IT BRAND PULSE™

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TCO Case Study

Enterprise Mass Storage: Less Than A Penny Per GB Per Year

Featured Products

Amazon Glacier

Dot Hill Ultra56

EMC VNXe 3200

NEC M110

NetApp E2700

SUSE Enterprise Storage

SUSE

TCO Case Studies

TCO Case Studies

IT professionals know the cost of owning servers, networking and storage equipment is more than the purchase price of the hardware. The total cost of IT equipment also includes installation, software licenses, service, support, training, upgrades, and other costs related to a specific product or situation.

TCO case studies are designed to provide busy IT Pros with vendor-independent data about the total cost of specific products. This case study examines eight comparably equipped enterprise storage solutions: two from AWS, five from disk array vendors, and one from a software defined storage vendor. It turns out one of the vendors can deliver an HDD-based mass storage solution for less than 1 penny per GB per month.

Read the rest of this report to find out who it is. Hint: it isn't Amazon.

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The Cost of Owning Mass Storage

Mass Storage

The application for the systems evaluated in this report is storing large quantities of data which is infrequently accessed. Examples of applications which use mass storage are backup, archive, and replication for disaster recovery. In all cases, the data must be on-line and highly available. Other names for this application are Bulk Storage and Nearline Storage.

Cost Components

Below are the cost components used to calculate the total cost of a owning mass storage over a 5 year period.

Hardware Product Cost -The purchase price for storage array chassis', servers and HDDs.

Recurring Software License Fees - Annual license fees for software if applicable.

Recurring Annual Service & Support Fees -The cost of a service agreement providing 24 x7 on-site service and spares with 4-hour response time.

Training - The cost of certifying one network engineer for this class of product (not applicable in this report).

Spare Parts - The cost of on-site spare power supplies and SFPs (not applicable in this report).

Total Cost of Ownership - The sum of the hardware product cost, software license fees, service and support fees, training, and spare parts over a 5 year period.

Getting the Cost Data

The product pricing (cost) data used in this case study comes from on-line resellers and solution provider quotations who are responding to a request for quote (RFQ) from IT Brand Pulse.

Apples-to-Apples Comparison

The hardware, software and service products used in this case study were selected because they were comparable to each other. Differences in the products and services are described in the product overviews.

The Storage Systems

Cloud, Hardware and Software-Defined

Storage architects and administrators are now faced with three distinctly different classes of storage solutions to evaluate: 1) cloud storage-as-a-service, 2) traditional hardware disk array, and 3) software defined storage apps which run on industry standard servers.

This report examines one cloud offering from Amazon, four disk array systems, and one software defined storage solution consisting of software from SUSE and servers from Supermicro.

Entry-level disk arrays were used because they met the performance, availability and useable capacity of our application. If mid-range or high-end storage arrays were used, the 5-year TCO would have been significantly higher.

Dozens of features could have been added to all the configurations to enhance the performance (SSD), availability (RAID) and useable capacity (compression and dedup). But a simple storage configuration met our requirements for bulk storage which is infrequently accessed.

Solution	Type	Configuration
Amazon AWS Glacier	Cloud Storage-as-a-Service	Starting at 250TB
Dot Hill Ultra56	Disk Array	Growing at 25% per year (appx. 600TB after 5 years)
EMC VNXe 3200	Disk Array	Fully redundant 24x7 support
NEC M110	Disk Array	4 hour on-site service (not applicable for cloud)
NetApp E2700	Disk Array	Cost of raw storage (no compression, dedup, etc.)
SUSE Enterprise Storage	Server-based Software Defined Storage	

EMC VNXe 3200

EMC's Most Affordable Unified, Hybrid Storage Array is Flat Out Expensive

We chose the VNXe 3200 because it's the most affordable unified, hybrid storage array available from EMC. A single 2U Disk Processor Enclosure can support 150 HDDs up to 500TB of raw capacity. To meet our initial requirement for 250TB of raw capacity and growth of 25% per year, we had to purchase two VNXe systems and a total of 13 chassis'.

Highlights

This NAS and SAN array offers high-end features as standard, and includes a ton of software: VNXe Operating Environment (OE), Unisphere Web Console, Unisphere Central (Multi-site management), Unified Snapshots, Native Asynchronous Block Replication, FAST Suite, VNXe Monitoring and Reporting, Integrated Support/Dial-Home Services, File Deduplication and Compression, Thin Provisioning, Event Enabler (common anti-virus) and File-Level Retention (WORM).

