Technology Highlight

New Study Details Importance of TCO for HPC Storage Buyers

Sponsored by Panasas, Inc.

Steve Conway, Earl Joseph
Q1- 2020

HYPERION RESEARCH OPINION

Total cost of ownership (TCO) is often assumed to be an important consideration for buyers of HPC storage systems. Because TCO is defined differently by HPC users, it's difficult to make comparisons based on a pre-defined set of attributes.

With this fact in mind, Hyperion Research recently conducted a worldwide study that asked HPC storage buyers about the importance of TCO in general, and about specific TCO components that have been mentioned frequently in the past two years by HPC storage buyers.

The study findings still don’t point to a standard TCO definition that would satisfy most HPC storage buyers. The results do, however, confirm the importance of what happens during the period of ownership, after the storage system has been purchased. The findings show that for many HPC storage buyers, operating expenses—ranging from staffing needs and power to the cost of unscheduled downtimes—are just as important considerations in upfront buying decisions as the initial acquisition cost of the storage system.

The new study corroborates and adds to the findings of other recent Hyperion Research surveys.

- All the studies underscore the expanding role of HPC storage in the emerging era of digital transformation and AI, in both established and newer HPC markets. Hyperion Research forecasts that the global market for HPC storage systems will grow at a robust rate (7.0% CAGR), from $5.5 billion in 2018 to $7.0 billion in 2023.
- The new study in particular shows that HPC storage system requirements are becoming more complex and diverse. Iterative simulation methods and new HPDA-AI workloads are the most important factors driving the growth of HPC storage; unplanned system downtimes can be lengthy and costly; and recruiting and training qualified personnel is the most challenging aspect of storage operations for many HPC sites.

This paper presents key findings of the new study, along with supporting data.
KEY FINDINGS

Among the salient findings are the following:

- **Growth Drivers.** The largest factors driving the growth of HPC storage capacity were iterative simulation workloads and new workloads such as AI and other Big Data jobs.

- **Growth Inhibitors.** The most often-named challenge for HPC storage operations was recruiting and hiring qualified staff, followed by the time and cost needed to tune and optimize the storage systems.

- **Total Cost of Ownership.** Deliberately presented without a definition, TCO emerged as the second-most-important of all purchasing criteria for the surveyed group of HPC storage buyers, tied with "price" and trailing only "performance." Though the definitions respondents had in mind presumably differed in some particulars, as a group these buyers endorsed the importance of TCO. See Figure 1.

- **Downtime.** Almost half of the surveyed sites experience storage system failures once a month or more frequently. Downtimes range from less than one day to more than a week. A single day of downtime costs from under $100,000 to more than $1 million.

- **Satisfaction and Loyalty.** Although a large majority (82%) of respondents were relatively satisfied with their current HPC storage vendors, a substantial minority said they are likely to switch storage vendors the next time they upgrade their primary HPC system. The implication here is that a fair number of HPC storage buyers are scrutinizing vendors for competencies as well as price.

- **Storage Source.** HPC buyers as a group have grown sophisticated enough about storage to pay more attention to the product than to who sells it to them. The study showed that most buyers sometimes purchase storage at the same time as the HPC system it will support, other times separately. Many buyers don't care whether the storage system is sold by a dedicated storage vendor or a system vendor intermediary. It's the product and the support staff that count most.

A clear implication of this study is that to compete effectively, storage vendors need to deliver value far beyond the initial purchase price. They must pay attention to the full range of buyer considerations, including reliability, cost of management, responsive support and uninterrupted application user productivity.

STUDY FINDINGS

Summary

In HPC storage systems purchasing there are things that can be easily measured, such as I/O performance and cost of acquisition, but often overlooked is the ongoing cost of operations and the negative impact that inconsistent and complex storage solutions can have on productivity and time to quality outcomes. As HPC becomes more widely disseminated with increasing adoption in the enterprise market, so does the need for a better understanding of how HPC storage impacts organizations, both from a productivity as well as from an infrastructure investment perspective.

To identify the key challenges in HPC storage deployments today, particularly in the areas of total-cost-of-ownership (TCO) vs. initial acquisition costs, Hyperion Research conducted a site survey that solicited feedback from data center planners and managers, HPC storage system managers, purchasing decision-makers and key influencers, and HPC storage system users, based in North America, EMEA and Asia.
While performance was the number one criterion for purchasing HPC storage (Figure 1), TCO was tied with the purchase price for second place.

**FIGURE 1**

HPC Storage Buyers’ Most Important Purchase Criterion

![Diagram showing the most important purchase criteria for HPC storage. The top criteria are Performance (57%), Initial purchase price (37%), and Long-term value (TCO) (37%). Other criteria include HPC infrastructure fit (24%), Scalability/upgradability (18%), Architecture (14%), Vendor support (14%), Number and skill set of staff required (10%), Energy efficiency (8%), Recovery/resilience (8%), Longevity of the selected solution (6%), Software support (6%), Network connectivity (4%), and Floor space (footprint) (2%).]

