The Economics of Hitachi Command Suite

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Hitachi Storage Solutions

Hitachi Data Systems

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Executive Summary

Managing data storage environments in economically challenging times is difficult: data grows, complexity and risk grow, but budgets do not. IT leaders are looking for tools to adeptly manage through the extensive list of administrative tasks, across sprawling virtual environments and under resource constraints. Hitachi Command Suite v7.0 is a comprehensive and tightly integrated toolbox that equips organizations to transform sluggish, siloed and often inefficient assets into a cohesive agile data center of resources.

Command Suite uniquely employs 3 dimensions of management to ensure that organizations are able to cost-efficiently manage all data types while reducing costs. Command Suite also comprises 8 distinct Hitachi products that interoperate as a unified management platform: Hitachi Command Director, Hitachi Device Manager, Hitachi Tuning Manager, Hitachi Dynamic Provisioning, Hitachi Dynamic Tiering, Hitachi Tiered Storage Manager, Hitachi Dynamic Link Manager Advanced and Hitachi Replication Manager.

Hitachi Data Systems Storage Economics investigates 34 cost elements that help lower the total cost of ownership (TCO). By examining the economic benefits of 3D management, each component within Command Suite, and the aggregate benefits of Command Suite, Storage Economics provides tangible ways to increase data center agility and availability while lowering risk and costs.

Introduction

Commerce today seems to have no such status as "unplugged." Information touches most every-thing and now everything is connected. The challenge comes in managing it all against a backdrop of fluctuating global economic conditions and the urgency to do a great deal more with less, and within increasingly aggressive timelines. Mitigating both financial and technological risks is critical to being able to control and protect critical business information. But with so many mergers and acqui-sitions, new data requirements, increased competition and mandates, risks are inherent.

For the storage industry, much of the risk lies in being able to adeptly manage this new "information economy." The amount of information demanding nonstop accessibility, long-term archival and re-tention compliance is growing at astronomical rates. In fact, the IDC calculates that 486 exabytes of digital information have existed in the world since late 2008. That equates to 486 billion gigabytes, a number that doubles every 18 months.[1] And by today's standards, that usually means information also needs to be securely accessible anywhere, anytime, on any device.

Manage Storage in the Information Economy

For the storage administrator working in the information economy, the emphasis is on reducing risk, costs and complexities across the data infrastructure, which ultimately affects the business orga-nization as a whole. From rapidly changing or increasing business demands and new data require-ments to plummeting budgets, aging equipment and subsequent resource constraints, administra-tors are continually under pressure to solve very complicated issues. Power, cooling and footprint consumption are at a premium for older storage boxes, as are the costs to maintain them. Finding ways to spend less usually requires newer technologies, but finding dollars for capital expenditures is difficult, too. Older or inefficient storage architectures often yield poor utilization rates, data dupli-cation and access issues, and greater expenses for storing stale data.

From storage implementation to reporting, the cycle and length of storage administrative tasks steadily expand in order to accommodate ever-changing data demands. Here is a brief look at some of the activities a storage administrator is handling on any given day:

- **Storage implementation —** installation, testing, certifying, basic integration and getting the environment up and running
- **Planning —** identifying path-dependent devices, reducing impacts of unplanned downtime and troubleshooting, and correlating events to applications and dependencies
- **Configuration —** reaching across file, block, content and application environments; performing searches and data entry related to devices, ports and worldwide networks; mapping configu-rations for Microsoft SQL Server, Oracle and file server environments; identifying out-of-date switches, directors, host bus adapters (HBAs), firmware and changes in SAN configurations
- **Data movement —** managing the movement of data across tiers, environments, etc.
- **Policy definition —** managing service level agreements (SLAs) across business units and ap-plications

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[1] Source: "As the Economy Contracts, the Digital Universe Expands," IDC, May 2009.

- **Storage management —** consolidation planning and deployment; recovering from and reconfiguring after disasters; capacity growth planning and new capacity provisioning; learning new storage management tools; dealing with server growth and virtual machine sprawl; database management; provisioning for the SAN; backup, snapshots and replication changes; chargeback accounting; and safeguarding access to resources, audit trails and reports

- **Reporting —** tracking storage capacity; entering daily usage statistics (metering); checking hosts for reachable storage system capacity; policing users for excessive disk consumption; identifying and isolating storage-related performance problems; and entering performance stats for further trending and forecasting

With such burdens to bear, it is hard to believe that storage administrators are still doing many of these tasks manually. As the gap between managing business information and achieving cost efficiencies continues to widen, IDC estimates the annual cost of managing storage is about 60% of all enterprise storage-related spending.[2] Simplifying administration requirements in the information economy is important to reducing capital expenditures (CAPEX), operating expenditures (OPEX) and lowering the total cost of ownership (TCO) for storage infrastructure.

Help Create a New Vision of Data Center Reality

Hitachi Data Systems is diligently focused on creating a new vision of reality in the data center, one that empowers organizations to actually address the myriad of storage challenges and effectively stay in front of information obligations. As the world's only vertically integrated storage company, Hitachi is helping organizations create agility in the data center using essentials such as virtualization, automation, cloud enablement and sustainability.

This is evidenced with the evolution of Hitachi flagship platforms, chiefly the Hitachi Universal Storage Platform® V and the Hitachi Virtual Storage Platform. Built upon the principles of economically superior storage architecture, these enterprise platforms extend the IT organization's ability to:

- Scale performance and capacity based on business need

- Reduce administrative costs with simplified management

- Move and tier data based on information value

- Migrate in and out of new and existing platforms with ease

- Do it all faster, cheaper and easier than with other products

Having one platform for all data helps IT leaders satisfy the data center's unending demand for generating, sharing, retaining and accessing important information. All forms of data and their corresponding workload demands can then be unified and controlled. Top down, bottom up, end to end, Hitachi solutions are built to seamlessly integrate as a unified, virtualized and scalable data management architecture for all open systems and mainframe platforms, and all data and information types. This federated approach is in stark contrast to many vendors with discrete products and tools for different data types or silos. By simplifying, unifying and building flexibility into every Hitachi solution, organizations can take advantage of lower operating costs, greater availability and fewer risks.

