes were destined for applications and use cases that would require the nanosecond-to-millisecond access times that SSDs and HDDs can provide, and yet SSD and HDD shipments comprised 86% of the total exabytes delivered.

This must change, but it is likely that these percentage distributions of EBs among SSD, HDD, tape and emerging storage technologies will not much change prior to 2030. We fear there will continue to be immense waste of energy and money expended in the ways we choose to store and manage the active installed base of enterprise data. This will be tragic—“tragic” because the consequences of this waste can be so easily avoided, by more quickly integrating more tape and emerging storage technologies in our IT infrastructures.

Historically, we believe that at least 70% of shipments and the installed base comprised an archive of infrequently accessed data, which might be classified as 100% “cold,” the vast majority of which have been stored on HDDs, not tape. In the GenAI era, any file in that “cold” archive might become “hot” at any time, depending on unpredictable and increasingly refined and intelligent data-access requests.

As we move through a paradigm shift from a “cold” to a seamlessly accessible “active” archive, our assumption is that all data will be accessed eventually but may never require the 25-to-100 microsecond or 5-10 millisecond access speeds of SSDs or HDDs; however, conditioned by GenAI needs for speed, users will demand (reasonably or not) that most if not all of their active-archive data must be accessed within 30 seconds (preferably within 10 seconds).

Hence our deepening conviction that the creation and deployment of new, more cost-effective and power-efficient storage technologies which can deliver initial integration costs approaching \$1.00/TB with consistent <30-second (hopefully <10-second) data-access metrics, will be crucial to mitigate the escalating costs of managing our enormous dataverse over increasingly lengthy time periods.

A “Runaway Freight Train” of Enterprise Data Collides with ROI Demands

—And Yet our Dataverse Will Continue to Expand to Increasingly Staggering Dimensions...

GenAI will help to drive storage shipments at greater than 25% annual expansion rates 2025-2030, but after 2030, due to manufacturing and cost constraints, CFO interventions, energy compliance regulations, and sustainability requirements, GenAI will of necessity be increasingly used to enhance storage efficiencies.

With more-disciplined, -responsible and -sophisticated market management on the part of all storage vendors—having recently suffered once again the searing recognitions that “inventory is not an asset” and that “the effects of overproduction are always ruinous” (it’s like a combination of Alzheimers disease and deja-vu: we’ve forgotten how terrible it was all over again)—we do not anticipate any further precipitous declines of the sort we saw in 2022 and 2023, and it is increasingly obvious that global growth rates must decline.

It is also increasingly obvious that the billions of people and systems and sensors connected in our global dataverse will continue to generate vast quantities of data, and we will delete less and less of the data we create.

The data centers of the future will need everything the storage industry can manufacture and deliver to accurately analyze and reliably preserve the priceless artifacts of our personal, corporate, and cultural history.

Inevitably and inescapably, richly varied computing technologies will come and go, but the data we create will remain, and will continue to grow to unimaginable immensity.

Appendix

Revised Forecast

Changed assumptions in the wake of the 2025-2026 shortages and the freakish 4Q25-1Q26 pricing:

- SSD vendor ASPs peak in 2026 at >\$300/TB and may never decline to below \$20/TB (vs >\$9/TB in our prior forecast). SSD shipments never exceed 7ZB/year (vs >9.5ZB/year in our prior forecast).
- HDD vendor ASPs peak in 2026 at >\$15/TB and may never decline to below \$7.50/TB (vs >\$6/TB in our prior forecast). HDD shipments expand more quickly to ~4.9ZB/year in 2031 then decline more quickly to EOL in 2043 (vs expansion to 4.3ZB/year and slow decline through 2050 in our prior forecast).
- Tape user average acquisition Cost/TB declines to ~\$0.40/TB (vs. ~\$0.23/TB in our prior forecast) due to the lower cartridge capacities in the revised LTO tape roadmap. Tape ZB shipments are about the same as in our prior forecast.
- Emerging user average acquisition Cost/TB declines to <\$1.00/TB (vs. <\$0.80 in our prior forecast). Emerging shipments are somewhat less than in prior forecast.
- User storage spend expands to \$292 billion in 2030 and \$316 billion in 2050 (vs \$102 billion in 2030 and \$147 billion in 2050 in our prior forecast).

User Spend

We have depicted the reported and unreported 2010-2025 SSD and HDD vendor revenue with a great degree of accuracy, but because there are so many variables involved with so many different kinds of storage systems, it is impossible to know just what kind of average markups over bare-bones SSD and HDD vendor revenue to determine cost/TB user spend, are truly realistic. Major IT analyst firms forego any scrupulous analysis and simply use a 30% markup over vendor revenue as a universal average for all manner of hardware and software technologies to determine “user spend,” but that indolent estimate cannot possibly reflect actual user spend.

We know the 2020 vendor ASP for solid-state arrays (SSAs) was \$1,536/TB (uncompressed) and for Hybrid SSD/HDD arrays was \$265/TB (uncompressed). These estimates were extracted from the vendor revenue derived from the sale of external controller-based (ECB)/network fabric-attached storage systems to their direct customers. At a 30% markup for “user spend,” this would

equate to \$1,843.20/TB for SSAs and \$318/TB for Hybrid SSD/HDD arrays. We estimate the server/direct-attached storage (DAS) ASPs were at least 50% lower but much harder to determine with any degree of accuracy, since the server vendors do not separately report their substantial storage revenue.

After careful further analysis in the wake of the 1Q26 pricing dynamics, we raised our estimates of user spend to an 85% markup over SSD vendor revenue (vs. a 50% markup in our prior forecast) and raised our estimates of user spend to a 50% markup over HDD vendor revenue (vs. a 35% markup in our prior forecast). Our revised 2020 estimates of a compressed \$235.02/TB user-integrated SSD cost at 85% average markup over uncompressed SSD vendor revenue and of an uncompressed \$24.99/TB user-integrated HDD cost at 50% average markup over uncompressed HDD revenue, are still probably far too conservative a reflection of actual user spend, even considering that more than 60% of all the enterprise SSD and HDD EB go to the hyperscale customers at rock-bottom prices.

In any case, one can certainly argue that our SSD (85% markup) and HDD (50% markup) user spend estimates are responsibly cautious and perhaps greatly understated, and yet they still portend unprecedented growth in user spend.

