



Storage Value: The Time Is Right

Key strategies for measuring the true value of storage solutions

In today's challenging economic climate, it is of utmost importance that you get the best value from everything you buy. To help you make an informed decision when considering various storage solutions, Xiotech has developed the Storage Value Index, which takes into account not only purchase price, but actual usable capacity, performance efficiency, and operating expenses.

This paper describes the methodology used to design the Storage Value Index and offers suggestions for finding the best storage value for your needs.

When times are good, taking the time to thoroughly analyze the value of IT purchases often is overshadowed by other priorities. It is sometimes easier to simply stick with what has worked well enough in the past or choose a product with an attractive purchase price. Yet when times get tough, priorities change. It then becomes of utmost importance to be sure you get the best total value from everything you buy.

The Storage Value Index approach introduced in this document is designed to help you adjust to this sea of change and assess the true value of storage solutions, taking into account not only purchase price, but actual capacity, performance efficiency, and operating expenses.

Storage Value Index

The Storage Value Index is designed to quickly derive the true value of a storage solution by comparing the “work” it performs with its capital cost. To ensure an “apples-to-apples” comparison among storage systems, the Value Index uses measurements that are both objective and easily obtainable.

At a very basic level, there are three fundamental measures of work for storage systems: usable capacity, performance, and reliability.

- **Usable Capacity:** Usable capacity is the actual capacity available for data storage—what’s left after subtracting capacity the storage vendor reserves for sparing and/or specific storage services or processes). *The Value Index measures usable capacity in terabytes.*
- **Performance:** Performance is a key measure of work—particularly for performance-intensive applications—which depends on a storage system’s ability to read, write, and transmit data at least as fast as the servers can process it. *The Value Index measures performance as input/output operations per second (IOPS).*
- **Reliability:** The work of “usable capacity” and “performance” only happens to the extent that a storage system can perform reliably through its years of service. Reliability, particularly if accompanied by a longer warranty period, is an indicator of the operational expenses (OPEX) and ongoing costs associated with the solution. *The Value Index measures reliability in terms of years of warranty.*

Similarly, there is one fundamental measure of cost:

- **Cost:** Cost is the capital expense part of the equation and reflects the acquisition price of the storage solution hardware and software.

While value is relative and has a unique meaning for each environment, many IT users indicate these attributes are key to how they measure true storage value.

$$\text{Value Index} = \frac{\text{USABLE CAPACITY (Terabytes)} \times \text{PERFORMANCE (IOPS)} \times \text{RELIABILITY (Warranty Years)}}{\text{COST (Price \$\$)}}$$

Michael Szumielewski in his World Financial Blog makes the case that while recessions are painful, they are necessary for sustained growth.

He states “The ‘job’ of a recession is to clean the fat out of the system, mop up excess, and pave the way for the next expansion.”

The benefit of the Value Index is its ability to focus on the fundamental, measurable work and costs of storage solutions. This is critically important for assessing the true efficiencies, total costs, and ultimately the value of storage solutions.

Value Index: Usable Capacity

Storage capacity inefficiencies have been commonplace for years, with industry analysts estimating average usable capacity rates as low as 45 percent of total capacity. It is an area where there is a tremendous disconnect from what storage vendors market and what they actually deliver. This is readily evident by the storage industry leaders (the top 6 accounting for more than 70 percent market share), claiming to deliver 60 to 80 percent usable storage.

There are a number of reasons for this inefficiency, but primary causes are capacity the vendor reserves for storage features and the need to add drives not for capacity but to meet performance requirements.

The first factor on the Value Index, therefore, is usable capacity. It is measured in terabytes—before RAID and the small reduction caused by how operating systems see capacity. Most storage vendors post their recommendations for maximum storage utilization on their websites, often contained in best practices guides.