Why it Wasn't the Lowest Cost Solution

The VNXe 3200 may be EMC's most affordable array, but that is like saying the C-Class is Mercedes's most affordable car starting at $40,000. In addition, this system is not optimized for mass storage. You can scale, but it will be with only a dozen 4TB drives per chassis, resulting in the need for 2-3 new chassis' every year.

5-Year Cost of Ownership: $376, 976

			Year 1		Year 2		Year 3		Year 4		Year 5		Total
Hardware	Unit Cost	Qty	Cost	Qty	Cost	Qty	Cost	Qty	Cost	Qty	Cost	Qty	Cost
Storage System	$ 99,447	1	$ 99,447	0	$ -	0	$ -	0	$ -	0	$ -	1	$ 99,447
Expansion Chassis	$ 7,500	0	$ -	0	$ -	1	$ 7,500	0	$ -	0	$ -	1	$ 7,500
Disk Drives	$ 907	60	$ 54,420	16	$ 14,512	20	$ 18,140	25	$ 22,675	31	$ 28,117	152	$ 137,864
Software		Qty	Cost	Qty	Cost	Qty	Cost	Qty	Cost	Qty	Cost	Qty	Cost
SDS	$ -	0	$ -	0	$ -	0	$ -	0	$ -	0	$ -	0	$ -
Service		Qty	Cost	Qty	Cost	Qty	Cost	Qty	Cost	Qty	Cost	Qty	Cost
Installation	$ -	1	$ -	0	$ -	0	$ -	1	$ -	0	$ -	2	$ -
3-Year Controller	$ 39,055	1	$ 39,055	0	$ -	0	$ -	1	$ 39,055	1	$ 39,055	3	$ 117,165
3-Year Expansion	$ 1,500	0	$ -	2	$ 3,000	2	$ 3,000	3	$ 4,500	3	$ 4,500	10	$ 15,000
			$ 192,922		$ 17,512		$ 28,640		$ 66,230		$ 71,672		$ 376,976
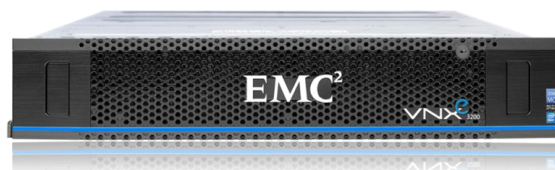
Entry-Level System, High-End Cost

The E2700 is NetApp's entry level block storage systems with an intuitive interface for administering E-Series storage systems such that no storage expertise is required. Dynamic disk pools simplify the management of traditional RAID groups by distributing data parity information and spare capacity across a pool of drives.

Highlights

The NetApp E2700 block storage system is available in configurations designed for capacity intensive environments. At the center of these configurations are ultra-dense 60-drive 4U system and disk shelves.

Why it Wasn't the Lowest Cost Solution

While the NetApp E2700 gets high marks for ease-of-use, and for offering high-density configurations which *should* make scaling mass storage cost effective. But customers are asked to pay a hefty premium for the NetApp brand. For example, add-on 6TB drives for a NetApp E2700 cost $2,512 — over four times the cost of add-on drives for industry standard servers supporting software defined storage.

5-Year Cost of Ownership: $261,622

	Unit Cost	Year 1 Qty	Year 1 Cost	Year 2 Qty	Year 2 Cost	Year 3 Qty	Year 3 Cost	Year 4 Qty	Year 4 Cost	Year 5 Qty	Year 5 Cost	Total Qty	Total Cost
Hardware													
Storage System	$ 60,206	1	$ 60,206	0	$ -	0	$ -	0	$ -	0	$ -	1	$ 60,206
Expansion Chassis	$ 51,880	0	$ -	0	$ -	1	$ 51,880	0	$ -	0	$ -	1	$ 51,880
Disk Drives	$ 2,512	42	$ -	11	$ 27,632	13	$ -	16	$ 40,192	21	$ 52,752	103	$ 120,576
Software													
SDS	$ -	0	$ -	0	$ -	0	$ -	0	$ -	0	$ -	0	$ -
Service													
Installation	$ -	1	$ -	0	$ -	0	$ -	1	$ -	0	$ -	2	$ -
3-Year Controller	$ 11,980	0	$ -	0	$ -	0	$ -	1	$ 11,980	1	$ 11,980	2	$ 23,960
3-Year Expansion	$ 5,000	0	$ -	0	$ -	1	$ 5,000	0	$ -	0	$ -	1	$ 5,000
			$ 60,206		$ 27,632		$ 56,880		$ 52,172		$ 64,732		$ 261,622

