



How to Apply Storage Economics with Hitachi AMS 2000 Family

By Hitachi Data Systems

December 2010

Table of Contents

Executive Summary	3
Introduction	4
Hitachi Adaptable Modular Storage 2000 Family	4
Hitachi Storage Economics	5
How the Adaptable Modular Storage 2000 Family Measures Up	6
Increase Operational Efficiency with Hitachi Dynamic Load Balancing Controller and Hitachi Command Suite	6
The Role of Operational Efficiency in Storage Economics	7
The Net Value of AMS 2000 Family Systems on Operational Efficiency	8
Betonwerk Godelmann KG Reaps Efficiency Benefits	8
Driving Utilization Efficiency with Dynamic Provisioning	8
The Role of Utilization in Storage Economics	8
The Net Value of AMS 2000 Family Systems on Utilization Efficiency	9
Tech Savvy SquareTwo Financial Gains Storage Efficiency	9
Procuring Industry Leading Price to Performance with SAS	10
The Role of Storage Price to Performance	10
The Net Value of AMS 2000 Family Systems on Price to Performance	12
Pixorial Uploads Better Cost per Gigabyte per User	12
Further Considerations for Optimizing the Data Center	13
Wide Striping of Data	13
Dense Storage Solution	13
Scalability	14
Consolidation	14
Energy Savings	14
Data Drives Our World	14
For More Information on Storage Economics	15

Executive Summary

Hitachi Data Systems has long been a leader in state-of-the-art storage technology that optimizes operational efficiency and price to performance, key elements in determining the true total cost of ownership (TCO) of storage. Hitachi has once again delivered on this promise with the Hitachi Adaptable Modular Storage (AMS) 2000 family, highly reliable midrange storage systems that provide 99.999 percent data reliability for medium, large or enterprise organizations. With the ability to automate many of the complex and time-consuming tasks typically associated with storage management, the Adaptable Modular Storage 2000 family offers organizations superior return on investment (ROI) as defined through the Hitachi Storage Economics framework.

Capital acquisition costs typically account for only 25 percent of TCO, with the remaining 75 percent of total cost coming from operational expenses such as labor, equipment, maintenance and downtime. Storage Economics helps you understand the true TCO of storage, providing a framework for understanding the impact of hard and soft costs on the long-term value of the storage purchase.

This paper explores the following aspects of storage economics for the Adaptable Modular Storage 2000 family:

- **Increasing Operational Efficiency.** The AMS 2000 family eliminates complex and time-consuming administrative tasks, self corrects performance-robbing bottlenecks and enables customizable views of the underlying storage. It also makes it easy to provision additional storage to manage growth and provides comprehensive reporting functions. In a recent survey of IT organizations using AMS 2000 family systems, the features that support these capabilities were the overwhelming top contenders for most valuable feature and most innovative feature.¹
- **Driving Utilization Efficiency.** The AMS 2000 family helps to boost storage utilization rates safely using virtual storage capacity. It reduces upfront storage purchases, energy consumption and administrative costs and improves administrative efficiencies by reducing time associated with provisioning. The result is a superior ROI.
- **Providing Industry Leading Price to Performance.** The AMS 2000 family uses a highly efficient back-end SAS, which provides performance that scales with capacity. This allows administrators to spend less time tuning their systems to remove back-end bottlenecks.

This paper demonstrates the storage economics of Hitachi Adaptable Modular Storage 2000 family systems, and how IT administrators can reach availability, performance and reliability goals while trimming both capital and operational costs.

¹ Source: TechValidate survey

Introduction

Challenging economic times put pressure on businesses to carefully manage all expenditures, including the cost of the storage infrastructure. In order to understand the true cost of storage, organizations must factor in labor, equipment, maintenance and downtime costs, in addition to the capital acquisition costs.

Hitachi Storage Economics is designed to help organizations get to the bottom of TCO. With a cadre of proven research, methodologies and metrics, Storage Economics helps organizations to successfully determine how best to lower TCO and maximize their return on assets (ROA).

