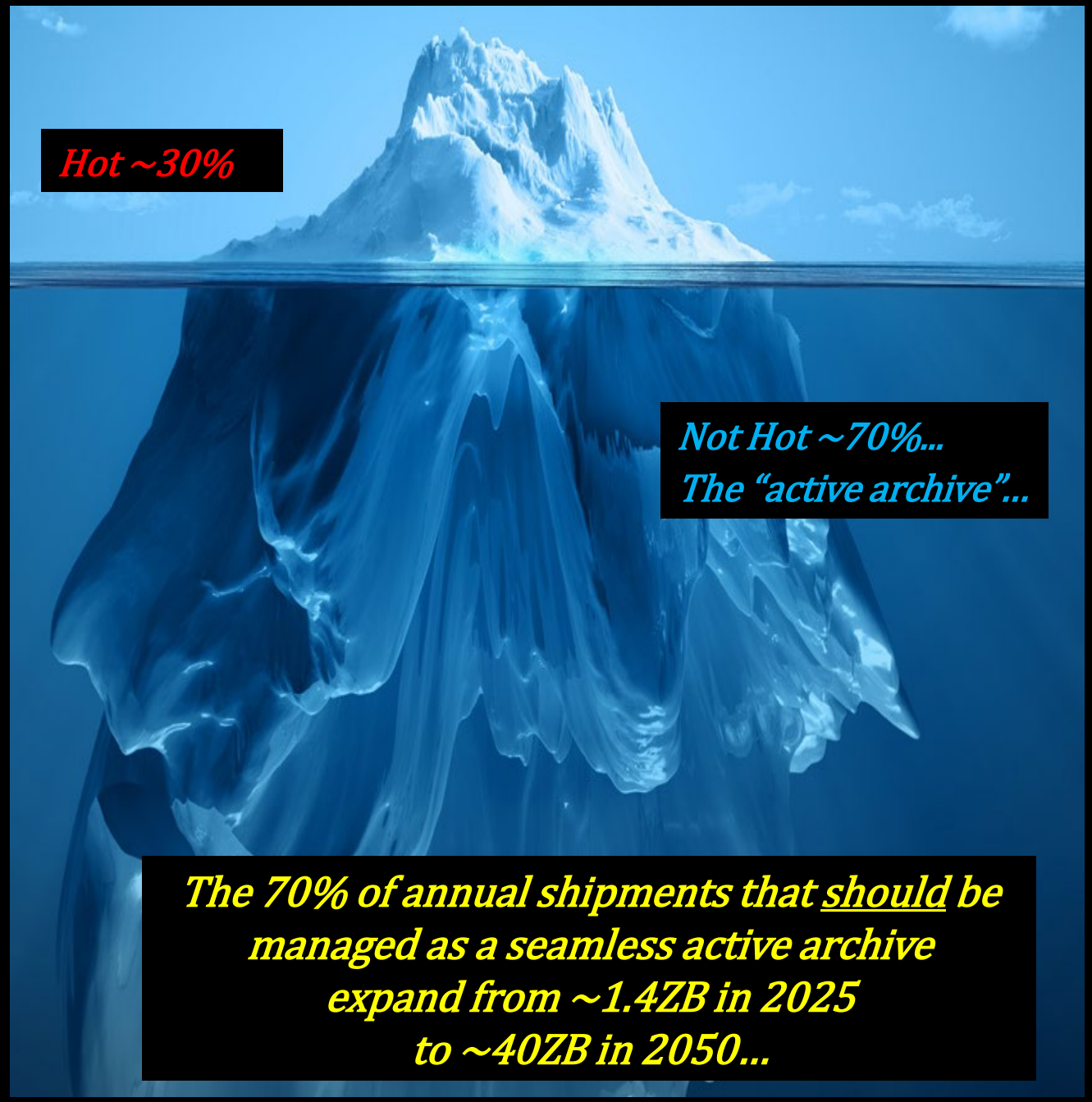

"Like Nothing We've Ever Seen Before":

The Growing Immensity of "Frostbitten" DATA in the Age of GenAI...

2031-2050 annual growth rates that merely mimic historic ~25% norms cannot be feasibly sustained.

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FMS the Future of Memory and Storage

OUR EXPANDING DATAVERSE

Gen AI will increasingly be utilized to enhance storage efficiencies…

In the GenAI era, all stored data will become "indispensable."
Acute "dysposaphobia" will become increasingly pandemic.
GenAI engenders an age of perpetual data migration.

PRELIMINARY EXPECTORATION

- *Analyzing storage dynamics is like walking through a maze whose walls rearrange themselves with each step that you take…*

Enduring Question: *Will the Past be Prologue, or Will History Be Bunk?*

Note—My forecasts are always devised with these precautionary adages in mind:

- *The only thing we know with certainty about any forecast is that it will be wrong.—Anonymous*
- *He who foretells the future lies, even if he tells the truth.—Arab Proverb*

SHIPMENTS AND NEW FORECASTS, 2020-2050 SUMMARIES

	2020	2025	2030	2035	2040	2045	2050
Vendor Enterprise SSD Compressed Shipment Estimates (EB)	131	359	1,180	3,331	5,984	8,386	11,442
Estimated SSD User Revenue ($M)	$24,902	$44,551	$56,193	$67,540	$82,136	$97,587	$114,849
Estimated SSD User Initial Integrated Compressed Average Acquisition Cost/TB ($)	$190.56	$124.17	$47.64	$20.28	$13.73	$11.64	$10.04
Vendor Enterprise HDD Uncompressed Shipment Estimates (EB)	680	1,366	3,665	3,088	896	390	72
Estimated HDD User Revenue ($M)	$15,289	$22,775	$41,165	$30,516	$7,971	$3,201	$566
Estimated HDD User Initial Integrated Uncompressed Average Acquisition Cost/TB ($)	$24.99	$16.67	$11.23	$9.88	$8.90	$8.21	$7.86
Enterprise Tape Compressed Shipment Estimates (EB)	136	299	821	1,995	1,453	690	108
Estimated Tape User Revenue ($M)	$1,048	$1,360	$1,946	$1,683	$451	$159	$5
Estimated Tape User Initial Integrated Compressed Average Acquisition Cost/TB ($)	$7.71	$4.55	$2.37	$0.84	$0.31	$0.23	$0.05
Vendor Enterprise Emerging Shipment Estimates (EB)			489	2,742	12,387	26,396	45,689
Estimated Emerging User Revenue ($M)			$2,401	$6,855	$16,970	$22,437	$31,982
Estimated Emerging User Initial Integrated Average Acquisition Cost/TB ($)			$4.91	$2.50	$1.37	$0.85	$0.70
Total Compressed Enterprise Shipment Estimates (EB)	**947**	**2,024**	**6,155**	**11,156**	**20,720**	**35,862**	**57,311**
SSD % of Total Shipments	13.8	17.7	19.2	29.9	28.9	23.4	20.0
HDD % of Total Shipments	71.8	67.5	59.5	27.7	4.3	1.1	0.1
Tape + Emerging (Active Archive) % of Total Shipments	14.4	14.8	21.3	42.5	66.8	75.5	79.9
Total Compressed Enterprise Active Installed Base Estimates (EB)	**3,032**	**7,770**	**20,219**	**46,705**	**80,907**	**147,886**	**243,469**
Total Enterprise User Revenue Estimates ($M)	**$41,240**	**$68,686**	**$101,706**	**$106,594**	**$107,528**	**$123,384**	**$147,402**
Total Estimated User Initial Integrated Compressed Average Acquisition Cost/TB ($)	**$43.57**	**$33.94**	**$16.52**	**$9.55**	**$5.19**	**$3.44**	**$2.57**
SSD % of Total Spend	60.4	64.9	55.3	63.4	76.4	79.1	77.9
HDD % of Total Spend	37.1	33.2	40.5	28.6	7.4	2.6	0.4
Tape + Emerging (Active Archive) % of Total Spend	2.5	2.0	4.3	8.0	16.2	18.3	21.7

