EXECUTIVE SUMMARY

Applications are the critical driver of business processes and decision making, impacting organizational growth, risk, and profitability. More than ever before, senior executives’ strategic decisions center around delivering the right information to the right person (or application) at the right time. In this environment, aligning IT investments with overall business investments is paramount.

For IT executives, however, the continued expansion in applications and the amount of information these applications generate is placing growing strains on their staffs and budgets. Each application places unique demands on the IT environment in terms of cost, capacity, performance, and level of availability. Deploying solutions that allow companies to optimize assets to support the rapid introduction of applications while enhancing existing application performance and reducing costs is critical.

Hitachi Data Systems, a leading supplier of storage systems, software, and services to enterprises around the globe, offers a broad suite of tightly integrated storage hardware, software, and services offerings under its Application Optimized Storage™ solutions portfolio. The solutions should be on the short list for companies that are seeking to get the maximum return on their application investments.

The foundation of the Application Optimized Storage solutions portfolio is the Hitachi TagmaStore™ Universal Storage Platform and Network Storage Controller that support high levels of modularity and performance for large-scale virtualization and data replication in enterprisewide tiered storage environments. The other key component of this portfolio is the Hitachi HiCommand® Suite of software that delivers robust and scalable storage, data, and application management capabilities across heterogeneous storage environments.

Combined with advanced, targeted professional services offerings from Hitachi Data Systems and its business partners, Application Optimized Storage solutions provide a solid foundation for building an enterprisewide storage architecture that can quickly expand to meet changing application needs without disrupting ongoing business activities or overextending IT resources.
THE INFORMATION EXPLOSION: MEETING NEW BUSINESS CHALLENGES

Companies of all sizes are deploying a growing variety of applications to meet evolving business needs. In many companies, decisions about the development and deployment of new applications are among the most important for senior executives because they are key drivers of business growth.

The continued application expansion and the amount of information these applications generate are major sources of stress for IT executives’ staffs and budgets. Costs, security, performance, and levels of availability vary widely across diverse applications, and they place widely different demands on the corporate IT environment. Optimizing storage assets to support the rapid introduction of new applications while enhancing existing application performance and reducing costs is a critical requirement for IT organizations as they evaluate new storage solutions.

Businesses Depend on Ever More Diverse Sets of Applications

Companies rely on growing sets of applications to compete in today’s changing business environment. Specifically:

- They are collecting, storing, and analyzing growing volumes of information about products, customers, and transactions.
- They rely on email, ecommerce systems, and Web sites to communicate and conduct business with customers and business partners.
- They are increasingly digitizing records, images, and other types of fixed content to boost efficiency and comply with evolving government regulations.

To better understand the impact of these key applications on data creation, IDC conducted a survey of 270 IT executives at U.S. companies with more than 100 employees, IDC’s 2005 Trends in Storage Survey. We asked respondents how current storage capacity is allocated across different application sets (see Figure 1). Given the diverse size of companies interviewed, the total capacity varied widely; however, with a few exceptions, the mix of applications was very consistent.
**FIGURE 1**

**Installed Storage Capacity Used for Specific Applications**

Q. What is the estimated total disk storage capacity, in terabytes, for the following kinds of data at your company, excluding disk drives on desktop systems?

<table>
<thead>
<tr>
<th>Application</th>
<th>Mean % of Installed Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERP, CRM, OLTP</td>
<td>32.1</td>
</tr>
<tr>
<td>Backup/recovery</td>
<td>27.6</td>
</tr>
<tr>
<td>Digital content</td>
<td>10.8</td>
</tr>
<tr>
<td>Email</td>
<td>7.7</td>
</tr>
<tr>
<td>Web servers</td>
<td>3.1</td>
</tr>
<tr>
<td>File and print</td>
<td>2.8</td>
</tr>
<tr>
<td>Other</td>
<td>15.9</td>
</tr>
</tbody>
</table>

n = 270

Note: "Other" includes high-performance computing.

Source: IDC's 2005 Trends in Storage Survey

Transactional applications such as ERP, CRM, and OLTP were the single biggest consumer of capacity (accounting for 32.1% of capacity, on average). File and print servers, the other traditional consumer of storage capacity, accounted for a very small portion of capacity used (just 2.8%), slightly less than that dedicated to supporting Web sites. Both of those application types were far exceeded in terms of capacity used by a relatively new set of applications — email and digital content. Email consumed 7.7% of capacity, and digital content consumed 10.8% of capacity.