This paper evaluates the Hitachi Adaptable Modular Storage 2000 family in light of the Storage Economics framework, providing insight on the features and benefits that will optimize storage assets in the data center.

Hitachi Adaptable Modular Storage 2000 Family

The Hitachi Adaptable Modular Storage 2000 family supplies an impressive suite of economically efficient technologies that were previously unavailable on any midrange storage platform. Offering highly resilient enterprise-class storage in an affordable and easy-to-manage modular package, the Adaptable Modular Storage 2000 family raises the bar with extensive scalability, cost-effective performance and elegant simplicity.

Available in three models, including the AMS 2100, AMS 2300 and AMS 2500, the AMS 2000 family offers important features that diminish complexity, cost and risk. In each system, the Hitachi dynamic load balancing controller feature frees administrators from the time-consuming task of monitoring utilization rates and re-balancing systems as workloads change over time, ensuring cost-effective performance. The SAS architecture provides exceptional bandwidth and outstanding performance to meet application service level agreements (SLAs) on budget. The AMS 2000 family brings together cost-effective performance, extensive scalability and outstanding system reliability to offer tangible cost-saving benefits.

AMS 2100, AMS 2300 and AMS 2500 aid administrators in meeting a myriad of needs, including storage consolidation, data replication, backup and archiving. These systems offer a solutions-ready platform for high volume applications, business continuity plans and regulatory mandates. And there is no need for administrators to sacrifice reliability or centralized management when setting up tiered storage. The AMS 2000 family is ideal as inexpensive lower tier storage in a virtualized environment when combined with Hitachi Universal Storage Platform® V, the Universal Storage Platform VM or the new Hitachi Virtual Storage Platform.

Each model is interoperable with all major operating systems. Each supports all RAID disk configurations, including RAID-6 disk configurations, cache partitioning, modular volume migration, power saving options and an intermix of SAS drives, solid state drives (SSD) and SATA drives on the same tray for cost and operational savings. All models support iSCSI and Fibre Channel host interfaces for additional flexibility and consolidation capabilities.

Finally, integration with the Hitachi enterprise-class storage management suite, Hitachi Command Suite, enables administrative and operational efficiencies not available on other modular storage offerings. By leveraging this offering, AMS 2000 family administrators can simplify task management,

improve workflows and benefit from expansive monitoring utilities. All of this contributes to additional cost savings.

Hitachi Storage Economics

Think of Hitachi Storage Economics as getting to the bottom line of TCO. Identifying the total cost of storage ownership is essential if organizations want to move beyond the dollars-per-megabyte formula to really reduce long-term storage ownership costs and risks. Grasping the meaning behind TCO is the first step in assessing the true cost of storage. Acquisition of hardware equipment or infrastructure, which is known as capital expenditure (CAPEX), typically accounts for only 25 percent of the total cost of owning them over three or four years.

However, what about after the purchase? Less tangible or unaccounted costs can include electricity, floor space, staff labor, migration or downtime, maintenance and licensing. And the list goes on. In fact, Hitachi Storage Economics has characterized 33 different types of operating expenditure (OPEX) costs, and helps organizations discover and classify the remaining 75 percent of TCO after purchase. While some operating expenses find their way into budgets and financial reports, other more "soft" OPEX measures such as performance and availability may not. Storage Economics illuminates how new storage architectures can be influential in systematically identifying and reducing storage costs with excellent ROI.

Identifying cost categories that are important to the organization is the first step in assessing the impact of a proposed storage purchase. Once identified, costs must be quantified using concise, deterministic methods, including time values of money saved, internal rates of return (IRR), payback or ROI and net present value (NPV) of future savings. These values allow differences between new and old storage infrastructures to be impartially assessed.

If all elements in the storage economics equation are not taken into account, the real cost of a purchasing decision can be decidedly different than intended. Storage Economics uses measurable techniques that can depict the accurate price tag of storage decisions and help IT leaders systematically reduce these costs over time.