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[2] Source: PPT, "IDC Industry Development and Models: The Economic Meltdown and Its Chilling Effect on the Cost to Power, Cool and Manage Enterprise Storage"

Once again, Hitachi Data Systems is moving the bar with differentiating must-have functionality, this time with Hitachi Command Suite v7.0 software. Designed to provide that one platform for managing all data, Command Suite embraces the essential capabilities necessary to transform even the most convoluted data infrastructure, for enterprise, for file and content, and in modular environments. Delivering a new customer experience with 3 dimensions of storage management, Command Suite allows organizations to manage up, manage out and manage deep. *Managing up* enables IT to unify scalability of large infrastructures and application deployments. *Managing out* provides a single framework for the span of storage, servers and IT infrastructure. *Managing deep* relates to the levels of integration within the Command Suite for highest levels of operational efficiency. The enterprise can reduce CAPEX, OPEX and ultimately TCO in the data center, along with the equipment footprint, by allowing optimal infrastructure growth in all dimensions.

The benefits of creating a more agile data infrastructure through the deployment of Command Suite include:

Hitachi Command Suite Lowers Costs and Complexity

A large enterprise professional services company selected their Hitachi Virtual Storage Platform over competing products for the following reasons:

- Lower cost of ownership
- Simplification of storage management
- More storage consolidation

Source: TechValidate ID 617-9C5-089

- Private cloud enabled storage management
- Improved scalability and performance
- Enhanced and simplified usability and workflow
- Greater ease in managing and sharing across multiple storage systems
- Automated page-based tiered storage capabilities
- Business unit dashboard

To better understand the value of having unified storage management in the data center, Hitachi Data Systems recommends that customers take a look at the true costs associated with their infrastructure investments and operations. Channeling customers through this maze is Hitachi Data Systems Storage Economics.

The Role of Hitachi Data Systems Storage Economics

Hitachi Data Systems Storage Economics has the depth and breadth of experience to assign value to what is happening across the storage infrastructure. With a successful record of helping IT administrators identify and capitalize on the long-term value of storage purchases, Storage Economics begins with a framework for thoroughly assessing TCO. Using financial metrics and calculable techniques to illuminate cost efficiencies, Storage Economics is able to determine accurate hard and soft costs associated with storage decisions, and ultimately assist IT leaders with proven measurable or quantifiable ways to reduce TCO and improve the return on assets.

In order to zoom in on cost efficiencies and opportunities for greater agility in the data center, it is important to know how and what to measure. Storage Economics provides the business acumen and extensive experience necessary to navigate the often unpredictable, overwhelming challenges that so many enterprises are facing. Assessing the efficiencies, technologies and integrative capabilities of Hitachi Command Suite is an important step to understanding how it may help meet high-priority business and IT drivers, such as cost savings and operational effectiveness.

Key Terms

- **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.

- **Capital Expenditure (CAPEX)** is the cost of purchasing or extending the useful life of a fixed or physical asset, such as equipment or property.

- **Operating Expenditure (OPEX)** is the ongoing expense of managing, supporting, maintaining and upgrading a system over its lifespan. These expenses may include the electricity to power it, as well as administrative labor and related day-to-day costs incurred by the system to support the business.

- **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.

Cost Elements to Consider

In its probe of Hitachi Command Suite 7.0, Storage Economics evaluates 34 various cost elements of storage TCO, which are not necessarily equal in weight, importance or time relevance, but important to better understanding the true cost of storage infrastructure. IT planners usually select between 6 and 10 of these hard and soft costs to create their own TCO baseline, based on business needs. The critical value of citing cost elements is to help the IT organization develop and implement a plan for reducing TCO.

Storage TCO cost modeling is likely to be inclusive of the entire storage infrastructure, not just storage devices or systems. So many of the cost elements can be derived from backup, SAN, remote and local circuits, tape systems, and management or monitoring consoles. In fully probing the value of Command Suite, Storage Economics methodology will list applicable costs from the general list of 34 that are addressed and reduced by each product. The following are descriptions are Storage Economics costs relevant to the Command Suite 7.0:

Procurement Impact

- Capital costs, lease expense for hardware and software
  - Storage hardware (and software), when depreciated, incurs a capital cost at the time of purchase. Each year after (during the depreciation term), the depreciation expense continues to be recognized on "the books" or the accounting system. Capital costs are up front, in that the payment is made one time. However, the annual depreciation costs are still a real factor for IT accounting, even if the cost is not seen as a real expense in that year.

- Cost of growth
  - Most storage infrastructures are in a constant state of capacity growth. Data is not static. Growth is not zero. Therefore a key cost component requires the inclusion to grow, or show the growth (at the margin) for the next period of time.
  - Some architecture is inexpensive to initially purchase, but is not so flexible in growth or cost-effective in the fluid nature of growth.
  - This cost needs to be correlated with the cost of waste. Having 20% to 40% reserve on hand does not constitute an effective growth program. Reducing the cost of waste and the cost of growth are mutually inclusive strategies.

- Cost of waste
  - The cost of waste is a sub-element of capitalization expense or lease expense, but is the portion of the total asset that is not being used. The reasons for underutilization vary, but the fact is that poor utilization exists and needs to be addressed. Sources include:
    - Usable but unallocated capacity (waste or reserve)
    - Allocated but unwritten to capacity (white space)

    This can be due to:
    - Underlying architecture
    - Multiple systems, tiered islands and segmented IT solutions
  - Increased waste equates to lower ROA

    Cost of waste (as a percent of the capital expense) can be 40% to 50% or higher.