The Effect of Total Capacity vs. Usable Capacity on Cost-per-Terabyte Comparisons

Storage purchasing decisions often are made based on the cost per terabyte. This is an easy way to compare storage solutions based on up-front price. It requires dividing the system's purchase price by the total amount of storage capacity within the quote.

$$\text{\$ per TB} = \frac{\text{System Quote}}{\text{System Quote TB}}$$

A problem with this equation is it assumes all other factors are equal. However, this is not the case as storage solutions have a number of different variables affecting usable capacity:

- **Hot Spare(s) Requirements:** In storage systems with drive bay or disk enclosure technology, hot spares are spinning assets with no useful purpose until something goes wrong.
- **RAID:** Some vendors recommend setting aside *additional* capacity beyond what RAID requires for the management of RAID processes.
- **Vendor Best Practices:** Many storage vendors have “best practices” that prevent you from using space due to bloated features or features that need safety nets of space.
- **Vendor Reserves:** Often storage vendors implement reserve space in the event the storage system needs to manage a remanufacturing event or for the addition of new features. This increases the system cost yet is only available to the vendor.

All these vendor hold backs can reduce the actual usable capacity of your system by as much as 70 percent.

Typical storage utilization rates in most enterprises run in the 25 to 40 percent range.

– Taneja Group

The cost-per-terabyte model often is over-emphasized due to its simplicity—and too often is the only metric used when making a storage decision. Since the calculation is based solely on the system cost, or capital expense, it only captures a small percentage of the total cost of ownership (TCO).

The Capacity/Performance Relationship

A misconception of storage performance is that it does not degrade. However, there are many factors that negatively impact performance—the greatest being how full, or utilized, disk drives are.

When a system is first installed and data is starting to be added, the performance is great. However, this is short lived. As data continues to be added and utilization increases, performance begins to lag. This inverse relationship is the utilization/performance trade-off (Table 1).

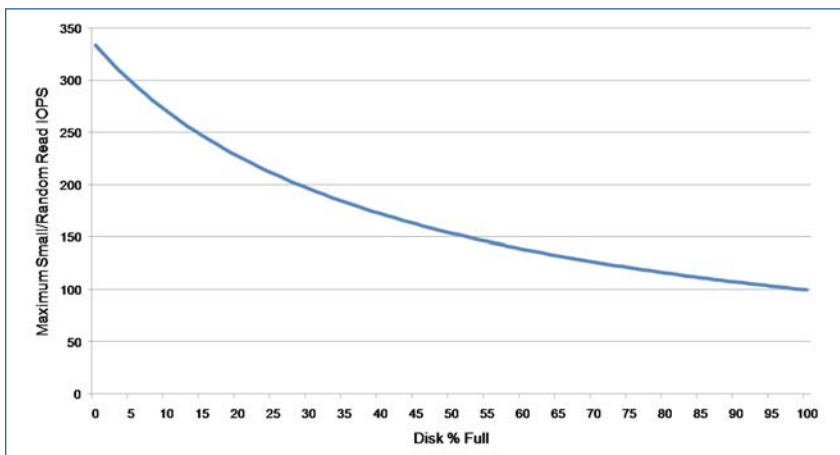


Fig. 1. Disk Full Percent vs. Maximum IOPS in a Typical Storage System

To protect you from inadequate or unpredictable performance described above, many storage vendors have best practices for maximum utilization rates, preventing you from using all the capacity you bought.

What this ultimately means is you must buy more drives than you need for capacity in order to meet your performance requirements. Called “short-stroking,” this practice uses only a fraction of a drive’s capacity, putting data only on the outer edge of the drive, where performance is the greatest. This sacrifices capacity for the sake of performance, resulting in higher capital costs and greater power consumption. If you are only able, or recommended, to use 50 percent of the available capacity, you have essentially doubled the cost of your storage.

Tiering Data on Drives

Another way some vendors address short stroking is by offering a variation of tiered storage—putting high-performance data on the outer edges of the drives, second tier data in the middle, and tertiary data in the inner ring. The use of tiered storage in this manner begs two questions:

1. If you paid for a high-performance disk drive, why are you getting performance only across the first 5 to 10 percent of it?
2. Why are you putting tertiary storage on expensive Fibre Channel drives rather than on lower cost drives, such as Serial ATA (SATA)?

Xiotech ISE: Lowest Cost per Usable Terabyte

- ISE technology lets you use up to 100 percent of available storage capacity (after RAID).
- ISE technology includes spare capacity (at no added cost), which is shared across all drives—letting you use all the capacity you buy.
- With ISE technology, performance remains strong—even up to 100 percent capacity utilization.
- ISE capacity and performance scale linearly, using every bit of added capacity

The scalability lets me know that when we grow from 5,000 concurrent users to 10,000 or 20,000, we can seamlessly scale up without disruption to the website.