These results send a clear message. IT executives must:

- Establish closer relationships with the internal business units and external business partners that are driving new applications to better understand their unique requirements
- Deploy a wide range of storage solutions to meet the unique performance, capacity, availability, and cost requirements of multiple applications throughout the data's life cycle
- Enable more diverse storage options for specific applications (e.g., ERP and email), depending on whether the information needs to be accessed by many users in real time or by a small set of users analyzing an archived data warehouse
- Deploy a storage architecture that can support diverse requirements while reducing infrastructure complexity, decreasing management overhead, and lowering costs
Data Protection/Retention and Application Recovery Are Emerging as Key Applications

One of the most interesting revelations from IDC's 2005 Trends in Storage Survey was that respondents are allocating over a quarter (27.6%) of their storage capacity for disk-based data protection. Companies are more concerned than ever with ensuring both short-term and long-term access to information throughout its useful life.

The importance of data protection became even clearer in a follow-on question in the survey. IDC asked executives to state which applications were driving the continued expansion in storage capacity (see Figure 2). The two most frequently cited applications were data protection/disaster recovery (50.2%) and long-term archiving of data (46.8%). The next two most frequently mentioned applications are email and digital content, relatively new application types. Not surprisingly, these are also applications for which companies often require reliable access and long-term online archiving for regulatory compliance.

FIGURE 2

Applications Driving Storage Expansion

Q. Which three of the following drivers are most responsible for your company's planned spending on additional storage capacity?

- Data protection/disaster recovery: 50.2%
- Archiving of data: 46.8%
- Email: 31.2%
- Digital imaging (e.g., photos, X-rays, video): 27.1%
- File sharing: 26.0%
- Data warehousing/business intelligence: 22.3%
- Web site/ecommerce: 15.2%
- Regulatory mandates: 12.6%
- ERP: 11.2%

n = 270
Note: Multiple responses were allowed.
Source: IDC's 2005 Trends in Storage Survey
The range of applications and information types that companies need to protect is expanding rapidly, and the pressure to ensure adequate protection for all corporate applications continues to rise. The scale and scope of enterprises' evolving needs are pushing traditional storage systems to the limit in terms of performance and practical administrative capabilities.

Enterprises must develop business continuity plans that allow them to protect more types of information while operating more efficiently and reacting more quickly to changing business conditions. They need storage partners that can deliver storage solutions to ensure application availability and information integrity.

**Optimizing the Value of Storage Assets**

Accommodating a growing variety of information types while boosting business continuity goals poses a significant challenge for budget-conscious IT executives. Between 2005 and 2008, IDC forecasts that the total enterprise storage capacity deployed annually by companies around the world will increase 367%, from 1,786PB to 6,652PB. IT managers also make clear that they will not significantly increase staffing levels to manage this nearly fourfold growth in storage capacity.

Enterprises’ expectations about the ongoing effectiveness of their storage environments are changing drastically. Economic and business uncertainties force executives to closely monitor new storage systems expenditures and maximize returns on previously purchased storage assets. Boosting the effective utilization and integration of existing storage systems as well as improving the manageability of those systems are now primary goals.

The key is to look for management solutions that address storage, data, and application management requirements through a common set of tools and interfaces.

**APPLICATION OPTIMIZED STORAGE: ALIGNING BUSINESS AND IT REQUIREMENTS**

Deploying storage optimized to meet the unique requirements of diverse applications is more than a theoretical concept. Today, enterprises can build storage environments that enable application-optimized storage. The key components of these solutions include:

- A network-based storage controller architecture that allows storage managers to virtualize and create large, dynamic storage pools, as well as finely tune the performance of key storage components (e.g., cache, network ports, volumes) optimized for specific applications
- A range of storage systems that can be deployed with networked storage controllers to support tiers of storage to best meet application performance, capacity growth, availability levels, and cost requirements
- An integrated suite of storage management software that automates the provisioning of capacity, the movement of data between tiers of heterogenous storage, and the reliable protection of data for rapid application recovery
- A comprehensive portfolio of consulting and deployment services to ensure that organizations achieve timely and maximal returns on their storage investments
The Foundation: Network-Based Storage Controllers

The demand for application optimized storage and the need for common storage management software are spurring the next step in storage systems evolution. While other vendors are developing, Hitachi Data Systems has already introduced a new category of products that IDC calls networked storage controllers. Networked storage controllers make it possible to extend many of the capabilities of individual high-end storage systems to a pool of diverse storage systems without sacrificing performance or reliability. These solutions:

- Connect and virtualize a wide range of heterogeneous storage systems from multiple suppliers to form a large-scale, liquid storage pool that can be managed as if a single system
- Reduce management complexity by leveraging a common set of storage and data management software
- Scale quickly and cost-effectively with minimal disruption to ongoing operations
- Enable allocation of tiered storage resources to meet variable application requirements and service level agreements

This last capability represents a critical next step for the storage industry. With these emerging systems, storage managers can quickly and non-disruptively deliver pools of storage optimized for diverse applications. IT departments and application vendors can leverage emergent capabilities, including:

- More granular/automated data protection
- Reduction of the need to pre-provision excess storage capacity
- Easy-to-use options for tuning applications and supporting storage assets to meet variable workload levels

Tiered Storage: Boosting Storage Efficiency

Over the past several years, the emergence of lower-cost and larger-capacity disk technologies significantly boosted data storage capacities, reduced costs, and enabled the tiered storage concept. The type of storage system deployed on these new tiers can vary significantly, depending on the size of the company and the application.

For example, in many large datacenters, tiered storage means leveraging modular storage as secondary storage for long-term archiving and business analytics. In other situations, companies want to exploit low-cost/high-capacity storage for lower-cost disk-based backup. While not appropriate for all application workloads, the growing variety of storage systems provides IT managers with greater control over up-front costs when allocating storage for specific applications.
In IDC's 2005 Trends in Storage Survey, IT executives made clear that incorporating capacity-oriented storage systems into existing environments is a high priority and is often a driver of tiered storage efforts. The primary forces driving this decision include:

- Enabling more cost-effective local and remote backup of application data
- Long-term archiving of structured and unstructured data for business analytics and regulatory compliance

Companies want solutions that support the development of a tiered storage infrastructure. Such tiered storage solutions allow IT departments to match application requirements to storage systems attributes and reduce cost through the use of different classes of storage.

**Common Storage Services: Reducing Administrative Burdens**

IT managers can now choose from a variety of different storage systems. These systems range from high-end enterprise storage systems that provide high performance and reliability in a single centrally managed system to modular storage systems that allow IT managers to add storage capacity for applications in smaller increments. They can also leverage networked storage controllers to ensure consistent performance and reliability across multi-vendor storage tiers.

Another key component in delivering application-optimized storage is the delivery of a common set of advanced storage services that allows IT managers to provision, define, and replicate storage based on centralized procedures, policies, and processes. These common services include:

- Robust and well-integrated volume management that IT managers can use to deploy and manage complementary virtual pools of storage
- Complementary storage management solutions that automate storage system provisioning/migration, capacity expansion, and data protection tasks across heterogeneous systems
- Common data replication capabilities that allow IT managers to match application data use and protection needs to storage attributes by easily and intelligently moving data between different classes of storage

When evaluating tiered storage solutions with common services, IT managers must also look for solutions that:

- Automate the provisioning, reconfiguration, and ultimate replacement of storage systems through their life cycle
- Coordinate the migration or replication of data across diverse storage systems based on predefined data protection or changing performance conditions
- Enable the integration of application management processes and procedures that can leverage advanced storage services
The remainder of this white paper examines the new generation of storage solutions that Hitachi Data Systems is delivering to address businesses' needs for application-optimized storage. It details the capabilities that differentiate Hitachi Data Systems storage products from existing storage systems. It also discusses the critical role that services play in enabling these solutions and highlights the further steps that Hitachi Data Systems must take to deliver on its promise.

THE HITACHI DATA SYSTEMS APPLICATION OPTIMIZED STORAGE PORTFOLIO

Hitachi Data Systems, a wholly owned subsidiary of Hitachi Ltd. (NYSE: HIT), is a leading supplier of storage systems, software, and services to enterprises around the globe. Under the Application Optimized Storage™ solutions portfolio, Hitachi Data Systems developed and continues to enhance a broad suite of tightly integrated storage hardware, software, and services offerings. This approach allows the company and its partners to address the specific needs of diverse customers based on company size and business need.

