Virtualized Tiered Storage Solutions

A Blueprint for Lowering Capital and Operational Costs for Storage Infrastructure

Unprecedented data growth, new application demands, regulatory requirements for data archival and greater business continuity needs are straining IT budgets and exposing inefficiencies in conventional storage architectures. One of the most pressing issues facing organizations today is the need to reduce storage costs. Simultaneously, single-vendor management tools and isolated pools of storage fragment the infrastructure, making it difficult to share resources, improve operational efficiency and migrate online data.

By implementing a virtualized tiered storage architecture, an IT organization can dramatically improve storage capacities and lower capital and operational expenses. Virtualized tiered storage better aligns data on storage systems by allowing you to efficiently match storage attributes with the service level needs of individual business applications.

The Cost and Complexity of Storage

Storage environments large and small face increasingly sophisticated demands from business applications and requests to maintain data online for longer periods of time. As a result, total capacity that IT storage administrators manage has exploded and the complexity of the storage infrastructure has grown enormously. These factors are raising the total cost of the storage ownership and significantly affecting the IT budget.

Regulatory compliance efforts offer an example. The Health Insurance Portability and Accountability Act (HIPAA), SEC rule 17a-4, Sarbanes-Oxley and Basel Capital Accord, along with other legislation, are setting mandatory guidelines. These guidelines are provided for data protection and data retention, with financial and legal penalties for noncompliance. Like business resilience measures, ensuring your organization is in compliance with government regulations implies increased capacity and complexity in the storage environment. Meeting the need for enhanced data protection, greater regulatory compliance and escalating demand for application storage capacity inevitably drives up the cost of storage.
Hardware Costs
Fragmentation of the storage environment, caused by disconnected islands of storage and interoperability problems, creates stranded capacity and duplicates storage networking equipment, contributing to escalating hardware costs. Eliminating barriers to sharing, storage recovery and improving capacity utilization rates can deliver sustainable long-term savings by allowing future purchase of storage assets to be deferred.

Solution: Virtualized Tiered Storage
Today's enterprise data centers feature storage systems and storage network infrastructures from many vendors. In order to support this approach, the Hitachi virtualized tiered storage architecture consolidates heterogeneous storage solutions in a single managed pool (see Figure 1). Within this pool different storage tiers are established. Hitachi virtualization technologies enable the separation of logical views from physical assets. This practice enables an architecture that provides the right cost, performance, reliability and availability characteristics of storage, as needed, matched with application requirements (see Table 1). As a result, organizations can strategically align storage infrastructure with business requirements.

Software Costs
With heterogeneous configurations the norm in enterprise data centers, managing storage requires the use of many software tools from different vendors. These tools frequently do not communicate well with each other, complicating the process of provisioning, optimizing, moving and protecting data, and increasing training costs.

Labor Costs
Labor expenses represent as much as 40% of the total cost of storage ownership. The best meaningful way to lower storage labor costs is to reduce the operational management complexity of the storage environment.

Maintenance Costs
Hardware and software maintenance costs correlate directly with the amount of capacity deployed in the environment and the number of tools in use by storage administrators. Improvements that simplify storage administration and reduce the number of tools required also benefit maintenance costs.

Soft Costs
Soft costs include storage system performance, scalability, downtime and regulatory compliance. For example, if inadequate data protection raises the risk of revenue and productivity losses from an outage, actual losses experienced during downtime are attributable to the storage infrastructure. This practice occurs even if the failure occurred elsewhere.

TABLE 1. IDC TIERED STORAGE DATA CLASSIFICATIONS

<table>
<thead>
<tr>
<th>Mission Critical Data</th>
<th>Business Critical Data</th>
<th>Accessible Online Data</th>
<th>Nearline Data</th>
<th>Off-line Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>■ Most valuable to an enterprise, high access.</td>
<td>■ Important to the enterprise, average cost.</td>
<td>■ Cost sensitive, low access, large volumes.</td>
<td>■ Cost sensitive, low access, large volumes.</td>
<td>■ Archived data, backup or compliance related.</td>
</tr>
<tr>
<td>■ High performance, high availability, near zero downtime, highest cost.</td>
<td>■ Reasonable performance, good availability, less than eight hour recovery.</td>
<td>■ Online performance, high availability, less than eight hour recovery.</td>
<td>■ Less than one hour access time, automated retrieval.</td>
<td>■ Very cost sensitive, limited access, ~72-hour seek time.</td>
</tr>
</tbody>
</table>
Email offers an excellent example of how tiered storage architectures lower costs. Not all email data has the same value. Typically, only relatively recent messages have the high-end requirements associated with top-of-the-line storage systems. As messages age and are archived, access frequency declines and needs change. Storing all email data on high-performance, highly available storage is wasteful.

In a tiered storage environment, the IT administrator can establish policies where only new email messages are stored on Tier 1, high-end, enterprise-class storage. Older email messages can be hosted on Tier 2 storage, offering performance and availability slightly below Tier 1 at a much lower cost. And archival messages, the bulk of all email storage, can be stored on cost-efficient midrange systems using near-line serial-attached SCSI (SAS) disk, offering online access but with lesser performance.