– Rich Kopcho, CEO, Holonyx

When our IT environment is fully virtualized, we plan to have 110 virtual machines running on 6 servers. So, for us, a successful transition hinged on the ability to remove the I/O bottlenecks found in traditional storage systems. With Emprise 7000 we’ll be able to eliminate those bottlenecks and expect to see a 200 percent increase in performance.

– Dan Lewis,
Network Services Manager,
USC Marshall School of Business

Reigning in Usable Capacity

The inefficiencies found in today's storage solutions is analogous to leasing 2 to 5 times as much office space as you actually need and paying all the ongoing heating, cooling, and maintenance costs, so the property manager can take over a significant percentage of the space for his own use, and to ensure there is enough unused space to keep everything moving freely.

Achieving greater levels of usable storage requires two important changes to most storage systems:

- Eliminate the need for vendor storage hold backs
- Eliminate performance bottlenecks and the need for short stroking

Unfortunately, few storage vendors have managed to effectively address these barriers to usable capacity.

Value Index: Performance

Storage performance is a growing problem for many storage managers. While Moore's Law helps to solve the capacity issue with ever-increasing drive size, this exacerbates the performance problem by significantly decreasing the number of spindles per terabyte of data. In fact, across the industry, IOPS per terabyte has declined significantly over the years.

To combat this problem, many storage vendors load their systems up with extra disk (that you have to buy)—sometimes including ultra-expensive solid state disk (SSD) drives—just to meet performance demands. This short stroking strategy, described in more detail in the previous section, adds to the cost of storage systems, while introducing more chance for disk failures.

Clearly, performance is a very important measure of a storage system's value and must be measured and compared consistently across the different systems being considered. The Storage Value Index utilizes SPC Benchmark 1™ (SPC-1) test results to measure IOPS performance. These tests are objective, have been audited and peer reviewed to ensure consistency across all storage systems tested, and readily available from the SPC website.

More about SPC Benchmarks

SPC-1 consists of a single workload designed to demonstrate the performance of a storage system while performing the typical functions of business-critical applications. These applications are characterized by predominately random I/O operations and require both queries and update operations. Examples of such applications include business analytics (OLAP), database (OLTP), operations, and mail servers. SPC-1 results are measured in IOPS.

An Executive Summary and Full Disclosure Report for each SPC benchmark result is available for download and review from www.storageperformance.org/results, so you can compare how storage systems perform in the benchmark tests.

The SPC also offers SPC Benchmark 2™ (SPC-2), which measures price-performance in megabytes per second (MBps). While MBps is a valuable measure of performance, IOPS is more commonly used and data is available for more storage systems.

Xiotech ISE: Industry-Leading Performance Efficiency

- ISE moves storage intelligence and cache closer to the disk drives, significantly boosting performance across all data types and workloads.
- ISE-based Emprise 5000 eliminates SAN controllers and back-end switches and the bottlenecks that can come along with them.
- ISE systems deliver 25 percent more performance per drive than typical storage systems
- ISE is proven to deliver some of the highest IOPS and MBps for the dollar in the industry (validated by the SPC).
- Performance scales linearly as you add ISE.

We have more than 1,000 users uploading 50,000 assignments daily, so we faced an enormous performance bottleneck. We conducted a production test of the Emprise 7000 storage system and recorded 50,000 IOPS—the highest we recorded with our previous system was 660 IOPS.

– Chris Dillow, CTO, AutoVIN

Emprise 7000 will give us performance equal to other vendors' high-end data storage systems at half the cost.

– Matt Woods, Administrator,
Long Beach Unified School District

Achieving Better Performance Efficiency

The solution to the growing problem of storage performance inefficiency is three-fold:

- **Increase Drive Performance:** New technologies are available that improve the utilization of cache and read/write efficiencies for as much as a 25 percent improvement in per-drive performance.
- **Eliminate Utilization/Performance Trade-Offs:** New cache algorithms and read/write efficiencies ensure full performance even as utilization of drive capacity approaches 100 percent.
- **Eliminate Performance Bottlenecks:** Select storage system designs that eliminate the traditional performance bottlenecks related to cache availability, interfaces, and controller processing.