AWS Glacier

Hyperscale Storage for the Masses

Amazon Glacier is their lowest cost storage offering and promoted as a storage service for data archiving and online backup. According to Amazon, customers can reliably store large or small amounts of data for as little as $0.01 per gigabyte per month, a significant savings compared to on-premises solutions. They go on to say that to keep costs low, Amazon Glacier is optimized for infrequently accessed data where a retrieval time of several hours is suitable.

Highlights

With basic storage costing $0.01 per gigabyte per month, Amazon Glacier allows customers to archive large amounts of data, pay for what they need, with no minimum commitments or up-front fees.

Why it Wasn't the Lowest Cost Solution

Amazon says Glacier allows you to archive large amounts of data "at a very low cost" — and $0.01 per gigabyte per month doesn't' sound like much — but it adds up fast. So fast that without any additional charges for requests or transfers, Glacier storage-as-a-service is the second most expensive mass storage solution covered. Even if we discount 25% because storage-as-a-service eliminates the need to purchase capacity headroom, the 5-year cost would be $184,000, and Glacier would be the third most expensive solution. And if there are bursts of requests or large data transfers, which is likely, the costs would go up.

5-Year Cost of Ownership: $245,611

Servi ce	Unit Cost	Year 1		Year 2		Year 3		Year 4		Year 5		Total
		GB	Cost	GB	Cost	GB	Cost	GB	Cost	GB	Cost	Cost
First 1 TB / month	0.0100	1,000	-	1,000	$ -	1,000	$ -	1,000	$ -	1,000	$ -	$ -
Next 49 TB / month	0.0100	49,000	5,880	49,000	$ 5,880	49,000	$ 5,880	49,000	$ 5,880	49,000	$ 5,880	$ 29,400
Next 450 TB / month	0.0100	200,000	24,000	262,500	$ 31,500	340,625	$ 40,875	438,281	$ 52,594	450,000	$ 54,000	$ 202,969
Next 500 TB / month	0.0100	-	-	-	$ -	-	$ -	-	$ -	110,352	$ 13,242	$ 13,242
Next 4000 TB / month	0.0100	-	-	-	$ -	-	$ -	-	$ -	-	$ -	$ -
		250,000	29,880	312,500	$ 37,380	390,625	$ 46,755	488,281	$ 58,474	610,352	$ 73,122	$ 245,611

Amazon Glacier

NEC M110

Middle-of-the-Road Among Disk Arrays

According to NEC, the NEC M110 SAN disk array is designed to serve as primary storage, high capacity secondary, or tiered storage. The M110 storage controller can support up to 120 HDDs.

Highlights

Among disk arrays, the NEC M110 is a middle-of-the-road product in terms of features and price. But for a mass storage application which demands the lowest cost of ownership, the NEC M110 is more than double the cost of our lowest cost solution.

Lowlights

In contrast to the lowest cost solutions evaluated in this report which support 6TB drives, the highest capacity drive supported by the NEC M110 is 4TB. Combine that with a controller supporting only 120 drives, and enclosures fitting only 12 drives per chassis, and it becomes clear the NEC M110 is not a high-density platform needed for scaling mass storage.