Alternate 2030-2050 Shipment Scenario at 25% Annual Expansion, Mimicing the 2025-2030 Forecast CAGR (EB)	**18,783**	**57,322**	**174,933**	**533,852**
EB Delta to Current Forecast	*7,627*	*36,602*	*139,071*	*476,541*
Alternate 2030-2050 User Revenue Scenario ($M)	**$179,468**	**$297,472**	**$601,866**	**$1,373,055**
$ Delta to Current Forecast	*$72,874*	*$189,943*	*$478,482*	*$1,225,653*
Alternate 2030-2050 Active Installed Base Scenario at 25% Annual Expansion, Mimicing the 2025-2030 Forecast CAGR (EB)	**63,142**	**192,694**	**588,054**	**1,794,599**
EB Delta to Current Forecast	*16,437*	*111,787*	*440,168*	*1,551,130*

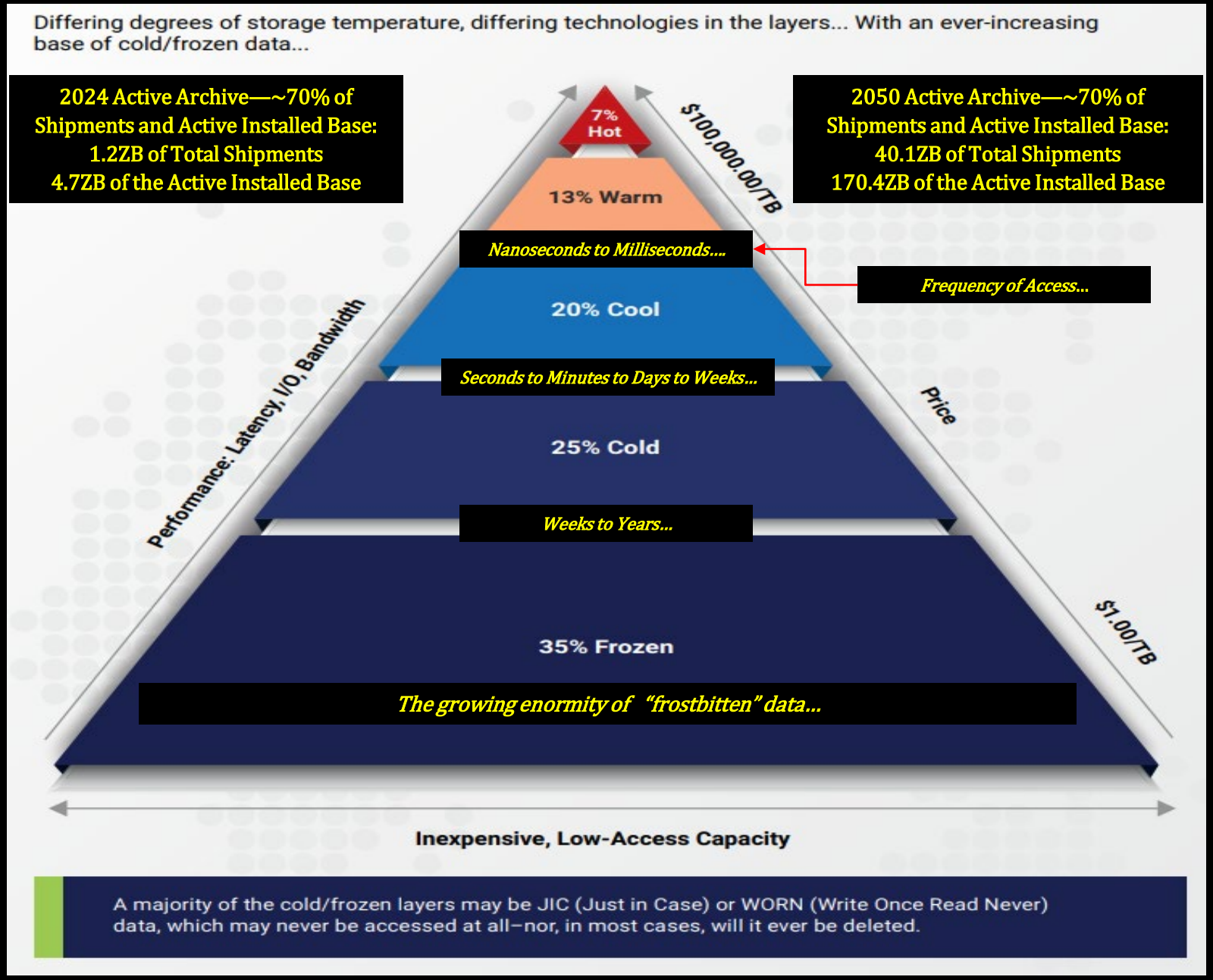
Source: Furthur Market Research and Brad Johns Consulting (July, 2025)

- There are colossal differences of opinion regarding the ability and the willingness of the SSD and HDD makers to invest adequately to build to a feasible—but unlikely, and possibly profitless—storage demand of staggering dimensions.

UNIMAGINABLE IMMENSITY…

- How much of these surging data oceans can our infrastructures manage? >100ZB? >250ZB? >500ZB?
- GenAI will help to drive ~25% annual shipment growth 2025-2030 (up from ~16.4% 2020-2025), but from 2031 onward, due to manufacturing and cost constraints, energy compliance regulations, and sustainability concerns, *GenAI will of necessity be increasingly utilized to enhance storage efficiencies.*
- After 2030, the >25% historic 2001-2020 growth rates cannot be feasibly sustained…
- But one thing is certain: the billions of people and systems and sensors connected in the global dataverse will continue to generate vast quantities of data…

THE EVOLVING STORAGE PYRAMID…



Source: Further Market Research, March, 2025

2024 Percentages of Enterprise Exabytes Delivered:

SSDs—18.2% (2020:13.8%)
HDDs—65.7% (2020: 71.8%)
Tape—16.1% (2020: 14.4%)

In 2024, tape serviced only ~21% of the data destined to become, within 60 days, an active archive…

Σ *Blindingly blatant "fact": Huge numbers of HDDs and a significant number of SSDs are managing and 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.*

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Source: Further Market Research, March, 2025

THE EVOLVING STORAGE PYRAMID…

2025-2040 (both-and-and-and, SSD-HDD-Tape-Emerging scenario): complicated integrations of diverse enterprise technologies used in concert and conjunction with each other.