Value Index: Reliability

Reliability is an important factor in the total value of a storage system. If the system is not reliable, then it is of little use for storing your organization's critical data.

The third attribute of the Value Index, reliability, is measured by the length of the hardware warranty. You can easily obtain warranty information from product data or specification sheets on the storage vendors' websites.

Warranty Length as a Measure of Reliability

The length of hardware warranty is a direct reflection of how long a vendor is willing to stand by its product and how much confidence the vendor has in the product's reliability. Typically, storage products have only a one to three year hardware warranty. This leaves you having to pay expensive maintenance fees to cover the remainder of your storage system's useful life. **Maintenance contracts frequently add up to 20 percent a year to the system's original storage price.**

Unfortunately for you, many storage vendors use hardware maintenance fees to increase their profitability or force you to upgrade systems earlier than is needed. Neither is a good choice: paying for expensive maintenance contracts or upgrading a system earlier than necessary.

Improving Reliability

Reliability improvements will reduce the time and expense of ongoing storage maintenance—and add to the value of storage systems:

- Technology to reduce or eliminate disk replacements will save you considerable time, expense, and risk to your data.
- Reducing the number of individual components to manage will free IT personnel for other tasks.
- Better reliability will enable storage vendors to extend system warranties, potentially saving you several years' worth of expensive maintenance renewals.

Xiotech ISE: Unmatched Reliability and an Exclusive Five-Year Warranty

- ISE self-healing technology prevents many disk failures and heals drives in place, without human intervention or business disruption.
- ISE technology eliminates the time, expense, and risk of replacing failed drives—which is all-too-common with other systems and constitutes a large portion of most vendors' maintenance contracts.
- Xiotech is so confident in ISE reliability that all its Emprise systems include a five-year hardware warranty—the longest warranty in the storage industry.

Nobody but Xiotech is offering a five-year warranty. That gives me the confidence to put our data on the Emprise 5000 system.

– Garret Acott, CTO, Holonyx

Other TCO Factors

Of course there are other factors that affect storage TCO, including ease of administration (labor costs) and resource utilization (power, cooling, floor space). It is important that you take these factors into consideration when evaluating storage systems.

However, the costs associated with these may be more subjective and can be difficult to measure or easily compare across different storage systems. Therefore, they are not included as part of the Storage Value Index.

Realizing Your Own Value Index

Value within the data center is a strong requirement for your storage purchasing decision. In today's economy, it is not just a matter of pinching pennies, but extracting the greatest value in your purchases.

However, you must sift through the promised hype and "dirty secrets" to discern what is real, what is measurable. The Storage Value Index gives you the power to clarify your storage purchasing decisions. The four attributes of usable capacity, performance, reliability, and cost, are factors that you can readily obtain, measure, and verify.

There is no better time than now to realize the efficiencies, cost savings, and value that are now available with Xiotech ISE technology and the Emprise line of storage systems. With superior storage capacity utilization, advanced performance, and industry-leading reliability backed by a five-year hardware warranty, ISE technology helps reduce costs in the short term and paves the way for growth and advanced operational efficiencies in the long term.

To find out how Xiotech's ISE technology and Emprise storage systems can lower your storage costs, contact your local Xiotech representative, visit www.xiotech.com, or call us toll free at 1.866.472.6764.

Xiotech ISE: Lowering Other Costs

ISE technology keeps ongoing operating costs at a bare minimum.

- ICON Manager, used with Emprise 7000 systems, provides the easiest management available anywhere—automating storage functions across storage, servers, and virtual machines.
- Emprise 5000 is easy to deploy and requires little ongoing management, for very low administration costs.
- ISE technology enables you to meet capacity and performance needs with far fewer disks, so you use less power and space.
- ISE technology features dense packaging with better cooling to reduce data center footprint—resulting in up to 30 percent more capacity in the same space.

The Emprise 5000 system's TCO beat all other products we considered. Plus with Xiotech's five-year, no-cost hardware warranty, I have great confidence in the product's reliability. With the industry-leading SPC price-performance numbers on top of this, it was an easy decision.

– Pete Crisp, IT Director,
Forbes Energy Services

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