Compressed tape user spend is based on our estimates of the media, drives and libraries required to support our estimates of compressed tape EB shipments (at least 2.5x native capacities). Emerging storage user spend is entirely speculative but is based on a competitive need to be 2.5x-5x less than HDD initial acquisition Costs/TB with a 15-year as opposed to a five-year replace/refresh cycle to achieve greater than 50% market penetration.

Enterprise Data Definitions

We define “enterprise exabytes” as the total capacities delivered on all enterprise-class SSDs, HDDs, tape, and—in the near future—enterprise emerging storage media. This definition specifically excludes exabyte shipments of consumer-grade SSDs, HDDs, and flash modules delivered to PCs, entertainment devices, cell phones, home video surveillance, and other consumer and industrial applications (such as aircraft and telecom installations), the vast majority of which are already backed up in, and therefore reflected by, the enterprise-grade exabytes serviced by corporate and cloud data centers.

Notes Relevant to All Tables

—**SSD:** Solid-state drive capacities reflect an approximate 5x compression ratio, but only for <10% of all enterprise SSD EBs shipped, the vast majority of which (>90%) are configured in server/direct-attached storage (DAS) systems, with little or no data compression, not in fabric-attached solid-state arrays (SSAs), wherein sophisticated data compression software is the norm.

—**HDD:** Hard-disk drive capacities are raw/uncompressed, since so few enterprise HDDs are integrated with any form of data compression.

—**Tape:** Capacity estimates include both LTO and IBM TS1100 shipments and reflect a global average of at least 2.5x data compression.

—**Emerging:** There should be huge opportunities for what we refer to collectively as “enterprise emerging storage” technologies to play major roles in future markets, as indicated in our 2026-2050 growth estimates, from 0.3EB in 2026 to 33ZB in 2050. Emerging shipments begin to exceed tape shipments in 2033.

—**Active Archive:** The total active-archive storage markets are the sum of all LTO+IBM+emerging shipments.

—**Active Installed Base:** This is an estimate of the total EBs of enterprise data which remain active, in use. We believe the active installed was 94.6EB in 2006 and will likely grow to exceed 180ZB in 2050. For the active installed base, we assume a 5-year SSD/HDD/tape infrastructure refresh/replacement cycle, retiring, for example, all 2010 shipments in 2015 while adding 2015 shipments to the installed base of the prior year, and we repeat this cycle through 2050. We have now refined our estimates of the active installed base with a 15-year emerging technology infrastructure refresh/replacement cycle.

—**ASP/TB:** This is the average price at which SSD and HDD vendors sell to hyperscalers (such as AWS), OEMs (such as Dell), and distributors (such as TD SYNTEX). Exabytes shipped and ASP/TB determine vendor revenue.

—**Cost/TB:** This is the average cost which users pay for cloud services from hyperscalers or smaller Internet Service Providers (ISPs) and integrated products from OEMs or distributors. Average Cost/TB and total exabytes delivered for integration determine User Spend.

Further Notes on Emerging Technologies: Proposed but still nascent emerging enterprise storage technologies include, in alphabetical order: Cerabyte’s ceramic nanolayers, DNA data storage, Folio Photonics’ dynamic multi-layer optical discs, Group47’s DOTS (Digital Optical Technology System), HoloMem’s high-capacity holographic media cartridges, Huawei’s MED (Magneto-Electric Disk— combining SSD speed with the capacity of tape), Microsoft’s silica, and SPhotonix’s 5D memory crystals (data is written inside of quartz glass). One or more of these technologies may initially be available in minimal strategic volume during 2H26, but Microsoft’s silica will likely be used internally (if at all), and will not be available externally for commercial consumption. The distribution of Huawei’s MED, if the technology is actually viable, may be limited to China. DNA storage has been generously funded by many companies and continues to command a great deal of perhaps unwarranted attention but will have minimal impact prior to 2035. New breeds of tape, as yet uncreated and unspecified, outside of and distinct from the LTO and IBM TS1100 specifications and roadmaps, may be included in our Emerging storage category.

Further Notes on the Active Installed Base: Some users replace their SSD infrastructures every three years while others claim their SSD infrastructures last for more than five years. Some users claim their HDDs last for more than seven years and their tapes last for more than 10 years. Most users we have spoken with agree that a 5-year infrastructure refresh/replacement cycle is a good and meaningful average to use, at least for today’s extant technologies. Emerging technologies should have greater than 15-year cycles. In an effort to more accurately reflect future markets, our new forecasts incorporate variable refresh/replacement cycles in our active-installed-base calculations, with a 5-year cycle for SSDs, HDDs and tape, and a 15-year cycle for emerging technologies. Longer emerging technology refresh cycles will substantially increase the size of the installed base because fewer EBs will be retired while annual shipments continue to escalate, and emerging technologies will display the greatest growth, accounting for the majority of enterprise EB shipments beginning in 2036.

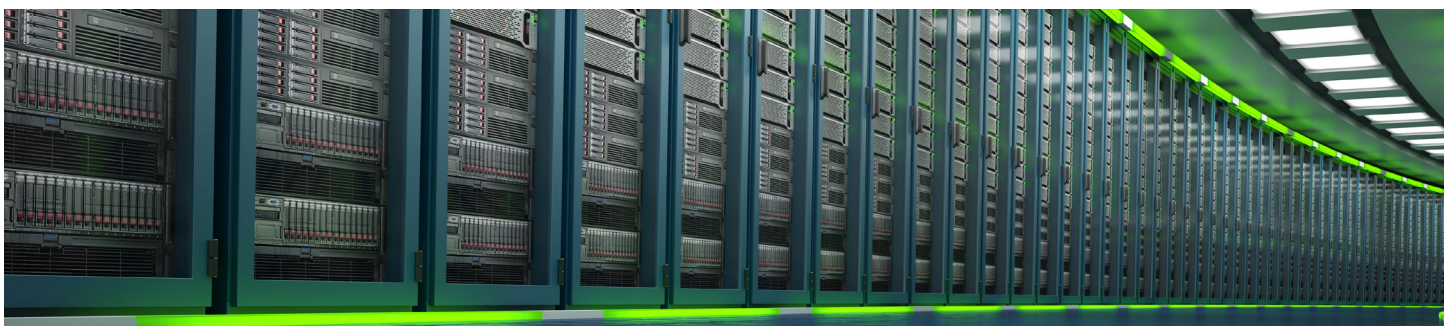


Table 4: Granular Details of Enterprise Storage Shipment and Revenue Histories, 2010-2020