2040-2050 (either-or , SSD-Emerging scenario): With the advent of more strictly enforced corporate archive and access rules, and the growing need to conduct GenAI business at the speed of flash, in most data centers ~30% of the data will be classified as hot, while the warm and cool and cold data layers diminish to insignificance, and the active-archive data layer grows to ~70% of the total—there will be no fine distinctions, either the data is hot, or it's not.

INCONCLUSIVE CONCLUSIONS: PERFORMANCE, POWER, COSTS

- 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.
  "Even with GenAI, you don't need to plow a field with a Ferrari"—in most cases, oxen will suffice.
- The costs of managing our multi-zettabyte-fold dataverse over increasingly lengthy time periods will continue to swell, and the power demands of enterprise storage—accelerated and exacerbated by GenAI server farms—will continue to increase as a percentage of the overall data center energy budget.
- 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.

Storage now accounts for 33% of operational and 61% of embodied emissions in Microsoft Azure DCs…
Hyperscalers are now investing in their own small nuclear power plants…

INCONCLUSIVE CONCLUSIONS: CONVERGENCE OF THE FISCAL AND THE ECOLOGICAL…

- New enterprise data infrastructures must not only cost less but must also consume less power to be in crucial and resilient alignment with the total availability of energy.
- 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.
- In the active-archive enterprise data layers, the most cost-effective and power-efficient technologies will inevitably prevail, because they make the greatest fiscal ***and*** ecological sense.

In the end, the CFOs will always have the final say…

APPENDICES

ENTERPRISE DATA DEFINITIONS

AI INTERVIEW RESULTS

GRANULAR 2020-2050 FORECAST DETAILS

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.

The following notes are relevant to all actual shipment and forecast tables:

—SSD capacities reflect an approximate 5x compression ratio, but only for approximately 5% of all enterprise SSD EBs shipped, the vast majority of which (~95%) 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 capacities are raw/uncompressed, since so few enterprise HDDs utilize any form of data compression.
—Tape capacities include both LTO and IBM TS1100 shipments and reflect a global average of 2.5x data compression.
—Enterprise optical shipments remain minimal at <1,000PB/year—less than half of 1% of the 2023 total—and have not been included in our estimates of historical shipments or the current active installed base. That said, there should be huge opportunities for what we are now referring to collectively as "enterprise emerging storage" technologies to play major roles in future markets, as indicated in our 2025-2050 growth estimates. The "Total 'Active-Archive' Storage Opportunity" is the sum of all LTO+IBM+enterprise emerging technology shipments. Examples of enterprise emerging storage technologies include, in alphabetical order: Cerabyte's ceramic nanolayers, DNA data storage, Group47's DOTS (Digital Optical Technology System), and Microsoft's silica.
—We estimate the active installed base of enterprise data was 94.6 exabytes in 2006 and will likely grow to exceed 200 zettabytes in 2050. For the active installed base, we assume a 5-year 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.
—CAGR stands for "Compound Annual Growth Rate." It is the measure of annual growth rate over time, with the effect of compounding taken into account, often used to measure the past performance of markets and to project their future rates of growth.

AI INTERVIEW RESULTS

Vertical Market	Database Size; Primary Application; Number of Users Serviced	Historical Annual Growth Rate Prior to Any AI Deployments	Current Uses of AI	Future Plans for AI Deployments	Potential Annual Growth Rate and Database Size Subsequent to AI Deployments
Scientific Modeling	~1,000PB; constantly changing experimental data; ~100 "active" users at any given time, ~10 heavy users	~20%	Using ML "inferrals" can—no matter how bad or flawed the statistics may be—reduce the numeric size of the models; "almost the right answer" can be an acceptable result	Creating tools that teach our scientists to do their jobs better and faster, with greater degrees of accuracy; using new GenAI simulations capable of producing "synthetic output" —unlike the older simulations wherein we can discard everything except the "checkpoints," with synthetically created modeling data we need to keep everything, every single bit of, say, temperature, inertia, and pressure "readings" over time	The uses of new kinds of "synthetic output" can be "truly scary," generating untenably huge dimensions of compute+storage, necessitating the creation of complex histograms to render sparse, irregular data "tiny" without discarding anything, "quantifying uncertainty" and "making the intractable tractable"
Government Public Records	~176PB; storage and maintenance of governmental records and other "cultural artifacts" (text, image, video); over 150 million unique users	~10%	Nascent; many GenAI "experiments" underway to improve our processes and procedures, but there are many moving parts and we've achieved only 0.5%-5% of what GenAI will eventually contribute to enhancing our internal efficiencies	GenAI helping with cost reductions; expediting input categorization and cataloging processes; examining and "transforming" (i.e. digitizing) older data—we have >175 million "items" in our collections but only ~60 million items available in the current online digital catalog	We are not a major content creator but a content preserver; if rulings deem that GenAI-generated works of art qualify for rights protections, then the number of our content submissions will explode
Media/Entertainment 1	~150PB; real-time video feeds from multiple sources; tens of millions of viewers	~10%	"Store everything" video content collections began in 2009; in 2012, budgetary edicts required diversely deployed proprietary ML metadata and "archive rules" to restrain the "runaway freight train" of archived data to ~10% annual growth; prior to any financial restraints, content records (and storage costs) were growing at 30%-40% per year	Using past deliverables to generate new deliverables; extracting the potential of monetizing aspects of "seemingly dead data" in the archive; creating new value out of old, "scratchy," low-resolution video with GenAI enhancements	Cannot sustain much more than 10% annual growth, but GenAI-automated metadata creation and new abilities to monetize historic video may drive annual growth toward 15% (if the CFO's budgets will allow it)

Source: Furthur Market Research and Brad Johns Consulting (August 2024)