Management, Operations, Lifecycle

- Storage management labor
  - Labor to manage, engineer and support the storage infrastructure can often be one of the largest cost components over time. It is common to see labor cost make up roughly 20% to 30% of storage TCO.

- Cost of monitoring
  - This includes computer systems and software needed to monitor the status and health of the SAN, storage, networks, backup systems, etc.
  - Monitoring is an overhead cost and should reduce the downtime or incident rate, providing higher quality of service (QoS) to the application and end user.

- Cost of data mobility
  - Data has a lifecycle (which is considered information lifecycle management or ILM) during which the age, value or nature of the data may require different quality and cost factors to accommodate the data. Moving data to different tiers (promotion and demotion) can be a difficult and time-consuming task. Sometimes the effort and cost is high enough to keep the data in its original location for the life of the data.
  - Moving data over time is a key element in lowering the cost of growth, and putting data in the right cost tier at the right time. Data movement capabilities need to be fluid and require as little human intervention as possible.

Environment

- Power consumption and cooling
  - Powering and cooling storage infrastructure components take energy, and energy costs money.
  - For most of the world, the power and cooling costs over 4 years will be as much or more than the original purchase price of the storage asset.
  - On a cost/TB/year basis, power and cooling tends to represent 15% to 30% of the storage TCO.
- Data center floor space
  - Floor space costs tend to be 4% to 8% of the storage TCO.

Business Impact

- Cost of performance
  - The cost of good or poor performance can be an attribute for most storage architectures. Including the performance metric in the cost modeling can help justify additional features and capabilities that help deliver the needed performance levels. Examples of storage features that assist with high-performance computing and storage include solid state disk (SSD), RAID mirroring, high-speed Fibre Channel or Ethernet, controller cache, etc.
  - Performance can be more than a qualitative feature or function. Performance can often be converted to revenue or business loss.
  - For some, increased performance equals increase revenue or increased profits where time is money.
- Cost of provisioning
  - The time and effort spent to provision storage (to a server) can cost the organization money. If a project has to wait for resources to be allocated (terabytes of capacity, SAN ports) then there can be negative impact to project schedules, developer's time, and internal and external resources. From the time a request is submitted until the capacity is presented to the server, several weeks can elapse.
- Cost of outage
  - These include costs associated with scheduled or unscheduled outages.
  - IT often requires scheduled maintenance outages to upgrade hardware or software. Although scheduled in advance, in today's modern 24/7 environment, this can cost the company in terms of revenue, business-to-business (B2B) access, or at a minimum, an opportunity loss cost.
- Minimizing or reducing scheduled outages can impact the IT and business with potential for higher revenues, improved customer satisfaction and reduced opportunity loss.
  - Unscheduled outages tend to have a bigger negative impact related to costs, such as opportunity cost, risk, revenue and wasted company resources.
  - This cost category deals with outage at the machine or infrastructure level. This can be:
    - Hardware failure (storage systems, filers, tape libraries, gateways)
    - Software or application failure

- Network failure
- Applications and database

General Risk

- Data loss
  - Previous cost categories have characterized outage risk, outage time and missing opportunities to recover data and systems to a full operational level in the case of a significant event. This cost area deals with the impact when data is lost or corrupted (beyond use) and is not recoverable.
  - Data loss can be the result of numerous events. The root cause can include poor backup coverage, sabotage, cyber attack, double disk failure, etc.
- Recovery time objective (RTO) and recovery point objective (RPO) costs
  - These include the impact of meeting or missing RTO
  - Similarly, RPO being met or not being met has a business impact to the company.
- Cost of disaster risk, business resumption
  - Disasters can pose a clear and measurable business risk to the organization if business operations cannot resume after the disaster strikes. This cost estimates the risk of outage (in monetary terms) for the time it takes to resume basic IT operations.

Data Protection

- Cost of copies
  - Copying data or databases is a common practice to provide:
    - Data protection
    - Rapid recovery in the event of an outage
    - Data source for data marts, data warehouses
    - Test and development
  - A production database may be copied 5 to 8 times, and even much higher in some situations.

A Note about Virtual Server Sprawl

Allowing the number of virtual machines to grow exponentially can quickly unravel any cost efficiencies that IT might be realizing. Virtual server sprawl is the proliferation of virtual machines without sufficient IT control to manage the virtualized infrastructure. Applications require processing, memory, storage and networking, regardless of whether or not they are contained in a virtual machine, so the more virtual machines the more resources and costs.

Enterprises with VMware deployments require management tools that will alleviate these issues while simplifying the virtual server environments. For IT groups looking to provide the delivery of flexible, cloud-like services, VMware implementations must include tighter integration between the storage layer and the rest of the application delivery stack. To control CAPEX and OPEX across the data infrastructure, organizations need to escalate the efficiency of growing the VMware storage architecture. To keep business continuance and disaster recovery capabilities strong, the storage environment must integrate seamlessly with various VMware functionalities.

When implemented and managed effectively, VMware storage environments certainly provide

nimble, flexible application delivery capabilities. Hitachi Command Suite generates a holistic way to integrate storage management with the overall VMware management system while shaving away complexities and the hidden costs of inefficiencies typical of virtual server sprawl environments.

What Are the Tools for Change?

Hitachi Command Suite takes the leap forward in creating sweeping cost efficiencies and administrative simplification with an advanced toolset that unifies visibility and manageability across virtualized environments. The key to capitalizing on these technologies is Command Suite's breakthrough 3D management.

3D Management

Hitachi Command Suite v7.0 delivers a 3D management platform to lower CAPEX and OPEX costs and efficiently manage all data types for the agile data center. With end-to-end reporting and management to maximize utilization of IT assets and tight integration for virtual tiered storage and server environments, Command Suite improves business application availability and performance, and expedites access to critical data.