5-Year Cost of Ownership: $225,203

	Unit Cost		Year 1		Year 2		Year 3		Year 4		Year 5		Total	
Hardware		Qty	Cost	Qty	Cost	Qty	Cost	Qty	Cost	Qty	Cost	Qty	Cost	
Storage System	$ 36,303	1	$ 36,303	0	$ -	0	$ -	0	$ -	0	$ -	1	$ 36,303	
Expansion Chassis	$ 4,710	0	$ -	2	$ 9,420	2	$ 9,420	3	$ 14,130	3	$ 14,130	10	$ 47,100	
Disk Drives	$ 678	63	$ 42,714	16	$ 10,848	20	$ 13,560	25	$ 16,950	31	$ 21,018	155	$ 105,090	
Software		Qty	Cost	Qty	Cost	Qty	Cost	Qty	Cost	Qty	Cost	Qty	Cost	
SDS	$ -	0	$ -	0	$ -	0	$ -	0	$ -	0	$ -	0	$ -	
Service		Qty	Cost	Qty	Cost	Qty	Cost	Qty	Cost	Qty	Cost	Qty	Cost	
Installation	$ 4,000	1	$ 4,000	0	$ -	0	$ -	1	$ 4,000	0	$ -	2	$ 8,000	
1-Year Controller	$ 12,000	0	$ -	0	$ -	0	$ -	1	$ 12,000	1	$ 12,000	2	$ 24,000	
3-Year Expansion	$ 4,710	0	$ -	0	$ -	1	$ 4,710	0	$ -	0	$ -	1	$ 4,710	
			$ 83,017		$ 20,268		$ 27,690		$ 47,080		$ 47,148		$ 225,203	

Dot Hill Ultra56

Optimized for Mass Storage

The Dot Hill Ultra56 is a member of the AssuredSAN Ultra Series of storage arrays. The products are designed for datacenters that require the highest storage density. The Ultra56 chassis houses up to 56 3.5-inch large form factor drives.

Highlights

The Dot Hill Ultra56 is optimized for scaling mass storage cost-effectively. The Ultra56 chassis offer 2 to 4 times the capacity of most general-purpose mid-range disk arrays.

Why it Wasn't the Lowest Cost Solution

With a high-density chassis design, this product should have offered the lowest cost, at least among disk arrays. And it was for the first 2 years. However, the drive pricing, which makes up such a huge part of the overall cost, was 26% higher than the lowest cost disk array, and the Ultra56 fell behind starting in year 3.

5-Year Cost of Ownership: $138,894

		Year 1		Year 2		Year 3		Year 4		Year 5		Total	
Hardware	Unit Cost	Qty	Cost	Qty	Cost	Qty	Cost	Qty	Cost	Qty	Cost	Qty	Cost
Storage System	$ 22,471	1	$ 22,471	0	$ -	0	$ -	0	$ -	0	$ -	1	$ 22,471
Expansion Chassis	$ 11,500	0	$ -	0	$ -	1	$ 11,500	0	$ -	0	$ -	1	$ 11,500
Disk Drives	$ 774	42	$ 32,508	11	$ 8,514	13	$ 10,062	17	$ 13,158	21	$ 16,061	103.75	$ 80,303
Software		Qty	Cost	Qty	Cost	Qty	Cost	Qty	Cost	Qty	Cost	Qty	Cost
Licenses	$ -	0	$ -	0	$ -	0	$ -	0	$ -	0	$ -	0	$ -
Service		Qty	Cost	Qty	Cost	Qty	Cost	Qty	Cost	Qty	Cost	Qty	Cost
Installation	$ 1,000	1	$ 1,000	0	$ -	0	$ -	1	$ 1,000	0	$ -	2	$ 2,000
1-Year Controller	$ 3,000	0	$ -	0	$ -	0	$ -	1	$ 3,000	1	$ 3,000	2	$ 6,000
3-Year Expansion	$ 1,500	0	$ -	0	$ -	1	$ 1,500	0	$ -	0	$ -	1	$ 1,500
			$ 55,979		$ 8,514		$ 23,062		$ 17,158		$ 19,061		$ 123,774

Hyperscale Storage for the Masses

SUSE Enterprise Storage is a self-managing, self-healing, distributed software-based storage solution for enterprise customers. Based on the Firefly version of the Ceph open source project, the fully featured SUSE Enterprise Storage is well suited for object, archival and bulk storage, with features including cache tiering, thin provisioning, copy-on-write cloning and erasure coding.

Highlights

The scalability of a SAN is limited by the capability of the controller head in each system. In a software defined storage architecture, storage nodes can be added to high-availability server clusters without limits, while maintaining a single namespace. For IT organizations maintaining a mass storage environment, this is the architecture of the future.