	2010	2011	2012	2013	2014	2015	CAGR 2010-2015	2016	2017	2018	2019	2020	CAGR 2015-2020
SSD													
Vendor Enterprise SSD Uncompressed Shipment Estimates (EB)	0.2	0.6	1.0	3.0	7.0	11.0	122.9	18.0	29.0	51.6	66.4	108.9	58.2
Vendor Enterprise SSD Uncompressed Direct Revenue Estimates (\$M)	\$994	\$2,662	\$3,022	\$4,429	\$5,630	\$6,283	44.6	\$8,359	\$12,973	\$14,861	\$9,424	\$16,601	21.4
Vendor Enterprise SSD Uncompressed Blended ASP/TB (\$)	\$4,970.04	\$4,436.41	\$3,021.87	\$1,476.48	\$804.34	\$571.18	(35.1)	\$464.39	\$447.36	\$288.00	\$141.92	\$152.45	(23.2)
Vendor Enterprise SSD Compressed Shipment Estimates (EB)	0.2	0.7	1	4	8	13		22	35	62	80	131	
Estimated SSD System User Spend, 85% Markup Over Vendor Revenue (\$M)	\$1,839	\$4,924	\$5,590	\$8,194	\$10,416	\$11,624	% Changes Same As Uncompressed	\$15,464	\$24,001	\$27,492	\$17,434	\$30,713	% Changes Same As Uncompressed
Estimated SSD User Initial Integrated Compressed Average Acquisition Cost/TB (\$)	\$7,662.15	\$6,839.47	\$4,658.72	\$2,276.23	\$1,240.03	\$880.57		\$715.94	\$689.68	\$444.00	\$218.80	\$235.02	
HDD													
Vendor Enterprise HDD Uncompressed Shipment Estimates (EB)	46	52	66	91	117	157	27.8	218	267	394	490	680	34.1
Vendor Enterprise HDD Uncompressed Direct Revenue Estimates (\$M)	\$6,698	\$7,831	\$8,897	\$8,917	\$9,181	\$9,523	% Changes Same As User	\$8,988	\$8,935	\$10,915	\$10,737	\$11,326	% Changes Same As User
Vendor Enterprise HDD Uncompressed Blended ASP/TB (\$)	\$145.61	\$150.60	\$134.80	\$97.98	\$78.47	\$60.66		\$41.23	\$33.46	\$27.70	\$21.93	\$16.66	
Estimated HDD System User Spend, 50% Markup Over Vendor Revenue (\$M)	\$10,047	\$11,747	\$13,346	\$13,375	\$13,772	\$14,285	7.3	\$13,482	\$13,403	\$16,372	\$16,106	\$16,988	3.5
Estimated HDD User Initial Integrated Uncompressed Average Acquisition Cost/EB (\$)	\$218.41	\$225.89	\$202.20	\$146.98	\$117.71	\$90.98	(16.1)	\$61.84	\$50.20	\$41.55	\$32.90	\$24.99	(22.8)
TAPE													
Enterprise Tape Compressed Shipment Estimates (EB)	30	43	53	62	86	98	26.8	124	136	125	134	136	6.7
Enterprise Tape User Spend Estimates (\$M)	Tracking begins 2018									\$1,162	\$1,066	\$1,048	(5.0)
Estimated Tape User Initial Integrated Compressed Average Acquisition Cost/TB (\$)	Tracking begins 2018									\$9.30	\$7.96	\$7.71	(8.9)
EMERGING													
Vendor Enterprise Emerging Shipment Estimates (EB)	Tracking begins 2026												
Vendor Enterprise Emerging Revenue Estimates (\$M)	Tracking begins 2026												
Estimated Enterprise Emerging User Initial Integrated Average Acquisition Cost/TB (\$)	Tracking begins 2026												
TOTAL ACTIVE ARCHIVE													
Active-Archive Storage, Vendor Tape+Emerging Shipment Estimates (EB)	30	43	53	62	86	98	26.8	124	136	125	134	136	6.7
Active-Archive Storage, Tape+Emerging Revenue Opportunity (\$M)	Tracking begins 2018									\$1,162	\$1,066	\$1,048	(5.0)
TOTAL SHIPMENTS FOR ALL TECHNOLOGIES													
Total Compressed Enterprise EB Shipped	76	96	120	157	211	269	28.6	364	438	581	703	947	28.7
YoY Change %	-	25.9	25.4	30.0	34.8	27.3		35.4	20.4	32.7	21.0	34.6	
Compressed SSD % of Total EB Shipped	0.3	0.7	1.0	2.3	4.0	4.9		5.9	7.9	10.7	11.3	13.8	
Uncompressed HDD % of Total EB Shipped	60.3	54.2	54.8	58.1	55.5	58.5		60.0	61.0	67.8	69.6	71.8	
Compressed Active Archive % of Total EB Shipped	39.3	45.1	44.2	39.6	40.6	36.6		34.1	31.1	21.5	19.1	14.4	
Total Compressed Active Installed Base of Enterprise EB	293	321	402	505	659	851	23.8	1,119	1,436	1,861	2,353	3,031	28.9
YoY Change %	-	9.4	25.4	25.6	30.5	29.2		31.4	28.4	29.6	26.4	28.8	
TOTAL USER SPEND FOR ALL TECHNOLOGIES													
Total User Acquisition Cost/TB (\$)	Tracking begins 2018									\$77.50	\$49.21	\$51.50	(18.5)
Total Enterprise Storage User Spend (\$M)	Tracking begins 2018									\$45,026	\$34,606	\$48,749	4.1
SSD % of Total Spend	Tracking begins 2018									61.1	50.4	63.0	
HDD % of Total Spend	Tracking begins 2018									36.4	46.5	34.8	
Active Archive % of Total Spend	Tracking begins 2018									2.6	3.1	2.2	
COMPREHENSIVE ASP AND COST RATIOS													
Vendor ASP Ratios													
SSD:HDD Vendor ASP/TB	34.1	29.5	22.4	15.1	10.3	9.4		11.3	13.4	10.4	6.5	9.2	
User Acquisition Cost Ratios													
SSD:Tape User Cost/TB	Tracking begins 2018									47.7	27.5	30.5	
HDD:Tape User Cost/TB	Tracking begins 2018									4.5	4.1	3.2	
SSD:Emerging User Cost/TB	Tracking begins 2026												
HDD:Emerging User Cost/TB	Tracking begins 2026												
Tape:Emerging User Cost/TB	Tracking begins 2026												