Understanding Key Terms

Hitachi Storage Economics provides the following definitions:

- **Total Cost of Ownership (TCO)** is a method for calculating all costs that will be incurred over the asset's useful life. TCO analysis is used when expansion is anticipated and the financial benefits of two or more proposed solutions must be assessed. The analysis places the total lifetime operating and purchasing costs of the assets side by side for comparison.
- **Return on Investment (ROI)** is a method for calculating the benefits of a particular investment. ROI is effective when challenging the status quo with a proposition to replace an existing solution by analyzing financial pros and cons of a purchasing decision. The ROI analysis would illustrate how much is to be invested, how quickly the investment is to be recouped and what net savings are to be expected.
- **Return on Assets (ROA)** is a method for calculating how profitable an organization is relative to its total assets, or how an individual asset impacts profitability. ROA can be a key metric to justify investments that improve aggregate utilization of IT assets in general, and storage specifically, even beyond the depreciation life of those assets.

How the Adaptable Modular Storage 2000 Family Measures Up

There are various quotes that convey a specific piece of advice: manage or improve only what you can measure. That certainly rings true with Storage Economics. The entire quote comes from one of the leading global experts on quality and performance improvement, Doctor H. James Harrington:

Measurement is the first step that leads to control and eventually to improvement. If you can't measure something, you can't understand it. If you can't understand it, you can't control it. If you can't control it, you can't improve it.

Assessing the economic impact of storage on an organization is a significant part of the technology culture at Hitachi Data Systems. For several years, Hitachi Data Systems has conducted ROI and TCO exercises at hundreds of organizations around the world. This work has led to an astounding data point. On average, for every 12TB of usable disk capacity within the storage infrastructure, there is potential for US\$1million in net operating expense savings. This single data point, which is often sufficient to justify further investigation and economic analysis, is achieved through savings in the categories of outages, labor and administration, maintenance fees, environmental efficiencies, operating efficiency improvements, waste and other categories.

These are the types of dramatic econometrics that can be realized when implementing intelligent storage architectures, such as the Adaptable Modular Storage 2000 family systems. When surveyed by an independent research firm², organizations listed the following top reasons for purchasing the Adaptable Modular Storage 2000 family systems:

- Lower operational expenses (63 percent)
- Higher reliability (57 percent)
- Faster performance (54 percent)
- Better design features (46 percent)

These are among the reasons why Adaptable Modular Storage 2000 family systems are so compelling to analyze through Storage Economics. The three main areas of focus for how the Adaptable Modular Storage 2000 family systems optimize Storage Economics are:

- Operational efficiency
- Utilization
- Price to performance

Increase Operational Efficiency with Hitachi Dynamic Load Balancing Controller and Hitachi Command Suite

Because IT managers are often bogged down with semi-automated or even manual diagnostic tasks, such as mitigating load imbalances, it is important to understand how operational efficiencies

² Source: TechValidate Survey of Hitachi Adaptable Modular Storage Users

can affect TCO. One way operational efficiency is measured is by how well storage assets perform, are managed and scale. Performance, management and scalability, while often considered soft costs of the storage infrastructure, have a real impact on expenses.

The Role of Operational Efficiency in Storage Economics

The Hitachi Adaptable Modular Storage 2000 family automates many of the intricate and time-consuming tasks that storage managers typically face each day in the data center to facilitate better performance and simplify administration. That's because the AMS 2000 family systems employ Hitachi dynamic load balancing controller with integrated symmetric active-active controllers to automatically balance I/O workloads, and Hitachi Command Suite, which provides comprehensive administrative management capabilities.

While many competitor dual controller systems are susceptible to workload imbalances, dynamic load balancing controller automatically spreads the host-to-disk I/O traffic across both controllers. This frees administrators from the need to diagnose and fix performance bottlenecks that can occur at the controllers. In a recent survey of IT organizations using the AMS 2000 family systems, the dynamic load balancing controller design and the symmetric active-active functionality were the overwhelming top contenders for most valuable feature and most innovative feature.³

Symmetric active-active controllers enable a server to send an I/O to its LUN through any host port and do so without a performance penalty. This eliminates the requirement to set an owning controller based on the forecasted workload each time a LUN is created, culminating in simpler LUN management. It also eliminates the need to set primary and failover paths from server to storage that matches the owning controller assignments. This is particularly beneficial in virtualized server environments. For example, virtual machines can be moved between physical machines without regard to how the data paths from the servers to the storage have been set.