AI INTERVIEW RESULTS

Vertical Market	Database Size; Primary Application; Number of Users Serviced	Historical Annual Growth Rate Prior to Any AI Deployments	Current Uses of AI	Future Plans for AI Deployments	Potential Annual Growth Rate and Database Size Subsequent to AI Deployments
Media/Entertainment 2	~150PB; we manage a "long-term archive" containing tens of thousands of cableTV and Web broadcasts as well as thousands of Hollywood movies; tens of millions of viewers	Unspecified, but "rapidly" expanding	Prevent the storage of unneeded production video that has nothing to do with the actual script/ content; after the advent of cheap digital footage vs film, the cameras are often simply left on all day, recording vast amounts "dead-space" video data	In general: GenAI will increase the production of new metadata and net new content and enrich all marketing materials Specifically: advanced GenAI deduplication schemes can greatly reduce the size of certain large video files by eliminating redundancies which were previously undetectable	Balancing all accelerators and inhibitors, we believe net new data growth rates will be 1%-5% above current rates
Large Video Surveillance Customers (with 2,000 or more cameras operating 24/7: casinos, airports, hospitals, amusement parks, shopping malls, universities, corporate campuses, prisons; there are tens of thousands of these installations in the US alone...)	2,000 cameras operating at 1080P generate ~5.6PB of surveillance data every 30 days, but because of high HDD storage costs, almost all of it is deleted after 30 days to make room for another 5.6PB of fresh data; dozens of operators/analysts at every site	Growing at variable rates in accord with each site's evolving needs for more cameras operating at higher resolution	ML solutions in use for years have the capability to identify events or people in this camera view at this particular point in time, but—in most cases—only for the last 30 days, since most surveillance data is discarded after 30 days	New GenAI video analysis tools can now generate new kinds of monetizable "business intelligence" out of "seemingly dead data," enabling lucrative new revenue opportunities; examples include refined shelf placement of certain products to increase customer interactions, and reductions in legal expenses spent battling frivolous lawsuits	To exploit chances for new kinds of revenue and cost savings we will need one year's worth of data, which will increase average database size by a factor of 12x, from ~5.6PB to 67.2PB; the CFOs must recognize the potential value and fund this database expansion; using only HDDs will be prohibitively expensive

Source: Furthur Market Research and Brad Johns Consulting (August 2024)

SHIPMENTS 2020-2024 AND NEW FORECASTS 2025-2030, GRANULAR DETAILS

	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	299	22.4	395	501	575	752	983	26.9
YoY Change %	*64.0*	*36.9*	*16.0*	*(30.5)*	*108.7*	*19.2*		*32.1*	*26.8*	*14.8*	*30.8*	*30.7*	
Vendor Enterprise Uncompressed SSD Direct Revenue Estimates ($M)	$16,601	$20,353	$20,741	$8,173	$26,891	$29,701	12.3	$34,108	$34,557	$26,909	$31,671	$37,462	4.8
YoY Change %	*76.2*	*22.6*	*1.9*	*(60.6)*	*229.0*	*10.4*		*14.8*	*1.3*	*(22.1)*	*17.7*	*18.3*	
Vendor Uncompressed Enterprise SSD Blended ASP/TB ($)	$152.45	$136.51	$119.96	$68.00	$107.22	$99.33	(8.2)	$86.35	$68.98	$46.80	$42.12	$38.11	(17.4)
YoY Change %	*7.4*	*(10.5)*	*(12.1)*	*(43.3)*	*57.7*	*(7.4)*		*(13.1)*	*(20.1)*	*(32.2)*	*(10.0)*	*(9.5)*	
Vendor Enterprise SSD Compressed Shipment Estimates (EB)	131	179	207	144	301	359	% Changes	474	601	690	902	1,180	% Changes
Estimated SSD User Revenue, 50% Markup Over Vendor Revenue ($M)	$24,902	$30,529	$31,112	$12,260	$40,337	$44,551	Same As	$51,161	$51,835	$40,364	$47,507	$56,193	Same As
Estimated SSD User Initial Integrated Compressed Average Acquisition Cost/TB ($)	$190.56	$170.63	$149.95	$85.00	$134.03	$124.17	Uncompressed	$107.94	$86.22	$58.50	$52.65	$47.64	Uncompressed
HDD													
Vendor Enterprise HDD Uncompressed Shipment Estimates (EB)	680	959	942	1,039	1,085	1,366	15.0	1,629	1,912	2,407	3,088	3,665	21.8
YoY Change %	*38.9*	*41.0*	*(1.8)*	*10.3*	*4.4*	*26.0*		*19.2*	*17.4*	*25.9*	*28.3*	*18.7*	
Vendor Enterprise Uncompressed HDD Direct Revenue Estimates ($M)	$11,326	$13,035	$12,887	$13,755	$14,077	$16,870	% Changes	$18,925	$20,803	$24,022	$27,638	$30,493	% Changes