Manage Up
By managing up with Command Suite, the IT administrator is able to automate data placement for higher performance and lower costs. Through a common interface that tightly integrates both virtual tiered storage and server environments, Command Suite manages up to 5 million logical objects and scales to 247PB of virtualized capacity. Administrators can manage large storage resource management deployments with agentless technologies and scale up virtual server deployments by eliminating shared resource contention and improving performance.

The business value of managing up is realized with the alignment of business application needs and costs, an increase in storage utilization up to 50%. Significant CAPEX and OPEX savings are achieved by moving data to lower cost tiers, automatically, by policy to support service level agreements.

Manage Out
By managing out with Command Suite, the IT administrator is able to unify block, file and content data across all Hitachi storage and manage all virtualized heterogeneous storage assets. Command Suite provides a single tool to manage all Hitachi and other-vendor storage within a Hitachi virtualized environment. It facilitates end-to-end visibility and enables the user to correlate applications, virtual machines, virtual servers and logical storage devices, for both traditional and VMware environments, inside one management framework. A base logical construct that can be leveraged across all Command Suite storage functions provides the flexibility to map to any company's business. As a result, the simplified efficiencies gained by such a methodology translate into reduced management costs. This also can reduce costs associated with manual approaches and inherent human error.

Companies are required to provide better accountability for consumed resources, so it is imperative that the deployment of such controls be simplified. The simpler the implementation, the lower the

Hitachi Virtual Storage Platform Selected by IT to Simplify Storage

Sixty percent of IT organizations purchased the Hitachi Virtual Storage Platform, which comes standard with Hitachi Command Suite, over competing products because of simplification of storage management.

Source: TechValidate ID 677-5A8-198

overall costs of deployment. The cost efficiencies gained by implementing a storage management strategy that leverages a persistent logical construct for provisioning, migration, replication and reporting (for service level objective or SLO management and metering), can best be illustrated by the Command Suite screenshots in Figures 1 and 2.

Figure 1. The logical construct on the left of the screen is shared construct and persistent across all Command Suite components. It is used for performance SLO management.
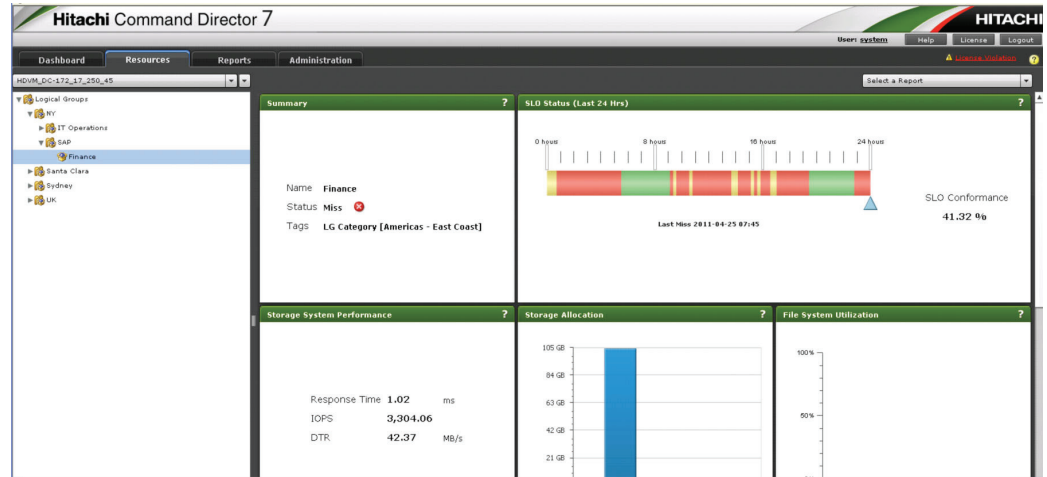

Figure 2. The logical construct is also used to meter (and/or enable chargeback for) individual lines of business capacity consumption.

The business value of managing out materializes through effective and efficient monitoring and planning of resources for virtual server farms, and the ability to consolidate and orchestrate multivendor storage management for less complexity and expense.

Manage Deep

Command Suite manages deep to help IT staff expertly manage data center complexities. Persistent logical grouping and consistent management operations collectively reduce human errors, improve business agility and establish better management practices. A common GUI and data repository facilitate easier operation between activities while improving task workflows. Deep integration through the suite of technologies allows for the highest levels of operational efficiency.

The business value for managing deep is being able to reduce management steps by up to 50% for graphical user interface (GUI) based operations. This allows faster provisioning, simpler operations and reduced deployment times. Organizations gain more liberal business agility and reduce IT risks.

Hitachi Command Suite Technology Components

To further appreciate the overall cost benefits of Hitachi Command Suite, let's now examine an overview of each technology product within the software suite. Organizations derive business value in the form of administrative savings from each of these elements as well as from the collective solution.

Hitachi Command Director

Hitachi Command Director provides centralized reporting and management of Hitachi storage environments with comprehensive business application views and integration of key performance and capacity statistics. Command Director makes it easy for all users, from executives to administrators, to align business objectives to storage. This includes monitoring storage assets, improving storage utilization, ensuring that business applications adhere to storage service levels, and detecting problems early to avoid performance bottlenecks.

Hitachi Device Manager

Hitachi Device Manager facilitates the management of multiple Hitachi storage systems for unified, simpler control of open and shared environments. Device Manager improves business agility with continuously available views and rapid deployments of storage resources. It simplifies configuration-related procedures and automates storage management processes to reduce overhead costs. Able to quickly discover configuration attributes, Device Manager allows users to proactively and remotely manage complex, heterogeneous storage via an intuitive GUI.

Hitachi Tuning Manager

Hitachi Tuning Manager uses advanced reporting and analysis tools to comprehensively monitor performance of storage resources from application through to storage logical devices. It also provides troubleshooting and capacity forecasting for Hitachi virtualized storage environments. Tuning Manager makes it easier to manage storage growth with proactive alerts, correlation analysis tools and support for virtual server farms. Administrators can rapidly improve decision making and capacity planning, as well as increase terabytes per storage manager ratios.