Since workloads can change over time, this technology is also beneficial to storage administrators who would typically need to reconfigure their storage. When workloads on other storage systems evolve to put excess strain on a single controller, the administrator must diagnose the problem and move LUN ownership assignments from the hot controller to the underutilized controller. At the same time, the server to storage path assignments must be re-mapped to reflect the LUN ownership changes. The operational efficiency benefit of the AMS 2000 family systems is that this entire process becomes automated by the system, and the controller bottleneck is resolved without any administrative effort.

Likewise, with the integration associated with Hitachi Command Suite, administrators can quickly and easily provision storage for AMS 2000 family systems as well as other systems. Also, many of the repetitive tasks inherent with storage administration are simplified with Hitachi Command Suite. This includes multiple LUN creation, reduced wait time for multiple commands, customizable business-oriented views of storage with smart, task-oriented workflow, and the ability to use the agentless framework for configuration data on hosts. All of this adds up to improved productivity, better performance and further simplification, which results in lower operating costs.

Operational efficiency can be further improved with the AMS 2000 family systems through the streamlined process of updating the system or disk drive microcode. Such updates can be done on

³ Source: TechValidate survey

either AMS 2000 controller while the system is running and without interrupting host I/Os. Seamless updates can even be done when there is a single host bus adapter (HBA) installed on the server.

The Net Value of AMS 2000 Family Systems on Operational Efficiency

AMS 2000 family systems provide operational efficiencies by:

- Eliminating complex and time-consuming administrative tasks
- Self correcting performance-robbing bottlenecks
- Making it easy to provision additional storage to manage growth
- Allowing for comprehensive performance and business-oriented monitoring

Betonwerk Godelmann KG Reaps Efficiency Benefits

Betonwerk Godelmann KG specializes in the production and sales of paving stones. With the growth of the business came the need to upgrade the technology infrastructure. While Godelmann had modern applications such as enterprise resource planning (ERP) and Microsoft® Exchange, the systems on which the applications were running could no longer guarantee reliability. Also, complete backups were extending beyond weekend windows, and space in the server room was severely limited.

In an effort to ensure that the company's IT department can keep pace with the growth in its business, the IT managers decided to completely upgrade their data center. Paving the way for this transition was the Hitachi Adaptable Modular Storage 2100. The revamp included virtualizing the backup server with help from VMware technology to optimize both space in the server room and availability across the data center. The unique architecture of the AMS 2100, which employs Hitachi dynamic load balancing controller feature with symmetric active-active controller technology, allows Godelmann to automatically balance changes in workloads across both controllers and eliminate performance bottlenecks. Godelmann also takes advantage of the flexibility of intermixing drives within the Adaptable Modular Storage 2100, keeping active data on SAS and using the SATA disks to cost-effectively manage backup and trim shelf space by half. Godelmann has also reduced its need for power consumption with the new Hitachi solution.

Driving Utilization Efficiency with Dynamic Provisioning

The utilization efficiency rate is the ratio of used capacity over total capacity for any given system to store data. In the case of storage utilization, higher isn't the only factor to consider for success, and finding the right ratio for optimal cost-efficiency can be tricky.

The Role of Utilization in Storage Economics

Average storage utilization rates across the industry range from 25 to 35 percent. Storage administrators are often reluctant to increase the utilization rates of their storage assets, because pushing to increase utilization can lead to more out-of-space spawned outages or unpopular allocation limits.

Some choose to hedge data growth and costs with more storage systems and lower utilization, since storage capacity can be less expensive than OPEX increases. But provisioning new storage tends to be time-consuming and often requires application downtime, thereby driving up OPEX costs anyway.