Source: Hyperion Research, 2019

**Demographics of the Survey Respondents**

Employee populations among the surveyed sites varied from fewer than 500 to over 10,000 (Figure 2).

**FIGURE 2: Number of Employees**

![Diagram showing the distribution of employee populations among surveyed sites. The majority of sites have 500-2500 employees (35%), followed by >10,000 employees (29%), 2,500-5,000 employees (16%), 500-2,500 employees (14%), and <500 employees (4%).]

Source: Hyperion Research, 2019
As Figure 3 shows, the study captured a wide range of organization sizes, with annual revenues from less than $5 million to more than $10 billion.

FIGURE 3

Annual Revenues of Respondent Organizations

![Annual Revenues of Respondent Organizations](image)

Which of the following categories best describes your organization’s annual revenue?

- $10B+: 19.6%
- $5B to $9.99B: 2.0%
- $2.5B to $4.99B: 3.9%
- $1B to $2.49B: 5.9%
- $500M to $999M: 2.0%
- $250M to $499M: 5.9%
- $100M to $249M: 5.9%
- $50M to $99M: 15.7%
- $25M to $49M: 2.0%
- $10M to $24M: 3.9%
- $5M to $9M: 3.9%
- $1M to $4.9M: 3.9%
- < $5M: 25.5%
- Don’t know/cannot discuss: 0.0%

Source: Hyperion Research, 2019

As Figure 4 shows, the major market sectors were well represented in the study.

FIGURE 4: Major Market Sectors

![Major Market Sectors](image)

Survey Respondent Organizational Representation

- Industry: 43%
- Academia: 39%
- Government: 18%

Source: Hyperion Research, 2019
The major geographic regions for HPC were represented as well (Figure 5).

**FIGURE 5**

World Geographic Regions

Source: Hyperion Research, 2019

Figure 6 shows the combined storage capacities of the sites’ HPC systems today.

**FIGURE 6**

Current HPC Storage Capacity

Approximately how much HPC storage capacity does your organization have today?

Source: Hyperion Research, 2019
Figure 7 displays the annual growth of storage capacity for the surveyed sites.

**FIGURE 7**

**Annual Growth in HPC Storage Capacity**

![Annual Growth in HPC Storage Capacity](chart)

Source: Hyperion Research, 2019

The most often-named driver of the sites' HPC storage growth (Figure 8) is the increase in iterative (multiple-run) simulations. Today's more powerful HPC systems can allow many more attempts at a problem solution to be made in an allotted timeframe. In the past, car designers might have been able to try out 3-4 designs in their part of the development cycle. Today, that process may involve hundreds or thousands of runs—and for regulatory and liability reasons, all that data may need to be stored for the market lifetime of the vehicle in question. Iterative methods are especially common in the manufacturing industry (parametric modeling), the financial services industry (stochastic modeling) and the weather/climate sector (ensemble modeling).

**FIGURE 8**

**Most Important Driver of HPC Storage Growth**

![Most Important Driver of HPC Storage Growth](chart)

Source: Hyperion Research, 2019
People, Productivity and Operations—Three Aspects of TCO

Although HPC storage buyers don't agree on a single TCO definition, three areas are generally accepted as contributing to TCO: people (staffing), productivity and operations. This section presents survey findings in these areas.

People

In the average HPC storage deployment, skilled technical staff are required to manage day-to-day operations, tune and retune to sustain performance, and manage changing workloads. The complexity of open source file systems typically requires a larger and more skilled staff to keep the storage system operating at peak level. Recruiting, training and retaining skilled staff at an affordable level is getting more difficult, as the demand for these skilled technicians grows with the expansion of HPC into the enterprise and the emergence of new technologies and use-cases.

Storage staffing among the respondents ranged in size, from one to more than five FTEs per site (Figure 9).

FIGURE 9

Number of FTE Staff Managing HPC Storage

Source: Hyperion Research, 2019
The estimated annual costs for the sites’ HPC storage staff vary considerably and sometimes top $500,000, presumably at sites employing multiple people to manage the storage operations (Figure 10).

**FIGURE 10**

Annual Cost for Staff Managing HPC Storage

<table>
<thead>
<tr>
<th>Cost Range</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>$500K or more</td>
<td>13.7%</td>
</tr>
<tr>
<td>$300K to $500K</td>
<td>7.8%</td>
</tr>
<tr>
<td>$100K to $300K</td>
<td>31.4%</td>
</tr>
<tr>
<td>Less than $100K</td>
<td>25.5%</td>
</tr>
<tr>
<td>Not sure/don’t know</td>
<td>21.6%</td>
</tr>
</tbody>
</table>

Source: Hyperion Research, 2019

Figure 11 shows that a people issue — recruiting and training storage staff — is also the most frequently cited challenge the sites associate with HPC storage operations.