SSD and HDD vendors sell directly to hyperscalers (such as AWS), OEMs (such as Dell), and distributors (such as TD SYNEX). Users purchase cloud services from hyperscalers or smaller Internet Service Providers (ISPs) and integrated products from OEMs or distributors. Source: Furthur Market Research and Brad Johns Consulting, April 2026

Table 5: Granular Details of Enterprise Storage Shipment and Revenue Histories, 2020-2024, and Forecasts, 2025-2030

	2020	2021	2022	2023	2024	2025	CAGR 2020-2025	2026	2027	2028	2029	2030	CAGR 2025-2030	
SSD														
Vendor Enterprise SSD Uncompressed Shipment Estimates (EB)	109	149	173	120	251	329	24.7	535	671	711	902	1,098	27.3	
Vendor Enterprise SSD Uncompressed Direct Revenue Estimates (\$M)	\$16,601	\$20,353	\$20,741	\$8,173	\$26,891	\$32,890	14.7	\$163,888	\$179,327	\$146,430	\$128,562	\$119,793	29.5	
Vendor Enterprise SSD Uncompressed Blended ASP/TB (\$)	\$152.45	\$136.51	\$119.96	\$68.00	\$107.22	\$99.97	(8.1)	\$306.33	\$267.25	\$205.95	\$142.53	\$109.10	1.8	
Vendor Enterprise SSD Compressed Shipment Estimates (EB)	131	179	207	144	301	395		642	805	853	1,082	1,318		
Estimated SSD System User Spend, 85% Markup Over Vendor Revenue (\$M)	\$30,712.55	\$37,653	\$38,371	\$15,121	\$49,749	\$60,847	% Changes Same As User	\$303,193	\$331,755	\$270,896	\$237,840	\$221,617	% Changes Same As User	
Estimated SSD User Initial Integrated Compressed Average Acquisition Cost/TB (\$)	\$235.02	\$210.45	\$184.94	\$104.83	\$165.30	\$154.12		\$472.26	\$412.02	\$317.51	\$219.73	\$168.20		
HDD														
Vendor Enterprise HDD Uncompressed Shipment Estimates (EB)	680	959	942	1,039	1,085	1,439	16.2	1,753	2,211	2,709	3,581	4,496	25.6	
Vendor Enterprise HDD Uncompressed Direct Revenue Estimates (\$M)	\$11,326	\$13,035	\$12,887	\$13,755	\$14,077	\$20,598	% Changes Same As User	\$27,180	\$30,909	\$31,121	\$36,916	\$43,076	% Changes Same As User	
Vendor Enterprise HDD Uncompressed Blended ASP/TB (\$)	\$16.66	\$13.59	\$13.68	\$13.24	\$12.98	\$14.31		\$15.50	\$13.98	\$11.49	\$10.31	\$9.58		
Estimated HDD System User Spend, 50% Markup Over Vendor Revenue (\$M)	\$16,988	\$19,553	\$19,330	\$20,633	\$21,116	\$30,897	12.1	\$40,770	\$46,364	\$46,682	\$55,374	\$64,614	16.4	
Estimated HDD User Initial Integrated Uncompressed Average Acquisition Cost/EB (\$)	\$24.99	\$20.39	\$20.52	\$19.86	\$19.47	\$21.47	(3.5)	\$23.26	\$20.97	\$17.23	\$15.46	\$14.37	(7.3)	
TAPE														
Enterprise Tape Compressed Shipment Estimates (EB)	136	190	207	228	265	299	17.1	350	435	501	639	821	22.4	
Enterprise Tape User Spend Estimates (\$M)	\$1,048	\$1,172	\$1,068	\$1,132	\$1,296	\$1,459	6.8	\$1,776	\$2,023	\$2,098	\$2,160	\$2,455	11.0	
Estimated Tape User Initial Integrated Compressed Average Acquisition Cost/TB (\$)	\$7.71	\$6.17	\$5.16	\$4.97	\$4.89	\$4.88	(8.7)	\$5.07	\$4.65	\$4.19	\$3.38	\$2.99	(9.3)	
EMERGING														
Vendor Enterprise Emerging Shipment Estimates (EB)	Tracking begins 2026								0.3	15.0	129.0	298.0	583.0	>1000
Vendor Enterprise Emerging Revenue Estimates (\$M)								\$4.08	\$139.45	\$889.00	\$1,753.00	\$3,005.00	>1000	
Estimated Enterprise Emerging User Initial Integrated Average Acquisition Cost/TB (\$)								\$13.60	\$9.30	\$6.89	\$5.88	\$5.15	(21.5)	
TOTAL ACTIVE ARCHIVE														
Active-Archive Storage, Vendor Tape+Emerging Shipment Estimates (EB)	136	190	207	228	265	299	17.1	350	450	630	937	1,404	36.3	
Active-Archive Storage, Tape+Emerging Revenue Opportunity (\$M)	\$1,048	\$1,172	\$1,068	\$1,132	\$1,296	\$1,459	6.8	\$1,780	\$2,162	\$2,987	\$3,913	\$5,460	30.2	
TOTAL SHIPMENTS FOR ALL TECHNOLOGIES														
Total Compressed Enterprise EB Shipped	947	1,328	1,356	1,411	1,650	2,133	17.6	2,745	3,466	4,192	5,600	7,218	27.6	
YoY Change %	34.6	40.3	2.2	4.0	17.0	29.2		28.7	26.3	20.9	33.6	28.9		
Compressed SSD % of Total EB Shipped	13.8	13.5	15.3	10.2	18.2	18.5		23.4	23.2	20.4	19.3	18.3		
Uncompressed HDD % of Total EB Shipped	71.8	72.2	69.4	73.6	65.7	67.5		63.9	63.8	64.6	63.9	62.3		
Compressed Active Archive % of Total EB Shipped	14.4	14.3	15.3	16.2	16.1	14.0		12.8	13.0	15.0	16.7	19.5		
Total Compressed Active Installed Base of Enterprise EB	3,031	3,995	4,914	5,744	6,692	7,878	21.0	9,295	11,405	14,186	18,136	23,221	24.1	
YoY Change %	28.8	31.8	23.0	16.9	16.5	17.7		18.0	22.7	24.4	27.8	28.0		
TOTAL USER SPEND FOR ALL TECHNOLOGIES														
Total User Acquisition Cost/TB	\$51.50	\$43.96	\$43.32	\$26.14	\$43.72	\$43.70	(3.2)	\$125.94	\$109.71	\$76.47	\$53.05	\$40.41	(1.6)	
Total User Enterprise Storage Spend	\$48,749	\$58,378	\$58,769	\$36,886	\$72,160	\$93,202	13.8	\$345,742	\$380,281	\$320,564	\$297,127	\$291,691	25.6	
YoY Change %	40.9	19.8	0.7	(37.2)	95.6	29.2		271.0	10.0	(15.7)	(7.3)	(1.8)		
SSD % of Total Spend	63.0	64.5	65.3	41.0	68.9	65.3		87.7	87.2	84.5	80.0	76.0		
HDD % of Total Spend	34.8	33.5	32.9	55.9	29.3	33.2		11.8	12.2	14.6	18.6	22.2		
Active Archive % of Total Spend	2.2	2.0	1.8	3.1	1.8	1.6		0.5	0.6	0.9	1.3	1.9		
COMPREHENSIVE ASP AND COST RATIOS														
Vendor ASP Ratios														
SSD:HDD Vendor ASP/TB	9.2	10.0	8.8	5.1	8.3	7.0		19.8	19.1	17.9	13.8	11.4		
User Acquisition Cost Ratios														
SSD:Tape User Cost/TB	30.5	34.1	35.8	21.1	33.8	31.6		93.1	88.6	75.8	65.0	56.3		
HDD:Tape User Cost/TB	3.2	3.3	4.0	4.0	4.0	4.4		4.6	4.5	4.1	4.6	4.8		
SSD:Emerging User Cost/TB	Tracking begins 2026								34.7	44.3	46.1	37.4	32.6	
HDD:Emerging User Cost/TB									1.7	2.3	2.5	2.6	2.8	
Tape:Emerging User Cost/TB									0.4	0.5	0.6	0.6	0.6	