Vendor Uncompressed Enterprise HDD Blended ASP/TB ($)	$16.66	$13.59	$13.68	$13.24	$12.98	$12.35	Same As User	$11.62	$10.88	$9.98	$8.95	$8.32	Same As User
Estimated HDD User Revenue, 35% Markup Over Vendor Revenue ($M)	$15,289	$17,597	$17,397	$18,569	$19,004	$22,775	8.3	$25,549	$28,083	$32,430	$37,311	$41,165	12.6
YoY Change %	*5.5*	*15.1*	*(1.1)*	*6.7*	*2.3*	*19.8*		*12.2*	*9.9*	*15.5*	*15.1*	*10.3*	
Estimated HDD User Initial Integrated Uncompressed Average Acquisition Cost/EB ($)	$24.99	$18.35	$18.47	$17.87	$17.52	$16.67	(7.8)	$15.69	$14.69	$13.47	$12.08	$11.23	(7.6)
YoY Change %	*(15.6)*	*(26.6)*	*0.6*	*(3.2)*	*(2.0)*	*(4.9)*		*(5.9)*	*(6.4)*	*(8.3)*	*(10.3)*	*(7.0)*	
TAPE													
Enterprise Tape Compressed Shipment Estimates (EB)	136	190	207	228	265	299	17.1	350	435	501	639	821	22.4
YoY Change %	*1.5*	*39.7*	*8.9*	*10.1*	*16.2*	*12.8*		*17.1*	*24.3*	*15.2*	*27.5*	*28.5*	
Enterprise Tape User Revenue Estimates ($M)	$1,048	$1,172	$1,068	$1,132	$1,296	$1,360	5.3	$1,442	$1,650	$1,665	$1,672	$1,946	7.4
YoY Change %	*(1.7)*	*11.8*	*(8.8)*	*6.0*	*14.4*	*4.9*		*6.0*	*14.5*	*0.9*	*0.5*	*16.4*	
Estimated Tape User Initial Integrated Compressed Average Acquisition Cost/TB ($)	$7.71	$6.17	$5.16	$4.97	$4.89	$4.55	(10.0)	$4.12	$3.79	$3.32	$2.62	$2.37	(12.2)
YoY Change %	*(3.1)*	*(20.0)*	*(16.3)*	*(3.8)*	*(1.5)*	*(7.0)*		*(9.4)*	*(7.9)*	*(12.4)*	*(21.2)*	*(9.5)*	
EMERGING													
Vendor Enterprise Emerging Shipment Estimates (EB)								1	17	121	296	489	>1000
YoY Change %								-	*1,600.0*	*611.8*	*144.6*	*65.2*	
Vendor Enterprise Emerging Revenue Estimates ($M)								$11	$134	$788	$1,669	$2,401	>1000
YoY Change %								-	*1,092.3*	*487.3*	*111.9*	*43.8*	
Estimated Enterprise Emerging User Initial Integrated Average Acquisition Cost/TB ($)								$11.25	$7.89	$6.51	$5.64	$4.91	(18.7)
YoY Change %								-	*(29.9)*	*(17.5)*	*(13.4)*	*(12.9)*	
TOTAL ACTIVE ARCHIVE													
Active-Archive Storage, Vendor Tape+Emerging Shipment Estimates (EB)	136	190	207	228	265	299	17.1	351	452	622	935	1,310	34.4
YoY Change %	*1.5*	*39.7*	*8.9*	*10.1*	*16.2*	*12.8*		*17.4*	*28.8*	*37.6*	*50.3*	*40.1*	
Active-Archive Storage, Tape+Emerging Revenue Opportunity ($M)	$1,048	$1,172	$1,068	$1,132	$1,296	$1,360	5.3	$1,453	$1,784	$2,452	$3,342	$4,347	26.2
YoY Change %	*(1.7)*	*11.8*	*(8.8)*	*6.0*	*14.4*	*4.9*		*6.8*	*22.8*	*37.4*	*36.3*	*30.1*	
Total Compressed Enterprise EB Shipped	**947**	**1,328**	**1,356**	**1,411**	**1,650**	**2,024**	16.4	**2,454**	**2,965**	**3,719**	**4,925**	**6,155**	24.9
YoY Change %	*34.6*	*40.3*	*2.2*	*4.0*	*17.0*	*22.6*		*21.2*	*20.8*	*25.4*	*32.4*	*25.0*	
Compressed SSD % of Total EB Shipped	*13.8*	*13.5*	*15.3*	*10.2*	*18.2*	*17.7*		*19.3*	*20.3*	*18.6*	*18.3*	*19.2*	
Uncompressed HDD % of Total EB Shipped	*71.8*	*72.2*	*69.4*	*73.6*	*65.7*	*67.5*		*66.4*	*64.5*	*64.7*	*62.7*	*59.5*	
Compressed Active Archive % of Total EB Shipped	*14.4*	*14.3*	*15.3*	*16.2*	*16.1*	*14.8*		*14.3*	*15.2*	*16.7*	*19.0*	*21.3*	
Total Compressed Active Installed Base of Enterprise EB	**3,032**	**3,997**	**4,916**	**5,746**	**6,693**	**7,770**	20.7	**8,896**	**10,505**	**12,813**	**16,088**	**20,219**	21.1
YoY Change %	-	*31.8*	*23.0*	*16.9*	*16.5*	*16.1*		*14.5*	*18.1*	*22.0*	*25.6*	*25.7*	
Total End-User Enterprise Storage Spend	**$41,240**	**$49,299**	**$49,577**	**$31,962**	**$60,636**	**$68,686**	10.7	**$78,164**	**$81,703**	**$75,245**	**$88,160**	**$101,706**	8.2
YoY Change %	*38.9*	*19.5*	*0.6*	*(35.5)*	*89.7*	*13.3*		*13.8*	*4.5*	*(7.9)*	*17.2*	*15.4*	
SSD % of Total Spend	*60.4*	*61.9*	*62.8*	*38.4*	*66.5*	*64.9*		*65.5*	*63.4*	*53.6*	*53.9*	*55.3*	
HDD % of Total Spend	*37.1*	*35.7*	*35.1*	*58.1*	*31.3*	*33.2*		*32.7*	*34.4*	*43.1*	*42.3*	*40.5*	
Active Archive % of Total Spend	*2.5*	*2.4*	*2.2*	*3.5*	*2.1*	*2.0*		*1.9*	*2.2*	*3.3*	*3.8*	*4.3*	
Vendor ASP Ratios													
SSD:HDD Vendor ASP/TB	9.2	10.0	8.8	5.1	8.3	8.0		7.4	6.3	4.7	4.7	4.6	
User Acquisition Cost Ratios													
SSD:Tape User Cost/TB	24.7	27.7	29.1	17.1	27.4	27.3		26.2	22.7	17.6	20.1	20.1	
HDD:Tape User Cost/TB	3.2	3.0	3.6	3.6	3.6	3.7		3.8	3.9	4.1	4.6	4.7	
SSD:Emerging User Cost/TB								9.6	10.9	9.0	9.3	9.7	
HDD:Emerging User Cost/TB								1.4	1.9	2.1	2.1	2.3	
Tape:Emerging User Cost/TB								0.4	0.5	0.5	0.5	0.5	