Hitachi Dynamic Provisioning

Hitachi Dynamic Provisioning is a thin provisioning technique that provides virtual storage capacity and maximizes performance by provisioning only what is used; it uses capacity only when required

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Hitachi Command Suite Simplifies Storage Management

A large enterprise telecommunications services company selected their Hitachi Virtual Storage Platform over competing products for the following reasons:

- Simplification of storage management
- Reduction in space and energy consumption
- Ease of migration

Source: TechValidate ID 3CC-DDA-BE5

by applications. Dynamic Provisioning improves the responsiveness to new storage demands without downtime, helps organizations defer or eliminate additional capacity purchases and expedites lower TCO.

Hitachi Dynamic Tiering and Hitachi Tiered Storage Manager

Hitachi tiering software facilitates data movement among heterogeneous storage, volumes and sub-LUN levels, in a way that is transparent, automated and interactive. Hitachi Dynamic Tiering combines with Dynamic Provisioning and virtual tiered storage to shift data to the right cost levels. Hitachi Tiered Storage Manager allows administrators to accurately match application QoS requirements to storage system attributes. Together, Hitachi tiering technologies simplify storage administration and give top tier performance to information stored primarily on less expensive tiers.

Hitachi Dynamic Link Manager Advanced

Hitachi Dynamic Link Manager Advanced provides robust multipath SAN connectivity between servers and storage systems. In this way, Dynamic Link Manager Advanced delivers fault-tolerant failover, failback and load balancing; it centralizes and simplifies path management for greater information access, usability and availability. Collectively, these activities improve administrative productivity and control while protecting data availability.

Hitachi Replication Manager

Hitachi Replication Manager simplifies complex data replication tasks, guarantees availability of data and applications in open systems and mainframe environments, and orchestrates configuration management for local and remote systems. Replication Manager upholds security with role-based user access control and multiple-user access control, and it allows administrators to schedule and automate configuration of replicated data volume pairs.

Product Economics of Hitachi Command Suite

Each of the components within the Hitachi Command Suite has unique product benefits that lead to administrative task improvement and map to specific cost savings.

Map Product Benefits of Hitachi Command Director to Cost Savings

Storage Economics has identified cost reductions associated with the Hitachi Command Director benefits shown in Table 1.

TABLE 1. HITACHI COMMAND DIRECTOR BENEFITS AND COST REDUCTIONS

Product Benefit	Description	Storage Economics Costs Reduced	How?
Centralized storage reporting and monitoring	Allows administrators to interpret data from across the storage infrastructure to optimize environments with a unified view of storage configurations, performance, capacity, tiers, policies and paths	• Capital costs for hardware and software purchase • Storage management labor • Cost of monitoring • Cost of growth	The centralized view provides a streamlined approach to analyzing the health of a storage environment, and the use of templates and policy-based management ensures best practice deployment and management. This reduces storage management labor costs, training, complexity and disruption associated with disparate reporting systems.
Alignment and correlation of storage resources to business applications and business needs	Groups storage resources by hosts, applications, business units and other user-defined groups for customized, meaningful visibility and re-porting (I/O, reads and writes, response times and utilized capacity) Ensures that service level agreements are met	• Storage management labor • Cost of monitoring • Cost of growth • Cost of performance	Use existing systems more effectively. Improve storage utilization and just-in-time purchasing. Fully leverage existing resources, including Hitachi and third-party products, to reduce capital and op-erational spending for speedy investment recovery.
Verification of application-based storage service level objectives	Ensures that policy-based storage tier management can be implemented to rapidly meet changing business re-quirements	• Capital costs for hardware and software purchase • Storage management labor • Cost of monitoring • Cost of growth • Cost of performance	Reduces the need to purchase or develop special-ized, in-house or custom storage management monitoring and reporting tools to manage across the environment Saves on costs associated with additional software or hardware and administration
Proactive monitoring	Proactive monitoring of com-pliance SLAs and resources to minimize downtime and disruptions	• Capital costs for hardware and software purchase • Storage management labor • Cost of monitoring • Cost of growth • Cost of performance	Reduces risk and business impact Improves storage management effectiveness Reduces administrative costs associated with training and monitoring

The competitive differentiators of Command Director include:

- Statistics are usually stored across several management tools with integration that fosters big-picture visibility (i.e. statistics assimilated into a single repository for a holistic single view across the environment)
- No host agents, including virtual machines
- Executive-level dashboard

Map Product Benefits of Hitachi Device Manager to Cost Savings

Storage Economics has identified cost reductions associated with the Hitachi Device Manager benefits shown in Table 2.

TABLE 2. HITACHI DEVICE MANAGER BENEFITS AND COST REDUCTIONS

Product Benefit	Description	Storage Economics Costs Reduced	How?
Storage management and organization	Manages storage from a logical perspective, along lines of business and/or departments	• Capital costs for hardware and software purchase • Storage management labor • Cost of monitoring • Cost of growth • Cost of performance	Consolidates storage management for all Hitachi storage systems, improving productivity and reducing capital and operational costs associated with multiple interfaces Improves efficiency and utilization, which directly impacts ROI and ROA
Intuitive GUI and command line interface (CLI) with tight storage integration	Simplifies and speeds management for tiered storage and virtual server environments	• Storage management labor • Cost of provisioning • Cost of outage • Cost of monitoring • Cost of growth • Cost of performance	With the intuitive interface, administrators can easily and rapidly deploy storage resources to meet business and application needs. This reduces costs associated with configuration and business disruption. The tight integration allows for proactive alerts to identify storage system issues before problems occur to reduce costs associated with downtime and business disruption.
Multiple management views	Views include physical, logical, host, NAS head and virtual server for provisioning, as well as storage pooling for primary and secondary storage	• Capital costs for hardware and software purchase • Storage management labor • Cost of monitoring • Cost of growth • Cost of performance	Offers multiple, comprehensive management views Reduces the need to purchase or develop specialized, in-house or custom storage management monitoring and reporting tools to manage across the environment and get the level of detail necessary to optimize a system Allows administrators to use existing systems more effectively and only purchase additional resources when necessary, which delays capital outlay
Centralized management	Manage across all Hitachi storage, with end-to-end reporting and management for maximizing asset utilization, as well as immediate visibility of storage usage and availability	• Capital costs for hardware and software purchase • Storage management labor • Cost of outage • Cost of monitoring • Cost of growth	Employs centralized management Improves IT productivity through consistent administrative operations across storage platforms Simplifies procedures linked to the configuration and management of storage Automates many management processes, reduces management time spent on storage operations, decreases the risk of human error, and facilitates more efficient use of existing resources to manage significantly more storage Through its centralized view reduces costs associated with storage management, labor, training and costs arising from multiple software interfaces