Thin provisioning has been one answer to driving better utilization efficiency and business agility. The Hitachi Adaptable Modular Storage 2000 family comes with Hitachi Dynamic Provisioning software, which allows storage to be allocated to an application without actually being physically mapped until it is needed. This "just-in-time" provisioning de-couples the provisioning of storage from the physical addition of storage capacity and, as a result, storage utilization is significantly improved. Organizations that use AMS 2000 family systems with Dynamic Provisioning typically see their utilization rates improved to 65 percent or better. This reduces upfront storage costs as well as energy and floor space costs associated with unused spinning disk.

Zero page reclaim is a feature of Dynamic Provisioning software. With it, the pages of all zeros in a Dynamic Provisioning pool are identified and reclaimed for use again. Pages of zeros are typically created after data is migrated to a new location. Zero page reclaim reduces the consumed capacity of the Dynamic Provisioning pool to further improve storage utilization rates.

The Net Value of AMS 2000 Family Systems on Utilization Efficiency

AMS 2000 family systems provide utilization efficiencies by:

- Helping to safely boost storage utilization rates using virtual storage capacity
- Reducing upfront storage purchases, energy consumption and administrative costs
- Improving administrative efficiencies by reducing time associated with provisioning

Tech Savvy SquareTwo Financial Gains Storage Efficiency

As a leader in the US\$40 billion asset recovery management industry, SquareTwo Financial is a one-of-a-kind organization solely dedicated to making distressed assets whole. Through industry leading asset modeling, which is powered by award-winning technology, their focus is on accelerating financial asset recovery.

With tremendous year-over-year data growth, the existing infrastructure was becoming insufficient and began spawning instability issues. As a company that considers its commitment to technology a competitive advantage, SquareTwo needed a more modern, centralized and better-supported infrastructure to support the evolving data growth.

To keep momentum within its IT infrastructure, SquareTwo implemented Hitachi Adaptable Modular Storage 2500 and Hitachi NAS Platform 3100, powered by BlueArc®, at the main data center and a disaster recovery site for centralized single-pane management of SAN and storage architecture. The environment was enabled with in-system and remote replication, Hitachi Dynamic Provisioning and proactive performance monitoring, all unified through one interface.

For virtual storage capacity and just-in-time thin provisioning, SquareTwo Financial takes advantage of Hitachi Dynamic Provisioning to improve application availability and storage utilization rates. "Previously, we had to find the right amount of space, the right configurations, spindles and such.

Those deeper levels of involvement are no longer necessary. We can provision a brand new box, with cabling, in less than an hour, and provide systems with high availability, high performance disk in a short amount of time," says Ken Vandembark, vice president of IT operations and engineering at SquareTwo Financial.

Procuring Industry Leading Price to Performance with SAS

Understanding how well a storage system performs is germane to anticipating the way throughput demands will be met in the data center. Knowing the cost of performance helps determine the total value of a particular piece of equipment. Price to performance is a ratio of a product's ability to deliver performance for its price, which gives the IT manager a way to reduce hard costs of purchasing the right level of performance.

“We saw immediate value with our Hitachi architecture. The systems continue to run smoothly and without intervention, allowing my team time to work on other priorities. Today, we have outstanding performance, scalability and availability. The Hitachi gear just does the job.”

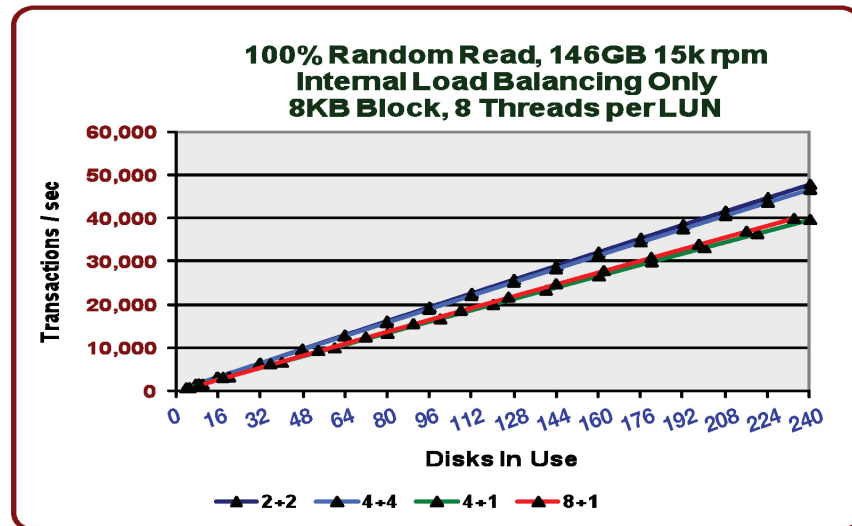
*Ken Vandembark
Vice President of IT Operations and Engineering
SquareTwo Financial*