Source: Furthur Market Research and Brad Johns Consulting (July 2025)

NEW FORECASTS, 2030-2040 GRANULAR DETAILS

	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)	983	1,233	1,509	1,784	2,372	2,776	23.1	3,310	3,691	3,894	4,399	4,987	12.4
YoY Change %	*30.7*	*25.4*	*22.4*	*18.2*	*33.0*	*17.0*		*19.2*	*11.5*	*5.5*	*13.0*	*13.4*	
Vendor Enterprise Uncompressed SSD Direct Revenue Estimates ($M)	$37,462	$40,923	$44,712	$36,661	$42,672	$45,027	3.7	$49,451	$52,486	$44,197	$48,785	$54,757	4.0
YoY Change %	*18.3*	*9.2*	*9.3*	*(18.0)*	*16.4*	*5.5*		*9.8*	*6.1*	*(15.8)*	*10.4*	*12.2*	
Vendor Uncompressed Enterprise SSD Blended ASP/TB ($)	$38.11	$33.19	$29.63	$20.55	$17.99	$16.22	(15.7)	$14.94	$14.22	$11.35	$11.09	$10.98	(7.5)
YoY Change %	*(9.5)*	*(12.9)*	*(10.7)*	*(30.6)*	*(12.5)*	*(9.8)*		*(7.9)*	*(4.8)*	*(20.2)*	*(2.3)*	*(1.0)*	
Vendor Enterprise SSD Compressed Shipment Estimates (EB)	1,180	1,480	1,811	2,141	2,846	3,331	% Changes	3,972	4,429	4,673	5,279	5,984	% Changes
Estimated SSD User Revenue, 50% Markup Over Vendor Revenue ($M)	$56,193	$61,385	$67,068	$54,992	$64,008	$67,540	Same As	$74,177	$78,729	$66,295	$73,177	$82,136	Same As
Estimated SSD User Initial Integrated Compressed Average Acquisition Cost/TB ($)	$47.64	$41.49	$37.04	$25.69	$22.49	$20.28	Uncompressed	$18.68	$17.78	$14.19	$13.86	$13.73	Uncompressed
HDD													
Vendor Enterprise HDD Uncompressed Shipment Estimates (EB)	3,665	4,318	4,833	4,277	3,560	3,088	(3.4)	2,555	1,980	1,545	1,119	896	(21.9)
YoY Change %	*18.7*	*17.8*	*11.9*	*(11.5)*	*(16.8)*	*(13.3)*		*(17.3)*	*(22.5)*	*(22.0)*	*(27.6)*	*(19.9)*	
Vendor Enterprise Uncompressed HDD Direct Revenue Estimates ($M)	$30,493	$35,105	$38,422	$33,104	$26,736	$22,604	% Changes	$18,268	$13,880	$10,630	$7,576	$5,905	% Changes
Vendor Uncompressed Enterprise HDD Blended ASP/TB ($)	$8.32	$8.13	$7.95	$7.74	$7.51	$7.32	Same As User	$7.15	$7.01	$6.88	$6.77	$6.59	Same As User
Estimated HDD User Revenue, 35% Markup Over Vendor Revenue ($M)	$41,165	$47,392	$51,870	$44,690	$36,093	$30,516	(5.8)	$24,662	$18,738	$14,350	$10,227	$7,971	(23.5)
YoY Change %	*10.3*	*15.1*	*9.4*	*(13.8)*	*(19.2)*	*(15.5)*		*(19.2)*	*(24.0)*	*(23.4)*	*(28.7)*	*(22.1)*	
Estimated HDD User Initial Integrated Uncompressed Average Acquisition Cost/EB ($)	$11.23	$10.98	$10.73	$10.45	$10.14	$9.88	(2.5)	$9.65	$9.46	$9.29	$9.14	$8.90	(2.1)
YoY Change %	*(7.0)*	*(2.3)*	*(2.2)*	*(2.6)*	*(3.0)*	*(2.5)*		*(2.3)*	*(2.0)*	*(1.9)*	*(1.6)*	*(2.7)*	
TAPE													
Enterprise Tape Compressed Shipment Estimates (EB)	821	1,030	1,267	1,525	1,807	1,995	19.4	1,939	1,890	1,599	1,510	1,453	(6.1)
YoY Change %	*28.5*	*25.4*	*23.0*	*20.4*	*18.5*	*10.4*		*(2.8)*	*(2.5)*	*(15.4)*	*(5.6)*	*(3.8)*	
Enterprise Tape User Revenue Estimates ($M)	$1,946	$2,001	$2,018	$2,037	$1,918	$1,683	(2.9)	$1,315	$1,053	$708	$561	$451	(23.2)
YoY Change %	*16.4*	*2.8*	*0.8*	*0.9*	*(5.8)*	*(12.3)*		*(21.9)*	*(20.0)*	*(32.7)*	*(20.8)*	*(19.6)*	
Estimated Tape User Initial Integrated Compressed Average Acquisition Cost/TB ($)	$2.37	$1.94	$1.59	$1.34	$1.06	$0.84	(18.7)	$0.68	$0.56	$0.44	$0.37	$0.31	(18.1)
YoY Change %	*(9.5)*	*(18.0)*	*(18.0)*	*(16.1)*	*(20.5)*	*(20.5)*		*(19.6)*	*(17.9)*	*(20.5)*	*(16.2)*	*(16.4)*	
EMERGING													
Vendor Enterprise Emerging Shipment Estimates (EB)	489	654	851	1,293	1,856	2,742	41.2	3,942	5,806	8,081	9,867	12,387	35.2
YoY Change %	*65.2*	*33.7*	*30.1*	*51.9*	*43.5*	*47.7*		*43.8*	*47.3*	*39.2*	*22.1*	*25.5*	
Vendor Enterprise Emerging Revenue Estimates ($M)	$2,401	$2,780	$3,191	$4,267	$5,197	$6,855	23.3	$8,672	$11,322	$13,980	$15,294	$16,970	19.9
YoY Change %	*43.8*	*15.8*	*14.8*	*33.7*	*21.8*	*31.9*		*26.5*	*30.5*	*23.5*	*9.4*	*11.0*	
Estimated Enterprise Emerging User Initial Integrated Average Acquisition Cost/TB ($)	$4.91	$4.25	$3.75	$3.30	$2.80	$2.50	(12.6)	$2.20	$1.95	$1.73	$1.55	$1.37	(11.3)
YoY Change %	*(12.9)*	*(13.4)*	*(11.8)*	*(12.0)*	*(15.2)*	*(10.7)*		*(12.0)*	*(11.4)*	*(11.3)*	*(10.4)*	*(11.6)*	
TOTAL ACTIVE ARCHIVE													
Active-Archive Storage, Vendor Tape+Emerging Shipment Estimates (EB)	1,310	1,684	2,118	2,818	3,663	4,737	29.3	5,881	7,696	9,680	11,377	13,840	23.9
YoY Change %	*40.1*	*28.5*	*25.8*	*33.1*	*30.0*	*29.3*		*24.2*	*30.9*	*25.8*	*17.5*	*21.6*	
Active-Archive Storage, Tape+Emerging Revenue Opportunity ($M)	$4,347	$4,781	$5,209	$6,304	$7,115	$8,538	14.5	$9,987	$12,374	$14,688	$15,854	$17,421	15.3
YoY Change %	*30.1*	*10.0*	*9.0*	*21.0*	*12.9*	*20.0*		*17.0*	*23.9*	*18.7*	*7.9*	*9.9*	
Total Compressed Enterprise EB Shipped	**6,155**	**7,482**	**8,762**	**9,236**	**10,069**	**11,156**	12.6	**12,408**	**14,105**	**15,898**	**17,775**	**20,720**	13.2
YoY Change %	*25.0*	*21.6*	*17.1*	*5.4*	*9.0*	*10.8*		*11.2*	*13.7*	*12.7*	*11.8*	*16.6*	
Compressed SSD % of Total EB Shipped	*19.2*	*19.8*	*20.7*	*23.2*	*28.3*	*29.9*		*32.0*	*31.4*	*29.4*	*29.7*	*28.9*	
Uncompressed HDD % of Total EB Shipped	*59.5*	*57.7*	*55.2*	*46.3*	*35.4*	*27.7*		*20.6*	*14.0*	*9.7*	*6.3*	*4.3*	
Compressed Active Archive % of Total EB Shipped	*21.3*	*22.5*	*24.2*	*30.5*	*36.4*	*42.5*		*47.4*	*54.6*	*60.9*	*64.0*	*66.8*	
Total Compressed Active Installed Base of Enterprise EB	**20,219**	**25,247**	**31,043**	**36,560**	**41,704**	**46,705**	18.2	**51,632**	**56,975**	**63,637**	**71,342**	**80,907**	11.6
YoY Change %	*25.7*	*24.9*	*23.0*	*17.8*	*14.1*	*12.0*		*10.5*	*10.3*	*11.7*	*12.1*	*13.4*	
Total End-User Enterprise Storage Spend	**$101,706**	**$113,558**	**$124,147**	**$105,986**	**$107,217**	**$106,594**	0.9	**$108,827**	**$109,841**	**$95,334**	**$99,259**	**$107,528**	0.2
YoY Change %	*15.4*	*11.7*	*9.3*	*(14.6)*	*1.2*	*(0.6)*		*2.1*	*0.9*	*(13.2)*	*4.1*	*8.3*	
SSD % of Total Spend	*55.3*	*54.1*	*54.0*	*51.9*	*59.7*	*63.4*		*68.2*	*71.7*	*69.5*	*73.7*	*76.4*	
HDD % of Total Spend	*40.5*	*41.7*	*41.8*	*42.2*	*33.7*	*28.6*		*22.7*	*17.1*	*15.1*	*10.3*	*7.4*	
Active Archive % of Total Spend	*4.3*	*4.2*	*4.2*	*5.9*	*6.6*	*8.0*		*9.2*	*11.3*	*15.4*	*16.0*	*16.2*	
Vendor ASP Ratios													
SSD:HDD Vendor ASP/TB	4.6	4.1	3.7	2.7	2.4	2.2		2.1	2.0	1.6	1.6	1.7	
User Acquisition Cost Ratios													
SSD:Tape User Cost/TB	20.1	21.4	23.3	19.2	21.2	24.0		27.5	31.9	32.0	37.3	44.2	
HDD:Tape User Cost/TB	4.7	5.6	6.7	7.8	9.6	11.7		14.2	17.0	21.0	24.6	28.7	
SSD:Emerging User Cost/TB	9.7	9.8	9.9	7.8	8.0	8.1		8.5	9.1	8.2	8.9	10.0	
HDD:Emerging User Cost/TB	2.3	2.6	2.9	3.2	3.6	4.0		4.4	4.9	5.4	5.9	6.5	
Tape:Emerging User Cost/TB	0.5	0.5	0.4	0.4	0.4	0.3		0.3	0.3	0.3	0.2	0.2	
Alternate 2030-2040 Shipment Scenario at 25% Annual Expansion (EB)		**7,694**	**9,617**	**12,021**	**15,027**	**18,783**		**23,479**	**29,349**	**36,686**	**45,858**	**57,322**	
EB Delta to Current Forecast		*212*	*855*	*2,785*	*4,957*	*7,627*		*11,071*	*15,244*	*20,788*	*28,083*	*36,602*	
Alternate 2030-2040 Active Installed Base Scenario at 25% Annual Expansion (EB)		**25,459**	**32,110**	**40,413**	**50,514**	**63,142**		**78,928**	**98,660**	**123,324**	**154,155**	**192,694**	
EB Delta to Current Forecast		*212*	*1,067*	*3,853*	*8,810*	*16,437*		*27,296*	*41,684*	*59,687*	*82,813*	*111,787*	