SSD and HDD vendors sell directly to hyperscalers (such as AWS), OEMs (such as Dell), and distributors (such as TD SYNnex). Users purchase cloud services from hyperscalers or smaller Internet Service Providers (ISPs) and integrated products from OEMs or distributors. Source: Furthur Market Research and Brad Johns Consulting, April 2026

Table 6: Granular Details of Enterprise Storage Shipment and Revenue Forecasts, 2030-2040

	2030	2031	2032	2033	2034	2035	CAGR 2030-2035	2036	2037	2038	2039	2040	CAGR 2035-2040
SSD													
Vendor Enterprise SSD Uncompressed Shipment Estimates (EB)	1,098	1,276	1,501	1,807	1,992	2,214	15.1	2,519	2,879	3,194	3,591	3,890	11.9
Vendor Enterprise SSD Uncompressed Direct Revenue Estimates (\$M)	\$119,793	\$115,281	\$115,670	\$128,765	\$129,653	\$131,421	1.9	\$145,092	\$153,064	\$149,197	\$148,587	\$153,474	3.2
Vendor Enterprise SSD Uncompressed Blended ASP/TB (\$)	\$109.10	\$90.35	\$77.06	\$71.26	\$65.09	\$59.36	(11.5)	\$57.60	\$53.17	\$46.71	\$41.38	\$39.45	(7.8)
Vendor Enterprise SSD Compressed Shipment Estimates (EB)	1,318	1,531	1,801	2,168	2,390	2,657	% Changes Same As User	3,023	3,455	3,833	4,309	4,668	% Changes Same As User
Estimated SSD System User Spend, 85% Markup Over Vendor Revenue (\$M)	\$221,617	\$213,270	\$213,990	\$238,215	\$239,858	\$243,129		\$268,420	\$283,168	\$276,014	\$274,886	\$283,927	
Estimated SSD User Initial Integrated Compressed Average Acquisition Cost/TB (\$)	\$168.20	\$139.28	\$118.80	\$109.86	\$100.34	\$91.51		\$88.80	\$81.96	\$72.01	\$63.79	\$60.82	
HDD													
Vendor Enterprise HDD Uncompressed Shipment Estimates (EB)	3,023	3,455	3,833	4,309	4,668	2,388	(11.9)	1,875	1,390	998	716	484	(27.3)
Vendor Enterprise HDD Uncompressed Direct Revenue Estimates (\$M)	\$268,420	\$283,168	\$276,014	\$274,886	\$283,927	\$19,876	% Changes Same As User	\$15,307	\$11,293	\$7,910	\$5,588	\$3,766	% Changes Same As User
Vendor Enterprise HDD Uncompressed Blended ASP/TB (\$)	\$88.80	\$81.96	\$72.01	\$63.79	\$60.82	\$8.32		\$8.16	\$8.12	\$7.93	\$7.80	\$7.78	
Estimated HDD System User Spend, 50% Markup Over Vendor Revenue (\$M)	\$64,464	\$65,877	\$58,622	\$46,964	\$37,545	\$29,814	(14.3)	\$22,961	\$16,940	\$11,865	\$8,382	\$5,649	(28.3)
Estimated HDD User Initial Integrated Uncompressed Average Acquisition Cost/EB (\$)	\$14.34	\$13.53	\$13.23	\$13.13	\$12.68	\$12.48	(2.8)	\$12.25	\$12.19	\$11.89	\$11.71	\$11.67	(1.3)
TAPE													
Enterprise Tape Compressed Shipment Estimates (EB)	821	1,030	1,267	1,525	1,807	1,995	19.4	1,939	1,890	1,599	1,510	1,453	(6.1)
Enterprise Tape User Spend Estimates (\$M)	\$2,455	\$2,582	\$2,602	\$2,565	\$2,509	\$2,327	(1.1)	\$1,867	\$1,565	\$1,111	\$886	\$746	(20.4)
Estimated Tape User Initial Integrated Compressed Average Acquisition Cost/TB (\$)	\$2.99	\$2.51	\$2.05	\$1.68	\$1.39	\$1.17	(17.2)	\$0.96	\$0.83	\$0.70	\$0.59	\$0.51	(15.1)
EMERGING													
Vendor Enterprise Emerging Shipment Estimates (EB)	583	799	1,087	1,603	2,055	2,981	38.6	4,402	5,906	8,081	9,867	11,629	31.3
Vendor Enterprise Emerging Revenue Estimates (\$M)	\$3,005	\$3,560	\$4,338	\$5,387	\$5,992	\$7,906	21.3	\$10,389	\$12,333	\$15,573	\$17,765	\$19,358	19.6
Estimated Enterprise Emerging User Initial Integrated Average Acquisition Cost/TB (\$)	\$5.15	\$4.46	\$3.99	\$3.36	\$2.92	\$2.65	(12.4)	\$2.36	\$2.09	\$1.93	\$1.80	\$1.66	(8.9)
TOTAL ACTIVE ARCHIVE													