The Role of Storage Price to Performance

The role of storage performance in particular ties directly to end user productivity and deferral of future hardware purchases, two factors imperative to gauging TCO. Other modular storage systems have limited bandwidth available access the disks. This limitation impacts both of these factors. As more drives are added to competitive systems, administrators find themselves spending more time tuning their systems to spread the I/Os over the limited number of data paths. As performance requirements increase over time, even a perfectly tuned system will reach its maximum performance levels, and adding more disks will not improve the system performance. At that point, another system must be deployed to keep up with the performance needs of the environment.

The Hitachi Adaptable Modular Storage 2000 family uses a highly efficient SAS back end with up to 32 data paths. If more performance is needed, simply add more drives and the AMS 2000 family will take full advantage of the extra I/Os that the drives deliver. Performance scales with capacity and administrators will spend less time tuning their systems to remove back-end bottlenecks. The linear relationship between capacity and performance is shown in Figure 1.

Figure 1. AMS 2000 family systems deliver scalable performance for online transaction processing (OLTP) workloads.



The AMS 2000 family systems are part of a long line of reliable, high performance modular products from Hitachi Data Systems and are specifically designed to address business growth and investment protection needs. In the recent benchmark study by the Storage Performance Council, which measures performance improvement in storage systems, the AMS 2000 family systems outperformed all of the competition. The flexibility and enormous bandwidth of the AMS 2000 SAS architecture delivers the highest performance of any midrange storage system⁴ (see Table 1). Not only does the AMS 2000 family deliver the overall best performance with the AMS 2500, but it also offers lowest price to performance results for all of its systems when compared to other models in their class.

Another benefit of SAS technology is the ability to intermix SAS and SATA disks in the same tray for further cost savings. With other designs, Fibre Channel and SATA drives require their own disk trays, which can negatively impact the tray utilization rates.

⁴ Full report available at www.storageperformance.org/results/benchmark_results_spc1/#hds_spc1

TABLE 1. SPC-1 BENCHMARK SHOWS THE HITACHI ADAPTABLE MODULAR STORAGE 2000 FAMILY SYSTEMS OUTPERFORMING COMPARABLE PRODUCTS FROM IBM AND NETAPP.

	Hitachi Data Systems			IBM			NetApp
<i>Model</i>	<i>AMS 2100</i>	<i>AMS 2300</i>	<i>AMS 2500</i>	<i>DS5020</i>	<i>DS5300</i>	<i>V7000</i>	<i>FAS3170</i>
<i>Controller Type</i>	Symmetric	Symmetric	Symmetric	Asymmetric	Asymmetric	Asymmetric	Asymmetric
<i>SPC-1 IOPS</i>	31,498.58	42,502.61	89,491.81	26,090.03	62,243.63	56,210.85	60,515.34
<i>Price to Performance</i>	\$5.85/IOP	\$6.96/IOP	\$6.71/IOP	\$7.49/IOP	\$11.76/IOP	\$7.24/IOP	\$10.01/IOP
<i>SPC-1 Sustainability Rate (Throughput MB/sec)</i>	258MB/sec	350MB/sec	735MB/sec	214MB/sec	511MB/sec	463MB/sec	497MB/sec
<i>Average Response Time (50% Load Point)</i>	2.67ms	2.70ms	2.88ms	3.91ms	2.95ms	4.19ms	4.16ms
<i>Average Response Time (80% Load Point)</i>	4.80ms	4.05ms	5.02ms	6.64ms	4.41ms	6.74ms	7.51ms
<i>Average Response Time (100% Load Point)</i>	8.15ms	6.33ms	8.98ms	10.49ms	14.37ms	10.80ms	20.80ms