This tiered configuration frees large amounts of high-end storage capacity for use by other applications and lowers the cost of providing storage for the email application (see Table 2).

The Hitachi virtualized tiered storage architecture leverages superior Hitachi controller technology. It provides thin provisioning, automated tiering, advanced replication, logical partitioning and virtual connections. It supports heterogeneous storage and the sheer performance and scalability needed to truly deliver storage services on demand. At the same time, it eliminates vendor lock-in. Tiered storage can be scaled out using hardware appropriate to the tier. This capability dramatically simplifies storage provisioning and management and helps organizations achieve:

- Management simplicity through the use of common storage services throughout an entire heterogeneous storage infrastructure.
- A radically more efficient IT environment that goes beyond consolidation into dynamically allocated tiered storage.
- Asset value protection by supporting the virtualization of heterogeneous storage systems from leading vendors.

### Table 2. Metrics of a Tiered Storage Implementation

<table>
<thead>
<tr>
<th>Tier Name</th>
<th>Mission Critical</th>
<th>Business Critical</th>
<th>Accessible Online</th>
<th>Nearline</th>
<th>Offline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Availability</td>
<td>99.999%</td>
<td>99.999%</td>
<td>99.99%</td>
<td>99.90%</td>
<td>Offline</td>
</tr>
<tr>
<td>Performance</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Maximum Backup Time (hours)</td>
<td>0.02</td>
<td>0.02</td>
<td>3</td>
<td>0.02</td>
<td>N/A</td>
</tr>
<tr>
<td>Maximum Local Recovery Time (hours)</td>
<td>1</td>
<td>4</td>
<td>6</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Local Recovery Point (hours)</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>N/A</td>
</tr>
<tr>
<td>Remote Recovery Time (hours)</td>
<td>1</td>
<td>72</td>
<td>72</td>
<td>72</td>
<td>72</td>
</tr>
<tr>
<td>Remote Recovery Point (days)</td>
<td>Sub 1</td>
<td>7</td>
<td>7</td>
<td>30</td>
<td>N/A</td>
</tr>
<tr>
<td>Offering Cost/GB (relative)</td>
<td>100%</td>
<td>80%</td>
<td>60%</td>
<td>40%</td>
<td>10%</td>
</tr>
<tr>
<td>Point-in-Time Snapshots</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>
Storage reclamation and improved utilization of physical assets.

Seamless, nondisruptive data migration between heterogeneous storage resources without affecting access to data by business applications.

Key Components
Hitachi virtualized tiered storage solutions provide government, enterprise and midsize businesses with scalable, cost-effective storage solutions with heterogeneous storage support, tier-oriented provisioning and built-in nondisruptive data mobility. Built around Hitachi Virtual Storage Platform (VSP) and Hitachi Virtual Storage Platform G1000 (VSP G1000), as well as content archiving and data resilience products from Hitachi Data Systems, products specific to virtualized tiered storage solutions include:

Hitachi Storage Virtualization Operating System
For VSP G1000, Hitachi Storage Virtualization Operating System (SVOS) provides system element management and advanced storage system functions. These capabilities include storage virtualization, thin provisioning, storage service-level controls and performance instrumentation across multiple storage platforms. SVOS abstracts information from storage systems, virtualizes and pools available storage resources and automates key storage management functions. This unified environment maximizes the utilization and capabilities of your storage resources and significantly reduces operations costs. Standards-compatible for easy integration into IT environments, SVOS enables the features and control required to build infrastructures that are continuously available, automated and agile.

The optional global active device feature* provides active-active clustering of volumes that span 2 physical storage systems. Spanned active-active volumes offer simplified high-availability server configurations and attractive distributed architecture advantages for concurrent applications in 2-site designs.

Hitachi Base Operating System
The Hitachi Base Operating System software package is used to configure and manage Virtual Storage Platform and Hitachi Unified Storage VM systems. It supports thin provisioning, virtualized front-end controller ports, external storage virtualization and dynamic partitioning of cache and storage resources. It also includes basic reporting and performance monitoring and management tools.

Hitachi Dynamic Tiering
Hitachi Dynamic Tiering software automates the complexity of using tiered storage efficiently. It delivers top-tier performance to information stored largely on less-expensive tiers. Dynamic Tiering uses Hitachi Dynamic Provisioning and inherits its advantages of simplified provisioning, capital savings and self-optimizing performance. Dynamic Tiering virtual volumes are an enhanced, tiered type of Dynamic Provisioning volume with up to 3 internal tiers. Dynamic Tiering automatically moves data in the volume at a fine-grain, page-based level within these tiers. It automatically moves data according to workload, to the most appropriate media, to maximize service levels and minimize total cost of storage. At the same time, to maximize cost savings and performance gains, it makes sure that the highest tiers are used efficiently and to their maximum capacity.