Active-Archive Storage, Vendor Tape+Emerging Shipment Estimates (EB)	1,404	1,829	2,354	3,128	3,862	4,976	28.8	6,341	7,796	9,680	11,377	13,082	21.3
Active-Archive Storage, Tape+Emerging Revenue Opportunity (\$M)	\$5,460	\$6,142	\$6,940	\$7,952	\$8,501	\$10,233	13.4	\$12,256	\$13,898	\$16,684	\$18,651	\$20,104	14.5
TOTAL SHIPMENTS FOR ALL TECHNOLOGIES													
Total Compressed Enterprise EB Shipped	7,218	8,230	8,587	8,873	9,212	10,021	6.8	11,239	12,641	14,511	16,402	18,234	12.7
YoY Change %	28.9	14.0	4.3	3.3	3.8	8.8		12.2	12.5	14.8	13.0	11.2	
Compressed SSD % of Total EB Shipped	18.3	18.6	21.0	24.4	25.9	26.5		26.9	27.3	26.4	26.3	25.6	
Uncompressed HDD % of Total EB Shipped	62.3	59.2	51.6	40.3	32.1	23.8		16.7	11.0	6.9	4.4	2.7	
Compressed Active Archive % of Total EB Shipped	19.5	22.2	27.4	35.3	41.9	49.7		56.4	61.7	66.7	69.4	71.7	
Total Compressed Active Installed Base of Enterprise EB	23,221	28,706	33,842	38,652	42,562	45,948	14.6	49,756	54,896	62,137	71,382	82,576	12.4
YoY Change %	28.0	23.6	17.9	14.2	10.1	8.0		8.3	10.3	13.2	14.9	15.7	
TOTAL USER SPEND FOR ALL TECHNOLOGIES													
Total User Acquisition Cost/TB	\$40.41	\$34.66	\$32.55	\$33.03	\$31.03	\$28.26	(6.9)	\$27.02	\$24.84	\$20.99	\$18.41	\$16.98	(9.7)
Total User Enterprise Storage Spend	\$291,691	\$285,288	\$279,551	\$293,131	\$285,904	\$283,176	(0.6)	\$303,637	\$314,006	\$304,564	\$301,919	\$309,680	1.8
YoY Change %	(1.8)	(2.2)	(2.0)	4.9	(2.5)	(1.0)		7.2	3.4	(3.0)	(0.9)	2.6	
SSD % of Total Spend	76.0	74.8	76.5	81.3	83.9	85.9		88.4	90.2	90.6	91.0	91.7	
HDD % of Total Spend	22.2	23.1	21.0	16.0	13.1	10.5		7.6	5.4	3.9	2.8	1.8	
Active Archive % of Total Spend	1.9	2.2	2.5	2.7	3.0	3.6		4.0	4.4	5.5	6.2	6.5	
COMPREHENSIVE ASP AND COST RATIOS													
Vendor ASP Ratios													
SSD:HDD Vendor ASP/TB	11.4	10.0	8.7	8.1	7.7	7.1		7.1	6.5	5.9	5.3	5.1	
User Acquisition Cost Ratios													
SSD:Tape User Cost/TB	56.3	55.6	57.8	65.3	72.3	78.5		92.2	99.0	103.6	108.7	118.5	
HDD:Tape User Cost/TB	4.8	5.4	6.4	7.8	9.1	10.7		12.7	14.7	17.1	20.0	22.7	
SSD:Emerging User Cost/TB	32.6	31.3	29.8	32.7	34.4	34.5		37.6	39.3	37.4	35.4	36.5	
HDD:Emerging User Cost/TB	2.8	3.0	3.3	3.9	4.4	4.7		5.2	5.8	6.2	6.5	7.0	
Tape:Emerging User Cost/TB	0.6	0.6	0.5	0.5	0.5	0.4		0.4	0.4	0.4	0.3	0.3	
Alternate 2030-2040 Shipment Scenario at 25% Annual Expansion (EB)		9,022	11,278	14,097	17,622	22,027		27,534	34,418	43,022	53,778	67,222	
EB Delta to Current Forecast		792	2,691	5,224	8,409	12,006		16,295	21,777	28,511	37,375	48,988	
Alternate 2030-2040 User Spend Scenario at 25% Annual Expansion (\$M)		\$312,748	\$367,147	\$465,707	\$546,889	\$622,465		\$743,885	\$854,956	\$902,979	\$989,895	\$1,141,673	
\$ Delta to Current Forecast		\$27,460	\$87,596	\$172,576	\$260,984	\$339,289		\$440,248	\$540,951	\$598,416	\$687,976	\$831,993	
Alternate 2030-2040 Active Installed Base Scenario at 25% Annual Expansion (EB)		29,498	37,310	47,215	59,236	74,046		92,558	115,697	144,622	180,778	225,972	
EB Delta to Current Forecast		792	3,468	8,563	16,674	28,098		42,802	60,801	82,485	109,396	143,396	

SSD and HDD vendors sell directly to hyperscalers (such as AWS), OEMs (such as Dell), and distributors (such as TD SYNEX). Users purchase cloud services from hyperscalers or smaller Internet Service Providers (ISPs) and integrated products from OEMs or distributors. Source: Furthur Market Research and Brad Johns Consulting, April 2026