Source: Furthur Market Research and Brad Johns Consulting (July 2025)

NEW FORECASTS, 2040-2050 GRANULAR DETAILS

	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)	4,987	5,659	6,092	5,689	6,381	6,988	7.0	7,644	7,989	7,865	8,873	9,535	6.4
YoY Change %	*13.4*	*13.5*	*7.7*	*(6.6)*	*12.2*	*9.5*		*9.4*	*4.5*	*(1.6)*	*12.8*	*7.5*	
Vendor Enterprise Uncompressed SSD Direct Revenue Estimates ($M)	$54,757	$60,099	$64,271	$55,126	$63,044	$65,058	3.5	$67,267	$69,424	$66,853	$72,315	$76,566	3.3
YoY Change %	*12.2*	*9.8*	*6.9*	*(14.2)*	*14.4*	*3.2*		*3.4*	*3.2*	*(3.7)*	*8.2*	*5.9*	
Vendor Uncompressed Enterprise SSD Blended ASP/TB ($)	$10.98	$10.62	$10.55	$9.69	$9.88	$9.31	(3.2)	$8.80	$8.69	$8.50	$8.15	$8.03	(2.9)
YoY Change %	*(1.0)*	*(3.3)*	*(0.7)*	*(8.2)*	*2.0*	*(5.8)*		*(5.5)*	*(1.3)*	*(2.2)*	*(4.1)*	*(1.5)*	
Vendor Enterprise SSD Compressed Shipment Estimates (EB)	5,984	6,791	7,310	6,827	7,657	8,386	% Changes	9,173	9,587	9,438	10,648	11,442	% Changes
Estimated SSD User Revenue, 50% Markup Over Vendor Revenue ($M)	$82,136	$90,148	$96,406	$82,690	$94,566	$97,587	Same As	$100,901	$104,137	$100,279	$108,472	$114,849	Same As
Estimated SSD User Initial Integrated Compressed Average Acquisition Cost/TB ($)	$13.73	$13.28	$13.19	$12.11	$12.35	$11.64	Uncompressed	$11.00	$10.86	$10.63	$10.19	$10.04	Uncompressed
HDD													
Vendor Enterprise HDD Uncompressed Shipment Estimates (EB)	896	788	721	535	454	390	(15.3)	350	276	215	150	72	(28.7)
YoY Change %	*(19.9)*	*(12.1)*	*(8.5)*	*(25.8)*	*(15.1)*	*(14.1)*		*(10.3)*	*(21.1)*	*(22.1)*	*(30.2)*	*(52.0)*	
Vendor Enterprise Uncompressed HDD Direct Revenue Estimates ($M)	$5,905	$5,059	$4,578	$3,365	$2,801	$2,371	% Changes	$2,111	$1,653	$1,275	$881	$419	% Changes
Vendor Uncompressed Enterprise HDD Blended ASP/TB ($)	$6.59	$6.42	$6.35	$6.29	$6.17	$6.08	Same As User	$6.03	$5.99	$5.93	$5.87	$5.82	Same As User
Estimated HDD User Revenue, 35% Markup Over Vendor Revenue ($M)	$7,971	$6,830	$6,181	$4,543	$3,782	$3,201	(16.7)	$2,849	$2,232	$1,721	$1,189	$566	(29.3)
YoY Change %	*(22.1)*	*(14.3)*	*(9.5)*	*(26.5)*	*(16.8)*	*(15.3)*		*(11.0)*	*(21.7)*	*(22.9)*	*(30.9)*	*(52.4)*	
Estimated HDD User Initial Integrated Uncompressed Average Acquisition Cost/EB ($)	$8.90	$8.67	$8.57	$8.49	$8.33	$8.21	(1.6)	$8.14	$8.09	$8.01	$7.92	$7.86	(0.9)
YoY Change %	*(2.7)*	*(2.6)*	*(1.1)*	*(0.9)*	*(1.9)*	*(1.5)*		*(0.8)*	*(0.7)*	*(1.0)*	*(1.0)*	*(0.9)*	
TAPE													
Enterprise Tape Compressed Shipment Estimates (EB)	1,453	1,299	1,085	904	782	690	(13.8)	491	345	293	199	108	(31.0)
YoY Change %	*(3.8)*	*(10.6)*	*(16.5)*	*(16.7)*	*(13.5)*	*(11.8)*		*(28.8)*	*(29.7)*	*(15.1)*	*(32.1)*	*(45.7)*	
Enterprise Tape User Revenue Estimates ($M)	$451	$396	$297	$197	$176	$159	(18.8)	$113	$17	$15	$10	$5	(49.1)
YoY Change %	*(19.6)*	*(12.2)*	*(25.0)*	*(33.7)*	*(10.7)*	*(9.7)*		*(28.9)*	*(84.7)*	*(15.1)*	*(32.1)*	*(45.7)*	
Estimated Tape User Initial Integrated Compressed Average Acquisition Cost/TB ($)	$0.31	$0.30	$0.27	$0.22	$0.22	$0.23	(5.8)	$0.23	$0.05	$0.05	$0.05	$0.05	(26.3)
YoY Change %	*(16.4)*	*(1.8)*	*(10.2)*	*(20.4)*	*3.3*	*2.3*		*(0.0)*	*(78.3)*	*0.0*	*0.0*	*0.0*	
EMERGING													
Vendor Enterprise Emerging Shipment Estimates (EB)	12,387	15,155	17,863	19,988	23,865	26,396	16.3	31,544	34,782	37,286	41,381	45,689	11.6
YoY Change %	*25.5*	*22.3*	*17.9*	*11.9*	*19.4*	*10.6*		*19.5*	*10.3*	*7.2*	*11.0*	*10.4*	
Vendor Enterprise Emerging Revenue Estimates ($M)	$16,970	$18,489	$19,649	$19,788	$21,001	$22,437	5.7	$24,604	$25,739	$26,846	$29,381	$31,982	7.3
YoY Change %	*11.0*	*9.0*	*6.3*	*0.7*	*6.1*	*6.8*		*9.7*	*4.6*	*4.3*	*9.4*	*8.9*	