**FIGURE 11**

Operational Challenges in Storage Infrastructure

<table>
<thead>
<tr>
<th>Challenge</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recruiting/training storage experts</td>
<td>22%</td>
</tr>
<tr>
<td>Storage system installation time and cost</td>
<td>18%</td>
</tr>
<tr>
<td>Tuning and optimization time and cost</td>
<td>16%</td>
</tr>
<tr>
<td>Administration time and cost</td>
<td>6%</td>
</tr>
<tr>
<td>System downtime</td>
<td>38%</td>
</tr>
</tbody>
</table>

Source: Hyperion Research, 2019
**Productivity**

Supporting high productivity for users of HPC servers (scientists, researchers, analysts and engineering staff) is of paramount importance to data center managers and other senior officials at HPC sites. In some industries, a day of downtime can cost the organization more than $1 million in lost revenue. Lack of storage system resiliency in the face of failures and changing requirements has been an ongoing issue for some file systems. Optimal time to customer problem resolution is particularly challenging when there are multiple layers in the customer support chain.

As Figure 12 indicates, more than three-quarters of the surveyed sites had episodes in the past year when storage issues reduced productivity. For one in eight sites, this occurred more than 10 times in the past 12 months.

**FIGURE 12**

Frequency of Tuning and Re-Tuning

![Frequency of Tuning and Re-Tuning](image)

Source: Hyperion Research, 2019

Figure 13 shows that about half the surveyed sites tune their storage systems once a month or more often, while the other half said they never do this.

**FIGURE 13**

Storage Issues Reducing Productivity

![Storage Issues Reducing Productivity](image)

Source: Hyperion Research, 2019
A substantial minority of sites said they experience storage system failures, defined as very significant episodes, on a monthly or weekly basis. Figure 14.

**FIGURE 14**

![Storage System Failure Frequency](image)

Source: Hyperion Research, 2019

In most cases, recovery from a storage system failure took less than 24 hours, but in some cases this process took a week or more (Figure 15).

**FIGURE 15**

![Recovery From System Failure](image)

Source: Hyperion Research, 2019
But even in cases where recovery from a storage system failure takes only one day, the cost can exceed $100,000. Figure 16.

**FIGURE 16**

![HPC Storage Single Day Down Time Cost](image)

Source: Hyperion Research, 2019

**Operations**

Serving the HPC infrastructure needs of an organization is important and challenging work. Keeping the system performing at peak levels as workloads, applications and users are changed and added, causes disruption and stress under the pressure of pending deadlines.

Installing an HPC storage system can take from under one day to more than one week, the respondents reported (Figure 17).

**FIGURE 17**

![Storage Installation Time](image)

Source: Hyperion Research, 2019
FUTURE OUTLOOK

TCO is a term variously used in the HPC community and therefore deliberately presented to respondents of this study without a definition. This had the advantage of enabling the respondents to apply their own definitions. When they did, TCO emerged as one of the top purchasing criteria of the surveyed sites—tied in importance with "price" and second only to the "performance" of HPC storage systems under consideration.

As a category, the study shows, HPC storage systems have become significantly more important in the current era of digital transformation and high-performance data analysis, including AI methods such as machine and deep learning.

To meet emerging requirements for what the U.S. Department of Energy calls "extreme heterogeneity"—the convergence of simulation and analytics, traditional and enterprise environments, and interoperation with cloud infrastructures—HPC storage systems, like other parts of the HPC ecosystem, have become more complex and more challenging to manage in many cases. As the study shows, HPC storage systems are subject to downtimes that can increase costs while lowering productivity, and finding qualified job candidates to help manage HPC storage systems can be a major challenge. These trends are likely to continue.

With these factors in mind, Hyperion Research advises HPC sites to evaluate a wide range of HPC storage vendors before making a purchase decision. There are important differences in the vendors' products, strategies and support. A wider search could pay large TCO dividends.
About Hyperion Research, LLC

Hyperion Research provides data-driven research, analysis and recommendations for technologies, applications, and markets in high performance computing and emerging technology areas to help organizations worldwide make effective decisions and seize growth opportunities. Research includes market sizing and forecasting, share tracking, segmentation, technology and related trend analysis, and both user & vendor analysis for multi-user technical server technology used for HPC and HPDA (high performance data analysis). We provide thought leadership and practical guidance for users, vendors and other members of the HPC community by focusing on key market and technology trends across government, industry, commerce, and academia.

Headquarters

365 Summit Avenue
St. Paul, MN 55102
USA
612.812.5798

Copyright Notice

Copyright 2020 Hyperion Research LLC. Reproduction is forbidden unless authorized. All rights reserved. Visit www.HyperionResearch.com to learn more. Please contact 612.812.5798 and/or email info@hyperionres.com for information on reprints, additional copies, web rights, or quoting permission.