Table 7: Granular Details of Enterprise Storage Shipment and Revenue Forecasts, 2040-2050

	2040	2041	2042	2043	2044	2045	CAGR 2040-2045	2046	2047	2048	2049	2050	CAGR 2045-2050
SSD													
Vendor Enterprise SSD Uncompressed Shipment Estimates (EB)	3,890	4,255	4,892	5,187	5,584	5,707	8.0	6,125	6,389	6,565	6,783	6,989	4.1
Vendor Enterprise SSD Uncompressed Direct Revenue Estimates (\$M)	\$153,474	\$155,808	\$165,216	\$163,983	\$168,544	\$168,511	1.9	\$161,780	\$165,602	\$152,607	\$151,801	\$152,429	(2.0)
Vendor Enterprise SSD Uncompressed Blended ASP/TB (\$)	\$39.45	\$36.62	\$33.77	\$31.61	\$30.18	\$29.53	(5.6)	\$26.41	\$25.92	\$23.25	\$22.38	\$21.81	(5.9)
Vendor Enterprise SSD Compressed Shipment Estimates (EB)	4,668	5,106	5,870	6,224	6,701	6,848		7,350	7,667	7,878	8,140	8,387	
Estimated SSD System User Spend, 85% Markup Over Vendor Revenue (\$M)	\$283,927	\$288,245	\$305,650	\$303,369	\$311,806	\$311,745	% Changes Same As User	\$299,293	\$306,364	\$282,323	\$280,832	\$281,994	% Changes Same As User
Estimated SSD User Initial Integrated Compressed Average Acquisition Cost/TB (\$)	\$60.82	\$56.45	\$52.07	\$48.74	\$46.53	\$45.52		\$40.72	\$39.96	\$35.84	\$34.50	\$33.62	
HDD													
Vendor Enterprise HDD Uncompressed Shipment Estimates (EB)	484	318	189				(100.0)						
Vendor Enterprise HDD Uncompressed Direct Revenue Estimates (\$M)	\$3,766	\$2,455	\$1,429				% Changes Same As User						
Vendor Enterprise HDD Uncompressed Blended ASP/TB (\$)	\$7.78	\$7.72	\$7.56										
Estimated HDD System User Spend, 50% Markup Over Vendor Revenue (\$M)	\$5,649	\$3,683	\$2,144				(100.0)						
Estimated HDD User Initial Integrated Uncompressed Average Acquisition Cost/EB (\$)	\$11.67	\$11.58	\$11.34				(100.0)						
TAPE													
Enterprise Tape Compressed Shipment Estimates (EB)	1,453	1,299	1,085	904	782	690	(13.8)	491	345	293	199	108	(31.0)
Enterprise Tape User Spend Estimates (\$M)	\$746	\$655	\$484	\$337	\$300	\$271	(18.3)	\$193	\$136	\$116	\$79	\$43	(30.9)
Estimated Tape User Initial Integrated Compressed Average Acquisition Cost/TB (\$)	\$0.51	\$0.50	\$0.45	\$0.37	\$0.38	\$0.39	(5.2)	\$0.39	\$0.40	\$0.40	\$0.40	\$0.40	0.1
EMERGING													
Vendor Enterprise Emerging Shipment Estimates (EB)	11,629	13,504	15,745	17,388	18,980	21,398	13.0	23,788	25,786	26,504	29,381	33,330	9.3
Vendor Enterprise Emerging Revenue Estimates (\$M)	\$19,358	\$20,808	\$22,312	\$22,644	\$23,312	\$25,338	5.5	\$27,195	\$28,179	\$28,360	\$30,481	\$33,531	5.8
Estimated Enterprise Emerging User Initial Integrated Average Acquisition Cost/TB (\$)	\$1.66	\$1.54	\$1.42	\$1.30	\$1.23	\$1.18	(6.6)	\$1.14	\$1.09	\$1.07	\$1.04	\$1.01	(3.2)
TOTAL ACTIVE ARCHIVE													
Active-Archive Storage, Vendor Tape+Emerging Shipment Estimates (EB)	13,082	14,803	16,830	18,292	19,762	22,088	11.0	24,279	26,131	26,797	29,580	33,438	8.6
Active-Archive Storage, Tape+Emerging Revenue Opportunity (\$M)	\$20,104	\$21,463	\$22,796	\$22,981	\$23,612	\$25,609	5.0	\$27,388	\$28,315	\$28,476	\$30,560	\$33,574	5.6
TOTAL SHIPMENTS FOR ALL TECHNOLOGIES													
Total Compressed Enterprise EB Shipped	18,234	20,227	22,889	24,588	26,463	28,936	9.7	31,629	33,798	34,675	37,720	41,825	7.6
YoY Change %	11.2	10.9	13.2	7.4	7.6	9.3		9.3	6.9	2.6	8.8	10.9	
Compressed SSD % of Total EB Shipped	25.6	25.2	25.6	25.3	25.3	23.7		23.2	22.7	22.7	21.6	20.1	
Uncompressed HDD % of Total EB Shipped	2.7	1.6	0.8	0.3	0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Compressed Active Archive % of Total EB Shipped	71.7	73.2	73.5	74.4	74.7	76.3		76.8	77.3	77.3	78.4	79.9	
Total Compressed Active Installed Base of Enterprise EB	82,576	95,966	112,105	130,135	149,765	171,513	15.7	195,620	221,186	247,058	275,240	306,545	12.3
YoY Change %	15.7	16.2	16.8	16.1	15.1	14.5		14.1	13.1	11.7	11.4	11.4	
TOTAL USER SPEND FOR ALL TECHNOLOGIES													
Total User Acquisition Cost/TB	\$16.98	\$15.49	\$14.44	\$13.31	\$12.68	\$11.66	(7.2)	\$10.33	\$9.90	\$8.96	\$8.26	\$7.54	(8.3)
Total User Enterprise Storage Spend	\$309,680	\$313,390	\$330,589	\$327,162	\$335,419	\$337,354	1.7	\$326,681	\$334,679	\$310,799	\$311,392	\$315,567	(1.3)
YoY Change %	2.6	1.2	5.5	(1.0)	2.5	0.6		(3.2)	2.4	(7.1)	0.2	1.3	
SSD % of Total Spend	91.7	92.0	92.5	92.7	93.0	92.4		91.6	91.5	90.8	90.2	89.4	
HDD % of Total Spend	1.8	1.2	0.6	0.2	0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Active Archive % of Total Spend	6.5	6.8	6.9	7.0	7.0	7.6		8.4	8.5	9.2	9.8	10.6	
COMPREHENSIVE ASP AND COST RATIOS													
Vendor ASP Ratios													
SSD:HDD Vendor ASP/TB	5.1	4.7	4.5										
User Acquisition Cost Ratios													
SSD:Tape User Cost/TB	118.5	112.0	116.7	130.8	121.2	116.0		103.6	101.1	90.7	87.3	85.1	
HDD:Tape User Cost/TB	22.7	23.0	25.4	30.3	0.0	0.0		0.0	0.0	0.0	0.0	0.0	
SSD:Emerging User Cost/TB	36.5	36.6	36.7	37.4	37.9	38.4		35.6	36.6	33.5	33.3	33.4	
HDD:Emerging User Cost/TB	7.0	7.5	8.0	8.7	0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Tape:Emerging User Cost/TB	0.3	0.3	0.3	0.3	0.3	0.3		0.3	0.4	0.4	0.4	0.4	
Alternate 2040-2050 Shipment Scenario at 25% Annual Expansion (EB)													
	67,222	84,027	105,034	131,293	164,116	205,145		256,431	320,539	400,674	500,842	626,053	
EB Delta to Current Forecast	48,988	63,800	82,145	106,704	137,653	176,209		224,802	286,741	365,999	463,123	584,228	
Alternate 2040-2050 User Spend Scenario at 25% Annual Expansion (\$M)													
	\$1,141,673	\$1,301,892	\$1,516,999	\$1,746,925	\$2,080,188	\$2,391,677		\$2,648,557	\$3,174,104	\$3,591,318	\$4,134,669	\$4,723,558	
S Delta to Current Forecast	\$831,993	\$988,502	\$1,186,410	\$1,419,762	\$1,744,769	\$2,054,323		\$2,321,876	\$2,839,425	\$3,280,520	\$3,823,278	\$4,407,991	
Alternate 2040-2050 Active Installed Base Scenario at 25% Annual Expansion (EB)													
	225,972	282,465	353,082	441,353	551,691	689,615		862,018	1,077,523	1,346,904	1,683,631	2,104,539	
EB Delta to Current Forecast	143,396	186,500	240,977	311,218	401,927	518,102		666,399	856,337	1,099,847	1,408,391	1,797,994	