The Net Value of AMS 2000 Family Systems on Price to Performance

AMS 2000 family systems provide price-to-performance value by:

- Improving capabilities to meet SLA and tiered storage requirements
- Outperforming all the major comparable competitor products
- Reducing costs for purchasing and managing multiple disk drive trays

Pixorial Uploads Better Cost per Gigabyte per User

Pixorial is revolutionizing the way customers preserve, store and share memories by remastering old 8mm home movies and forging video books and simulcast uploads with a single click. To ensure optimal digital workflow while meeting exponential growth projections, Pixorial needed to architect a highly dense, very versatile storage environment that would also meet a stringent cost-efficiency business model. The multimedia company wanted to build a storage infrastructure to accommodate the throughput or line speed performance needs of its network topology.

“No one out there is doing what we're doing so we want to have the maximum amount of flexibility, the maximum amount of density and capacity from our storage solution.”

Joshua Terry
Director of Systems Engineering
Pixorial

Pixorial implemented the Hitachi Adaptable Modular Storage 2500 to meet demands for high availability, performance, scalability and data protection with a modular, cost-effective footprint that reduces space, energy and management concerns. The AMS 2500 was fitted with two 1TB SATA high density expansion trays each holding up to 48 drives; two trays of 450GB SAS drives; and the Hitachi NAS Platform 3100C cluster.

The SATA drives are used for the private storage of the digital masters. The entire front end is virtualized. For the production data, Pixorial uses virtual machines sitting on the SAS drives to optimize performance and house an entire cloud infrastructure. The company uses a business cost model to measure the cost per gigabyte per user based on account subscriptions. Therefore, Pixorial is able to exploit cost-efficiencies at every turn, while still providing fast, easy customer offerings.

From a benefits perspective, Pixorial is well equipped to stay ahead of its current growth and strategically manage future expansion. "We wanted to maximize footprint cost-efficiency and performance. Hitachi Adaptable Modular Storage 2500 with high density expansion trays combined with the high performance NAS cluster will help decrease overall costs per gigabyte per square foot," says Joshua Terry, director of systems engineering at Pixorial.

Further Considerations for Optimizing the Data Center

As IT leaders continue assessing their storage infrastructure for healthier econometrics, Hitachi Data Systems offers further options for optimizing the Hitachi Adaptable Modular Storage 2000 family systems.

Wide Striping of Data

Performance bottlenecks can occur whenever too many I/Os are sent to too few disks. This can slow down the performance where it is most needed. This problem can be one of the most difficult types to resolve. The size of the RAID group must be expanded and the data restriped across the additional drives. If this is not possible, then selected LUNs must be moved to a new RAID group that can handle the extra performance requirements.

Hitachi Dynamic Provisioning eliminates this headache by spreading numerous individual I/O workloads over a very large number of physical disks. With Dynamic Provisioning, performance bottlenecks from too much activity on too few disks will disappear, as will the administrative expense from performance and capacity management.

Whenever there is a need to increase the capacity or the performance of the Dynamic Provisioning pool, more drives can be added. The mailboxes will be automatically striped over the new drives to boost performance and the capacity that was moved from the original drives becomes available again for expansion.

Dense Storage Solution

When looking to reduce consumption of high cost data center floor space, storage density plays a contributing role. The AMS 2000 family has a solution with an optional high density disk tray that holds up to 48 SATA or 38 SAS drives in a 4U high package. With more terabytes on a floor tile,

administrators are able to see better efficiencies in their data centers. The dense trays save 60 percent of the space when compared to other leading solutions, and an additional 11 percent of power and cooling costs. With 2TB SATA disks installed in high density trays, a single AMS 2500 can hold nearly 1PB (petabyte) of storage on a single floor tile.