Hitachi Tiered Storage Manager
Hitachi Tiered Storage Manager enables easy storage-tier creation and the nondisruptive movement of data volumes to match application-driven price, performance and availability characteristics. Tiered Storage Manager data

* Global active device feature licensed separately, consult your HDS sales representative for availability.
management software enables IT administrators to easily and interactively match application quality of service requirements to heterogeneous storage assets. It provides this capability through policy-based control of automated tiering and also by online migrations of entire volumes to different tiers, pools or systems. Using policy-based management, Tiered Storage Manager allows control of individual volumes or groups of volumes in a Dynamic Tiering pool. Volume, tier location, usage and migrations can all be dynamically specified.

Also, according to the Enterprise Strategy Group, data migration is a frequent task performed by data center storage administrators. Whether managing the replacement, relocation, consolidation or lease renewal of servers and storage or balancing workloads for performance, data migration is a fact of life for the storage administrator. Data migration is also a fundamental component of a tiered storage strategy. As the cost, quality of service and functionality demands of application data change over time, data must be migrated between tiers. This migration is how a tiered storage architecture maintains an optimal match of storage system characteristics and data requirements.

University of Utah Sees Success and a Positive Return on Investment

The University of Utah Health Sciences Center (UUHSC) Information Technology Services (ITS) group provides technical resources and support. It serves a wide range of departmental, hospital, research group and clinic-based facilities in Salt Lake City, Utah. Demand for storage capacity was growing at around 200% per year, and more UUHSC departments were signing up to share resources managed by the ITS group. As a result, the existing storage infrastructure was beginning to show signs of stress.

ITS supports several SANs from a number of different vendors. But, as deployed capacity increased, storage administrators noted several problems. Each vendor’s SAN requires its own set of tools and storage management procedures. This frustrated attempts by administrators to cross-train on the different tools. The fragmented management tools subsequently resulted in siloed management practices and in administrators themselves becoming a single point of failure for the environment.

In addition to storage management concerns, backup windows started to intrude on production work hours, and the amount of storage capacity wasted by stranded space on SANs was growing.

Storage virtualization was identified as a technology that could address many UUHSC growth and management issues. ITS evaluated several appliance and fabric-based storage virtualization products. It determined that the risk of managing another fabric element, the necessary increase in head count and training, and the single point of failure that would be introduced into the system did not warrant further investigation. The ITS group then decided to evaluate Hitachi Universal Storage Platform.

The Hitachi storage controller-based virtualization allowed UUHSC to implement a new tiered storage architecture. All fabric elements were kept the same and older storage systems were virtualized behind the Hitachi platform. SAN management was collapsed into a single point of control, and a multitiered storage strategy was implemented.

Economic Impact

The implementation of the Hitachi enterprise storage and a tiered storage infrastructure resulted in a dramatic range of financial savings for the UUHSC:

- Reduced the number of people needed to manage the storage infrastructure by 2 (saving US$320K).
- Improved capacity use, deferring planned purchase of 18TB of new capacity for 3 years.
- Removed 3 storage frames, with associated reduction in hardware, software and maintenance costs (US$200K), as well as floor space, electricity and air conditioning expenses (US$28K).
- Extended the life of older storage assets, reducing future capital procurement expenses.
- Removed older Fibre Channel switches from the SAN, further reducing hardware and maintenance costs.

## VIRTUALIZED TIERED STORAGE BENEFITS

### Business Benefits
- Capital expense savings and lower operational costs.
- Centralized management and better storage visibility.
- Increased utilization.
- Higher availability.
- Reduced application service interruptions.
- Storage infrastructure aligned with business requirements.

### Technical Benefits
- Simplified provisioning and storage management.
- Precise storage service level management.
- Leverage of lower cost storage resources.
- Non-disruptive data migration.
- New functionality extended to older assets.
- Enhanced performance and automated performance optimization.
- Thin provisioning.
- Improved security from logical partitioning, role-based access, audit logging and other security features.
Improved availability, with estimated risk cost avoidance for patient and billing systems conservatively put at US$118K, and for other systems at US$138K.

Improved performance, with an estimated US$340K savings in faster access to data.

Improved access to tiered storage for all ITS customers.

**Deploy Tiered Storage in Your Infrastructure**

In reading this solution profile, Virtualized Tiered Storage Solutions, you now have gained a basic understanding of what is involved in implementing a tiered storage solution. And you have the background to determine what kind of engagement will equip you to meet your storage needs. You can choose from among the available hardware, software and services to achieve a closer match between business and IT goals. In addition, we recommend engaging the Hitachi Data Systems Global Solution Services group before you undertake a tiered storage strategy. Global Solution Services can help you:

- Provide a framework for data lifecycle management.
- Quickly assess organizational needs for access, retention and protection of data.
- Evaluate patterns of access across the data's lifecycle.

- Define common storage and applications management environment services.
- Establish an optimized, cost-effective and long-term reference architecture to meet the needs of your business.

**For More Information**

To learn more about how Hitachi Data Systems can help with your tiered storage plans and to read more about tiered storage, please visit www.hds.com/solutions/tiered_storage or contact your local HDS sales representative. Or call Hitachi Data Systems at 888 234 5601, ext. 950. Explore an engagement that will result in the optimal solution for your tiered storage needs. (Hitachi TrueNorth Partners: Contact your channel manager for information.)