SSD and HDD vendors sell directly to hyperscalers (such as AWS), OEMs (such as Dell), and distributors (such as TD SYNnex). Users purchase cloud services from hyperscalers or smaller Internet Service Providers (ISPs) and integrated products from OEMs or distributors. Source: Furthur Market Research and Brad Johns Consulting, April 2026

This report was sponsored by Cerabyte and was written by **John Monroe** and **Brad Johns**.

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Cerabyte is a deep-tech start-up developing a new ecosystem for sustainable low-cost long-term data storage at the verified prototype system level (TRL6). Ceramic-on-Glass media using laser-matrix writing and high-speed microscope reading technology is the foundation enabling the storage of vast amounts of cold data, that is kept for decades to centuries and rarely retrieved. Leveraging semiconductor tool R&D investment, Cerabyte is uniquely positioned to deliver the sustainable, accessible, and affordable EB-scale data center rack storage solutions required for the yottabyte era.

Monroe Biography

John Monroe has been involved with the storage industry for more than 40 years, beginning in 1980.

- From 1997 to 2022, Monroe was a VP Analyst at Gartner, covering the history and forecasting the future of consumer and enterprise storage markets.
- From 1990 to 1997, he was the VP of all storage lines at SYNnex Information Technologies (now TD SYNnex), a global distribution and manufacturing services firm, responsible for the profitable resale and OEM integration of HDDs, controllers, subsystems, and tape.
- From 1988 to 1990 he was Director of North American Sales for Kalok Corporation (a startup HDD manufacturer).
- From 1983 to 1988 he was part owner and general manager of Media Winchester, Ltd., a storage products distributor and integrator which was one of Seagate's inaugural "SuperVARs."
- He began his career in 1980 at Electrolabs, selling ICs, power supplies, cables, monitors, printers, 8-inch floppy disk drives, and 8-inch HDDs ("oddmans of all things" related to computing electronics).

Unlike most industry analysts, Monroe has had balance-sheet accountability for the stuff that he studies. Monroe earned a BA degree summa cum laude, Phi Beta Kappa from Amherst College in 1976 and a master's degree in fine arts (MFA) with a merit scholarship from Columbia University in 1980.

Johns Biography

Brad Johns is President of Brad Johns Consulting LLC, an Information Technology consulting firm specializing in storage technology economics, marketing, and strategy. He has over 40 years of experience in the IT industry.

- In 2010, he established and led Brad Johns Consulting LLC, which provides consulting and marketing strategy assistance for storage technology companies.
- From 1997 until his retirement in 2010, he held various IBM storage product marketing and management leadership positions for IBM's worldwide disk, storage virtualization, tape storage, and archive product portfolio.
- From 1978 to 1997, after starting with the Data Processing Division, he held a variety of enterprise sales, sales management, industry marketing, and consulting positions. He was a founding member of IBM's Innovation Workflow consulting team and engaged with leading-edge clients in the aerospace, automotive, and information technology industries.
- Johns earned a BA in Economics from the University of Arizona in 1976 and a master's in business administration (MBA) in 1977.

As in his analyses and forecasts of "infinitely-self-similar-but-never-the-same" storage market trends over many years, Monroe's aim at Furthur Market Research is to bring actionable business perspectives tempered by Chaos Science, knowing that, within the unpredictably turbulent flow of dynamically changing systems—which "mirror a universe that is rough, not rounded, scabrous, not smooth," which reflect a fractal "geometry of the pitted, pocked and broken up, the twisted, tangled, and intertwined"*—there lies a deeply mysterious order that, in some way, at some scale, will always repeat itself.

**Chaos, Making a New Science*
—James Gleick