Scalability

What about the scalability of the AMS 2000 family? Designed to transparently expand as business grows, the AMS 2000 family systems will scale capacity to more than 940TB and use data-in-place upgrades to larger models in the same family. The ability to orchestrate extreme levels of scalability without performance degradation enables storage administrators to consolidate large amounts of storage into a single platform and simplify management.

Consolidation

As the number of servers and applications grow, the number of storage systems in a data center can proliferate over time. By replacing multiple systems with a single AMS 2000 family system, the elimination of the OPEX associated with these older systems can provide a rapid ROI. The AMS 2000 family is built to handle large-scale consolidation. The systems can connect to as many as 2,048 servers. The Hitachi virtual host port technology enables multiple servers to attach to the same physical port without allowing access to LUNs that are not owned by the server. Every model in the AMS 2000 family has an option for Fibre Channel and iSCSI multiprotocol connectivity. Both types of storage networks can be consolidated onto a single AMS 2000 family system.

Energy Savings

Data centers have traditionally doubled their power consumption every five years. The AMS 2000 family provides several ways to combat these trends. To battle the continual drain of energy consumed to spin disk drives, cool heat output and manage growth, Hitachi Power Savings offers proven practices for reducing power consumption and associated costs. The service enables host-based execution of spin-up and spin-down commands for designated disk drives. This helps to instantly reduce both the power consumption of the system and the amount of heat dissipated into the data center.

The internal fans in every controller and disk tray operate at variable speeds, from 4,000 rpm to 10,000 rpm. The fan speed will adjust according to the internal temperature of the unit in order to save energy consumption whenever it is not needed. The power supplies of the trays also have built-in intelligence to efficiently provide power at the required level with a small buffer.

Data Drives Our World

Data drives our world. And information is the new currency. Send it. Receive it. Store it. Manage it. Process it. Protect it. Use it. Information has become our most valuable asset. The challenge for global businesses lies in making information both available and secure. Hitachi Data Systems solutions help organizations transform raw data into valuable information by delivering on the vision that IT must be virtualized, automated, cloud-ready and sustainable.

Customers trust Hitachi Data Systems to protect their data, the raw resource that lies at the heart of their businesses, whether they are in financial services, healthcare, media, entertainment, retail,

manufacturing and so on. Every industry has been transformed or is being transformed. Perhaps the most common thread running throughout is the value and importance of data and, by extension, information, which is data with meaning, context and value.

For More Information on Storage Economics

The Adaptable Modular Storage 2000 family offers a surplus of operational efficiency, high utilization and excellent price to performance. It maximizes Storage Economics considerations for IT administrators. For more information on Hitachi Storage Economics or the Adaptable Modular Storage 2000 family, please visit www.hds.com.

For a more thorough discussion of storage economics, refer to "A Primer on Storage Economics" (by David Merrill, Hitachi Data Systems, 2008), which is available at www.hds.com/assets/pdf/primer-on-storage-economics.pdf.

 **Hitachi Data Systems Corporation**

Corporate Headquarters

750 Central Expressway
Santa Clara, California 95050-2627 USA
www.hds.com

Regional Contact Information

Americas: +1 408 970 1000 or info@hds.com
Europe, Middle East and Africa: +44 (0) 1753 618000 or info.emea@hds.com
Asia Pacific: +852 3189 7900 or hds.marketing.apac@hds.com

Hitachi is a registered trademark of Hitachi, Ltd., in the United States and other countries. Hitachi Data Systems is a registered trademark and service mark of Hitachi, Ltd., in the United States and other countries.

All other trademarks, service marks and company names in this document or website are properties of their respective owners.

Notice: This document is for informational purposes only, and does not set forth any warranty, expressed or implied, concerning any equipment or service offered or to be offered by Hitachi Data Systems Corporation.

© Hitachi Data Systems Corporation 2010. All Rights Reserved. WP-393-A DG December 2010