Map Product Benefits of Hitachi Tuning Manager to Cost Savings

Storage Economics has identified cost reductions associated with Hitachi Tuning Manager benefits shown in Table 3.

TABLE 3. HITACHI TUNING MANAGER BENEFITS AND COST REDUCTIONS

Product Benefit	Description	Storage Economics Costs Reduced	How?

Proactive monitoring and performance analysis	Provides the ability to correlate performance of network resources from the application through to logical storage devices, including hosts, file systems, databases, SAN switches and Hitachi storage systems
	
	Enables end-to-end visibility and quick identification and isolation of problems related to performance, capacity, latency and critical thresholds
		• Capital costs for hardware and software purchase
		• Storage management labor
		• Cost of provisioning
		• Cost of outage
		• Cost of monitoring
		• Cost of growth
		• Cost of performance
			Supports higher storage performance and capacity utilization with proactive management
			  • Improves business productivity and planning
			  • Reduces administrative and excess capital costs.
			Proactively monitors the storage environment
			  • Speeds the identification and resolution of storage performance and capacity problems
			  • Eliminates storage capacity overruns and costs associated with unnecessary business disruption
			Supports faster application deployment through planning and forecasting of adequate storage resources via actual usage patterns; allows administrators to reduce business risk, downtime and associated costs

Seamless integration with major business applications	Includes integration with Oracle, IBM® DB2®, Microsoft SQL Server, Microsoft Exchange and virtual server environments, such as VMware	• Storage management labor • Cost of outage • Cost of performance	Ensures SLAs by properly monitoring application performance from the application through to the storage logical devices Delivers automated alerts when utilization and/or performance exceed critical or predefined thresholds; reduces costs associated with performance and business disruption
Reporting flexibility	Provides the ability to deliver predefined reports and custom reporting	• Storage management labor • Cost of monitoring • Cost of performance	Enables more effective use of administrative resources through specialized reporting, monitoring, forecasting and troubleshooting Makes use of flexibility to help improve productivity and associated storage management costs

The competitive differentiators of Tuning Manager include:

■ Tightly integrated and centralized tools alleviate the typically labor-intensive and often inefficient performance monitoring tasks of traditional storage resource management practices.

■ End-to-end visibility and proactive notification help eliminate storage performance bottlenecks and improve capacity forecasting capabilities.

Map Product Benefits of Hitachi Dynamic Provisioning to Cost Savings

Storage Economics has identified cost reductions associated with Hitachi Dynamic Provisioning benefits in Table 4.

TABLE 4. HITACHI DYNAMIC PROVISIONING BENEFITS AND COST REDUCTIONS

Product Benefit	Description	Storage Economics Costs Reduced	How?
Thin provisioning/Zero Page Reclaim	Automatically allocates storage to an application without it being physically mapped until used or needed and reclaims storage capacity that has been allocated but unused by applications	• Capital costs for hardware and software purchase • Cost of provisioning • Cost of growth • Cost of performance • Cost of waste • Cost of copies • Power consumption and cooling • Data center floor space	Thin provisioning frees up allocated but unused storage and significantly reduces the ongoing physical capacity requirements for a given application. As a result, storage utilization rates improve, capacity purchases can be deferred and the entire storage system is tuned for maximum efficiency. Also, the reduction in physical disk requirements provides savings in space, power and cooling requirements.
Overprovisioning	Allows administrators to safely exceed the amount of storage that is physically installed	• Capital costs for hardware and software purchase • Storage management labor • Cost of provisioning • Cost of growth • Cost of performance • Cost of waste • Cost of copies • Power consumption and cooling • Data center floor space	Overprovisioning and just-in-time provisioning allow IT to better manage service requests for storage and control utilization of storage resources, avoiding the need to overpurchase static storage to meet allocation requests.
Virtualized capacity pooling	Creates a common pool of internal and externally attached heterogeneous storage	• Capital costs for hardware and software purchase • Storage management labor • Cost of provisioning • Cost of growth • Cost of performance • Cost of waste • Cost of copies • Power consumption and cooling • Data center floor space	Via virtual capacity pooling, allows IT to defray, defer or eliminate storage disk purchases Simplifies performance optimization by transparently spreading many individual application data sets across many physical disks; reduces performance management concerns and optimizes performance and throughput
Nondisruptive expansion	Allows physical storage to be added to the storage system or environment without disruption operations	• Storage management labor • Cost of growth • Cost of performance • Power consumption and cooling • Data center floor space	When needed, more physical storage disk can be added into the Dynamic Provisioning disk pool, simply and nondisruptively. This decoupling of physical resource provisioning from application provisioning simplifies storage management, reduces application outages, saves time and keeps costs down.

The competitive differentiators of Dynamic Provisioning include:

■ Application storage provisioning is simpler, faster and less demanding than traditional provisioning.

■ Administration for provisioning storage capacity is efficient.