Why it is the Lowest Cost Solution

Software defined storage, hardened by hyperscale companies such as Amazon, Facebook and Google, brings IT organizations into a world of open storage where the controller hardware is commodity x86 servers, and disk drives can be acquired on the open market. The result is low-cost hyperscale storage for the masses.

5-Year Cost of Ownership: $108,607

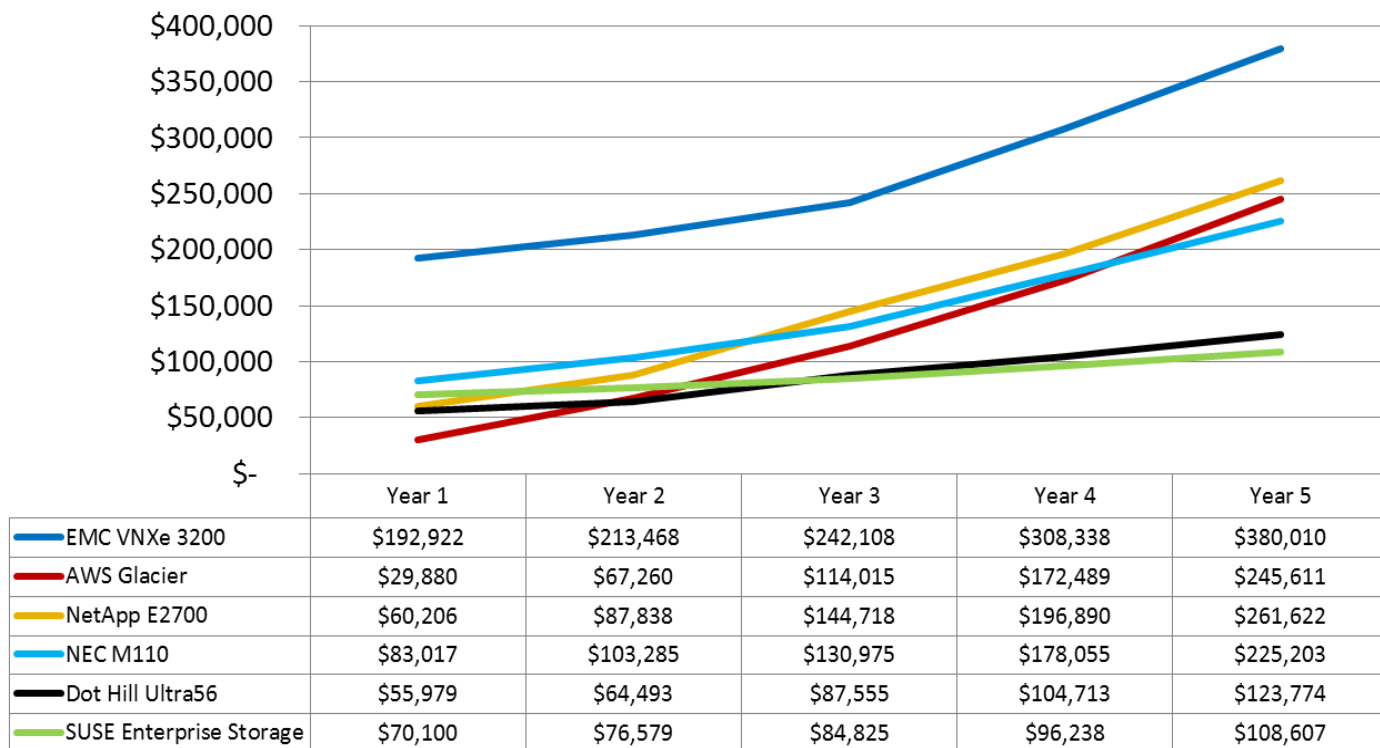|	Unit Cost	Year 1 Qty	Year 1 Cost	Year 2 Qty	Year 2 Cost	Year 3 Qty	Year 3 Cost	Year 4 Qty	Year 4 Cost	Year 5 Qty	Year 5 Cost	Total Qty	Total Cost
Hardware													
Storage Servers	$ 4,781	4	$ 19,124	0	$ -	0	$ -	0	$ -	0	$ -	4	$ 19,124
Monitor/Mgt Servers	$ 4,946	3	$ 14,838	0	$ -	0	$ -	0	$ -	0	$ -	3	$ 14,838
Disk Drives	$ 589	42	$ 24,738	11	$ 6,479	14	$ 8,246	17	$ 10,013	21	$ 12,369	105	$ 61,845
Software													
SUSE SW	$ 10,000	1	$ 10,000	0	$ -	0	$ -	0	$ -	0	$ -	1	$ 10,000
Service													
Installation	$ -	1	$ -	0	$ -	0	$ -	1	$ -	0	$ -	2	$ -
3-Year Servers	$ 200	7	$ 1,400	0	$ -	0	$ -	7	$ 1,400	0	$ -	14	$ 2,800
			$ 70,100		$ 6,479		$ 8,246		$ 11,413		$ 12,369		$ 108,607