Estimated Enterprise Emerging User Initial Integrated Average Acquisition Cost/TB ($)	$1.37	$1.22	$1.10	$0.99	$0.88	$0.85	(9.1)	$0.78	$0.74	$0.72	$0.71	$0.70	(3.8)
YoY Change %	*(11.6)*	*(10.9)*	*(9.8)*	*(10.0)*	*(11.1)*	*(3.4)*		*(8.2)*	*(5.1)*	*(2.7)*	*(1.4)*	*(1.4)*	
TOTAL ACTIVE ARCHIVE													
Active-Archive Storage, Vendor Tape+Emerging Shipment Estimates (EB)	13,840	16,454	18,948	20,892	24,647	27,086	14.4	32,035	35,127	37,579	41,580	45,797	11.1
YoY Change %	*21.6*	*18.9*	*15.2*	*10.3*	*18.0*	*9.9*		*18.3*	*9.7*	*7.0*	*10.6*	*10.1*	
Active-Archive Storage, Tape+Emerging Revenue Opportunity ($M)	$17,421	$18,885	$19,946	$19,985	$21,177	$22,595	5.3	$24,717	$25,756	$26,861	$29,390	$31,988	7.2
YoY Change %	*9.9*	*8.4*	*5.6*	*0.2*	*6.0*	*6.7*		*9.4*	*4.2*	*4.3*	*9.4*	*8.8*	
Total Compressed Enterprise EB Shipped	**20,720**	**24,033**	**26,979**	**28,254**	**32,758**	**35,862**	11.6	**41,558**	**44,990**	**47,232**	**52,378**	**57,311**	9.8
YoY Change %	*16.6*	*16.0*	*12.3*	*4.7*	*15.9*	*9.5*		*15.9*	*8.3*	*5.0*	*10.9*	*9.4*	
Compressed SSD % of Total EB Shipped	*28.9*	*28.3*	*27.1*	*24.2*	*23.4*	*23.4*		*22.1*	*21.3*	*20.0*	*20.3*	*20.0*	
Uncompressed HDD % of Total EB Shipped	*4.3*	*3.3*	*2.7*	*1.9*	*1.4*	*1.1*		*0.8*	*0.6*	*0.5*	*0.3*	*0.1*	
Compressed Active Archive % of Total EB Shipped	*66.8*	*68.5*	*70.2*	*73.9*	*75.2*	*75.5*		*77.1*	*78.1*	*79.6*	*79.4*	*79.9*	
Total Compressed Active Installed Base of Enterprise EB	**80,907**	**92,531**	**105,406**	**117,762**	**132,745**	**147,886**	12.8	**165,411**	**183,422**	**202,400**	**222,019**	**243,469**	10.5
YoY Change %	*13.4*	*14.4*	*13.9*	*11.7*	*12.7*	*11.4*		*11.9*	*10.9*	*10.3*	*9.7*	*9.7*	
Total End-User Enterprise Storage Spend	**$107,528**	**$115,862**	**$122,533**	**$107,218**	**$119,525**	**$123,384**	2.8	**$128,467**	**$132,124**	**$128,861**	**$139,052**	**$147,402**	3.6
YoY Change %	*8.3*	*7.8*	*5.8*	*(12.5)*	*11.5*	*3.2*		*4.1*	*2.8*	*(2.5)*	*7.9*	*6.0*	
SSD % of Total Spend	*76.4*	*77.8*	*78.7*	*77.1*	*79.1*	*79.1*		*78.5*	*78.8*	*77.8*	*78.0*	*77.9*	
HDD % of Total Spend	*7.4*	*5.9*	*5.0*	*4.2*	*3.2*	*2.6*		*2.2*	*1.7*	*1.3*	*0.9*	*0.4*	
Active Archive % of Total Spend	*16.2*	*16.3*	*16.3*	*18.6*	*17.7*	*18.3*		*19.2*	*19.5*	*20.8*	*21.1*	*21.7*	
Vendor ASP Ratios													
SSD:HDD Vendor ASP/TB	1.7	1.7	1.7	1.5	1.6	1.5		1.5	1.5	1.4	1.4	1.4	
User Acquisition Cost Ratios													
SSD:Tape User Cost/TB	44.2	43.6	48.2	55.6	54.9	50.6		47.8	217.3	212.5	203.8	200.8	
HDD:Tape User Cost/TB	28.7	28.4	31.3	39.0	37.0	35.7		35.4	161.7	160.1	158.5	157.1	
SSD:Emerging User Cost/TB	10.0	10.9	12.0	12.2	14.0	13.7		14.1	14.7	14.8	14.3	14.3	
HDD:Emerging User Cost/TB	6.5	7.1	7.8	8.6	9.5	9.7		10.4	10.9	11.1	11.2	11.2	
Tape:Emerging User Cost/TB	0.2	0.2	0.2	0.2	0.3	0.3		0.3	0.1	0.1	0.1	0.1	
Alternate 2030-2040 Shipment Scenario at 25% Annual Expansion (EB)	**57,322**	**71,652**	**89,566**	**111,957**	**139,946**	**174,933**		**218,666**	**273,332**	**341,666**	**427,082**	**533,852**	
EB Delta to Current Forecast	*36,602*	*47,620*	*62,586*	*83,703*	*107,188*	*139,071*		*177,108*	*228,343*	*294,434*	*374,704*	*476,541*	
Alternate 2030-2040 Active Installed Base Scenario at 25% Annual Expansion (EB)	**192,694**	**240,867**	**301,084**	**376,355**	**470,444**	**588,054**		**735,068**	**918,835**	**1,148,543**	**1,435,679**	**1,794,599**	
EB Delta to Current Forecast	*111,787*	*148,336*	*195,678*	*258,593*	*337,699*	*440,168*		*569,657*	*735,413*	*946,144*	*1,213,660*	*1,551,130*	

Source: Furthur Market Research and Brad Johns Consulting (July 2025)