Map Product Benefits of Hitachi Dynamic Tiering and Hitachi Tiered Storage Manager Software to Cost Savings

Storage Economics has identified cost reductions associated with Hitachi Dynamic Tiering and Hitachi Tiered Storage Manager software benefits as shown in Table 5.

TABLE 5. HITACHI DYNAMIC TIERING AND HITACHI TIERED STORAGE MANAGER BENEFITS AND COST REDUCTIONS

Product Benefit	Description	Storage Economics Costs Reduced	How?
Easily and interactively matching application requirements to storage system characteristics	Application-driven price, performance and availability are matched to storage characteristics such as LUNs and sub-LUNs	• Capital costs for hardware and software purchase • Storage management labor • Cost of monitoring • Cost of performance • Cost of growth • Cost of provisioning • Cost of waste • Cost of copies • Power consumption and cooling • Data center floor space	Hitachi Dynamic Tiering and Tiered Storage software allow storage administrators to simplify the task of optimizing the storage infrastructure to satisfy application storage requirements in regards to storage price and performance; this essentially eliminates the task of manual data classification and the costs associated with traditional price/performance matching. Through automation, Dynamic Tiering ensures SLAs are met and reduces the need for administrative intervention and alignment.
Intuitive GUI	Allows administrators to efficiently move data volumes across heterogeneous storage environments without disruption to operations	• Storage management labor	The intuitive user interface masks the underlying complexity of tiered storage data migration and does not require the administrator to master the operation of complicated storage analysis. This reduces costs and time related to storage management and user training.
Rapid and nondisruptive provisioning of storage	Allows administrators to meet application deployment requirements and fine-tine provisioning via multidimensional storage tiers	• Storage management labor • Cost of performance • Cost of provisioning • Cost of outage	The software helps organizations effectively and rapidly respond to business-driven changes and allows for fine-tuning and error correction of storage provisioning without application outages, reducing costs associated with business disruption.
Automated data classification and movement	Reduces administrative complexities and time, and optimizes usage of tiered storage	• Capital costs for hardware and software purchase • Storage management labor • Cost of monitoring • Cost of performance • Cost of growth • Cost of provisioning • Cost of outage • Cost of waste • Cost of copies • Cost of data mobility • Power consumption and cooling • Data center floor space	By automating the movement of data between tiers in a storage environment, Dynamic Tiering reduces operational overhead and provides for significantly streamlined administration effort, improved productivity and the ability to automatically adjust to dynamic workloads and capacity requirements. From a performance perspective, applications with the greatest I/O requirements will be satisfied with the highest performing tier, all without application disruption. As a result, the optimized system reduces drive counts required to manage the same or more storage, reducing CAPEX. It also reduces space, power and cooling requirements.

Map Product Benefits of Hitachi Dynamic Link Manager Advanced to Cost Savings

Storage Economics has identified cost reductions associated with Hitachi Dynamic Link Manager Advanced benefits as shown in Table 6.

TABLE 6. HITACHI DYNAMIC LINK MANAGER ADVANCED BENEFITS AND COST REDUCTIONS

Product Benefit	Description	Storage Economics Costs Reduced	How?
Comprehensive path failover and failback	Ensures higher data availability, reliability and accessibility	• Capital costs for hardware and software purchase • Storage management labor • Cost of performance • Cost of outage • Cost of data loss • Cost of disaster risk, business resumption	Achieves a higher level of data availability through automatic failover and failback Reduces the risk of financial loss due to failures of critical applications via path failover This directly impacts operational costs associated with risk and business disruption mitigation.
Automated workload balancing	Helps maintain outstanding system performance across all available paths by appropriately "throttling" I/O	• Storage management labor • Cost of monitoring • Cost of performance • Cost of growth • Cost of outage • Cost of data loss • Cost of disaster risk, business resumption	Improves system performance by taking all storage I/O requests and spreading the workload across available paths Matches path load-balancing algorithms to specific application needs, such as round-robin for applications with random I/O characteristics
Global path management interface	Simple, centralized and integrated	• Capital costs for hardware and software purchase • Storage management labor • Cost of monitoring • Cost of performance • Cost of growth • Cost of outage • Data loss • Cost of disaster risk, business resumption	Provides a single path-management interface for multiple servers, operating systems and storage system configurations Provides an easy way to check the health of all SAN paths through summary views As a result, the single interface improves productivity, reducing administrative labor and potentially reducing CAPEX/OPEX.
Optimized application performance	Controls path bandwidth relative to an application's needs	• Storage management labor • Cost of monitoring • Cost of performance	Optimizes application path reliability and performance, taking into account workloads in the whole system
Applications remain online during maintenance	Switches to alternate paths rather than requiring path downtime	• Storage management labor • Cost of outage	Applications remain online while performing maintenance that normally requires taking a path down. This directly reduces costs associated with downtime and storage management labor.
Automatic path health checks and reporting	Health checks and reporting from each host to improve system reliability, reduce downtime and facilitate rapid problem troubleshooting	• Storage management labor • Cost of monitoring • Cost of performance • Cost of outage • Data loss • Cost of disaster risk, business resumption	Monitors the status of online paths through a health check facility at administrator-specified intervals and places a failed path offline when an error is detected This increases administrator efficiencies, minimizes configuration errors and streamlines reporting. Costs reduction categories include business disruption and cost of downtime.

Map Product Benefits of Hitachi Replication Manager to Cost Savings

Storage Economics has identified cost reductions associated with Hitachi Replication Manager benefits as shown in Table 7.