Side-by-Side Comparison

Software Defined Storage Eliminates Branded Storage and Cloud Taxes

IT organizations have shown a strong preference for branded storage. Everyone knows they're paying a tax for the EMC or NetApp logo, but also know they won't get fired when something goes wrong, because they deployed the Mercedes of storage arrays. This branded storage tax is applied to every disk drive a customer purchases during the life of the system, and is as much as 4x the cost of HDDs used in industry standard servers and software defined storage systems.

	SUSE	Dot Hill	NEC	EMC	NetApp
Drive Capacity	6TB	6GB	4TB	4TB	6TB
Drive Price	$589	$774	$678	$907	$2,512
Cost/GB	$.098	$.129	$.169	$.227	$.419

At one penny per gigabyte, cloud storage-as-a-service is an attractive alternative for less than 300TB. As you scale beyond 300TB, the cloud tax of one penny per gigabyte per month continues, while storage arrays and software defined storage systems drive the cost per gigabyte per month well below one penny. Based on a simple storage model that does not discount for unused storage, or add cost for requests or transfers, the cloud tax per gigabyte makes AWS Glacier storage the third most expensive total cost of ownership. It's also worth noting that AWS Elastic Block Storage (EBS) is 2-3 times more expensive than AWS Glacier.

Cumulative Cost

	Year 1	Year 2	Year 3	Year 4	Year 5
EMC VNXe 3200	$192,922	$213,468	$242,108	$308,338	$380,010
AWS Glacier	$29,880	$67,260	$114,015	$172,489	$245,611
NetApp E2700	$60,206	$87,838	$144,718	$196,890	$261,622
NEC M110	$83,017	$103,285	$130,975	$178,055	$225,203
Dot Hill Ultra56	$55,979	$64,493	$87,555	$104,713	$123,774
SUSE Enterprise Storage	$70,100	$76,579	$84,825	$96,238	$108,607

The Future is Software Defined Storage

The data in this report indicates that traditional enterprise storage is under tremendous price pressure from cloud storage-as-a-service which use software defined storage on a massive scale, and by commercial versions of the same storage solution available from vendors like SUSE.

This report also reveals that Amazon's claim of 1¢ per gigabyte per month is true, but not necessarily the lowest cost solution.

The bottom line is this: IT organizations looking to lower the cost of archived data should evaluate software defined storage solutions. Based on easy-to-service x86 servers, the technology is proven by hyperscale public cloud providers and can be deployed in private clouds for 1/4 the cost of branded storage and 1/2 the cost of cloud storage-as-a-service.

Related Links

Total Cost of Ownership Wiki

AWS Glacier Pricing Info

EMC VNXe 3200 Product Info

IBM Storwize v3700 Product Info

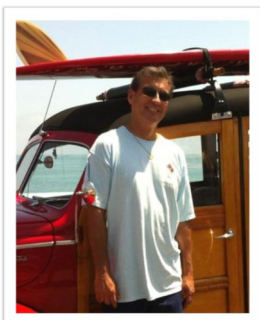NEC M110 Product Info

NetApp E2700 Product Info

SUSE Enterprise Storage Product Info

IT Brand Pulse

About the Author

Frank Berry is founder and senior analyst for IT Brand Pulse, a trusted source of data and analysis about IT infrastructure, including servers, storage and networking. As former vice president of product marketing and corporate marketing for QLogic, and vice president of worldwide marketing for the automated tape library (ATL) division of Quantum, Mr. Berry has over 30 years experience in the development and marketing of IT infrastructure. If you have any questions or comments about this report, contact frank.berry@itbrandpulse.com.