TABLE 7. HITACHI REPLICATION MANAGER BENEFITS AND COST REDUCTIONS

Product Benefit	Description	Storage Economics Costs Reduced	How?
Configuration, monitoring and management	One view of all Hitachi replication products on both local and remote storage systems	• Storage management labor • Cost of monitoring • RTO and RPO costs • Cost of outage • Data loss • Cost of disaster risk, business resumption	Improves service levels by reducing planned and unplanned downtime of customer-facing applications
Integration tool for better control	Control over RPOs and RTOs	• Storage management labor	Augments storage manager productivity by streamlining the administration of critical replication cycle functions
Replication capabilities	Leverages capabilities of Hitachi storage systems, and combines robust application-aware protection, reporting, mirroring and other features previously only available in separate offerings	• Storage management labor • Cost of monitoring • RTO and RPO costs • Cost of outage • Data loss • Cost of disaster risk, business resumption	Restores application-critical data quickly, for faster resumption of business operations, and reduced downtime and disruption
Single user interface	Provides single, consistent view of all local and remote replication tasks scheduled for the storage system, to simplify and expedite replication tasks	• Storage management labor • Cost of monitoring	Leverages a centralized management tool for all replication products, improving productivity and reducing costs associated with multiple software suites

Net Value of Hitachi Command Suite on Administrative Tasks

So how do the capabilities and savings of Hitachi Command Suite impact the administrative task burdens? The obvious answer is that these burdens are reduced by automating and integrating separate and manual activities. However, let's dig deeper to illustrate how those same tasks might be accomplished now, through Command Suite software (see Table 8).

■ **Storage implementation:** With Command Suite, a combination installer with agentless support allows administrators to automate installation, testing and other operational tasks without the need for hosts to run local agents.

- **Planning:** Hitachi Command Director allows for a single view across all storage systems and SLA definition capabilities because it can automatically gather information from Hitachi Device Manager, Hitachi Tuning Manager and Hitachi Tiered Storage Manager.

- **Configuration:** Device Manager allows administrators to build out a storage environment without storage system-specific software or needing to go to multiple storage systems. It uses logical group constructs that share or inherit from underlying functionality for ease of use.

- **Data movement:** In a future release, Command Suite will use a full GUI implementation to enable Command Director to provide reporting and automated data movement scheduling without the need for migration groups.

- **Policy definition:** Command Director now handles SLA management, providing administrators the ability to define SLAs and automatically tune the environment based on those policies.

- **Storage management:** Command Suite provides administrative capabilities to eliminate the potential for common errors; grow and plan capacity from a central view; define multitenant provisioning for individual users; manage and monitor heterogeneous environments; view, configure and optimize virtual server environments; perform chargeback accounting; and ensure safe access to resources, audit trails and reports.

- **Reporting:** Command Director pulls data directly from Device Manager and Tuning Manager to optimize performance monitoring, capacity monitoring and trend analysis at the application level.

TABLE 8. HITACHI COMMAND SUITE COMPONENTS AND THEIR ADMINISTRATIVE CAPABILITIES

Hitachi Command Suite Components	Administrative Task Categories					
	Planning	Configuration	Data Movement	Policy Definition	Storage Management	Reporting
Hitachi Command Director	✔	✔	✔	✔	✔	✔
Hitachi Device Manager	✔	✔			✔	✔
Hitachi Tuning Manager	✔				✔	✔
Hitachi Dynamic Provisioning					✔	
Hitachi Dynamic Tiering and Hitachi Tiered Storage Manager	✔		✔		✔	
Hitachi Dynamic Link Manager Advanced					✔	✔
Hitachi Replication Manager					✔	

Impact on Virtual Server Environments

Hitachi Command Suite creates greater functionality and simplicity across virtual server environments so that IT organizations can speed deployments, boost operational value and realize cost savings. Storage Economics cites the following cost benefits for integrating virtual server farms with Command Suite:

- Hitachi Command Director centralizes reporting and management to define and establish service levels for applications running in the virtual server environments.

- Hitachi Tuning Manager monitors entire I/O paths between individual virtual machines and storage and obtains historical trending and predictive analysis for forecasting storage requirements for service levels.

- Hitachi Device Manager improves disk utilization and automates key storage management processes for better control over virtual assets.

- Hitachi Dynamic Provisioning allows RAID-group-based storage and LUNs to be allocated from pooled resources and data to be automatically striped across all disks in the pool.

- Hitachi Dynamic Provisioning automatically balances varying workloads across all virtual machines serviced through a Hitachi storage system, which eliminates administrative time required to constantly monitor and reconfigure machines around performance bottlenecks.

- Administrators reduce time associated performing virtual machine-to-storage path provisioning and setup, and minimize trial-and-error provisioning and downtime.

As a result of these cost savings, administrators are able to deploy a denser, lower touch, virtual server environment and lower the total cost of virtual server ownership.

Conclusion

As Storage Economics has examined, the Hitachi Command Suite v7.0 delivers abundant savings across the data center. With 3 dimensions of management and 8 tightly integrated components, Command Suite provides demonstrated savings in capital and operating expenses, contributes to better returns on investments and assets, and ultimately lowers the total cost of ownership.

Command Suite enables overburdened IT organizations to centrally manage complex administrative tasks with intelligent automation and pervasive visibility across the storage environment through to the application. By replacing a myriad of manually performed administrative tasks with highly intelligent proactive automation, organizations can instead centrally define policies, simplify configuration, more accurately forecast for capacity and performance, and better move and manage data across heterogeneous storage environments. For mitigating sprawling virtual server environments, Command Suite integrates with VMware to swiftly manage growth without adding complexity. Enterprises with highly efficient VMware storage deployments are poised for faster, easier deployments and better control over virtualized infrastructure.

As organizations move toward a new vision of reality in the data center, Command Suite provides that often-elusive benefit of actually being able to regain control of the information economy. Now, the new reality is that organizations are empowered to actually address the multitude of storage challenges and effectively stay ahead of information requirements. Using Hitachi technologies such as virtualization, automation, cloud enablement and sustainability, organizations gain extensive agility in the data center and are able to seamlessly integrate, unify, scale and virtualize, culminating in lower operating costs, greater availability and less risk.