The TagmaStore Family of Networked Storage Controllers and Tiered Storage Systems

The foundation of the Hitachi Data Systems Application Optimized Storage solutions portfolio is the Hitachi TagmaStore™ Universal Storage Platform (models USP100, USP600, and USP1100) and the TagmaStore Network Storage Controller (model NSC55). The Universal Storage Platform and Network Storage Controller with supporting virtualization and data replication software deliver a high level of modularity and performance as well as exceptional scalability. They can virtualize and manage as much as 32PB of internal and externally attached heterogeneous storage. They also provide logical partitioning to dedicate internal and external storage resources to specific applications.

The company's goal with these systems is to be an early leader in delivering complete storage systems (including software and services) — designed for virtualization and tiered storage. The key differentiators incorporated into the Universal Storage Platform and Network Storage Controller include:

- The ability to scale quickly and cost-effectively with minimal disruption to ongoing operations, including the ability to partition resources (e.g., cache, network connections, virtualized volumes) to meet variable application requirements
- The flexibility to deploy systems optimized for large and midsize enterprises without sacrificing consistency and commonality of functions
- The incorporation of rapid and painless data migration services across existing and future storage systems
- The delivery of robust and well-integrated port aggregation, volume management, and common data replication functions across all systems
Hitachi Data Systems also offers a modular storage product family designed to address tiered storage and the changing needs of midsize organizations. The Hitachi TagmaStore™ Adaptable Modular Storage (models AMS200 and AMS500 with SATA and FC drives) and the Workgroup Modular Storage (model WMS100 with SATA-only drives) both support RAID 0 (Fibre Channel only), 1, 1+0, 5, and 6. These systems scale up to 88.5TB of capacity and are fully compatible with the Universal Storage Platform and Network Storage Controller as reliable and scalable tier-two or tier-three storage systems.

**Universal Storage, Data, and Application Management**

The other key component of the Application Optimized Storage solutions portfolio from Hitachi Data Systems is a set of software services that leverage the capabilities of the Universal Storage Platform and Network Storage Controller to deliver robust and scalable storage, data, and application management capabilities.

**Storage and Data Management**

Hitachi Data Systems offers a comprehensive view of IT management from the application through the network topology to device configuration and event management. The HiCommand® Suite, a mature set of storage and data management software, includes storage management modules that provide common management capabilities and an intuitive user interface for a heterogeneous storage infrastructure. Key components include:

- **HiCommand Storage Services Manager** acts as the main console for heterogeneous storage infrastructure management software, providing SAN visualization and reporting, asset management, performance and capacity monitoring and planning, and policy-driven event management.

- **HiCommand Device Manager** provides a single platform for centrally managing, configuring, and monitoring Hitachi storage systems, boosting the volume of storage each administrator can manage, raising the efficiency, and reducing IT management costs.

**Application Optimization**

A key element of the Application Optimized Storage strategy is the addition of application intelligence to the HiCommand Suite. These management solutions are designed to access the entire storage environment with a focus on monitoring and optimizing applications, business processes, and IT procedures. Key components of the HiCommand Suite that are especially critical in supporting application-optimized storage are as follows:

- **HiCommand Tuning Manager** provides a proactive performance monitoring and reporting tool designed to report throughput and response time between the application and the array. It automates traditionally labor-intensive storage planning tasks associated with assessing existing storage workloads and planning for future capacity increases.
HiCommand QoS Modules extend the Hitachi Data Systems integrated SAN management, storage resource management, and storage operations management capabilities "inside" applications, including Microsoft Exchange, Microsoft SQL, Oracle, Sybase, as well as general file servers.

HiCommand Tiered Storage Manager transparently and interactively migrates data between heterogeneous storage tiers, enabling IT administrators to match application quality of service requirements to storage system attributes. It enables the non-disruptive migration of application data between storage devices, without the need to acquiesce the system.

Managing the Virtualized Environment

Hitachi Data Systems also provides common data management capabilities for volume management and data replication across heterogeneous storage in virtualized environments:

- **Hitachi Universal Volume Manager** supports virtualization for up to 32PB of internal and external storage while also supporting data replication and migration capabilities across heterogeneous storage.

- **Hitachi Virtual Partition Manager** allocates internal and external physical storage resources, including ports, cache, and capacity, into independently managed Private Virtual Storage Machines that can be tuned for different applications.

- **Hitachi Universal Replicator** provides asynchronous remote replication (including heterogeneous replication across virtualized attached storage systems), disk-based journaling, protection against link failure, "pull" copying, and multi-datacenter support.

SERVICES TO ENABLE APPLICATION OPTIMIZED STORAGE

Hitachi Data Systems Global Solution Services organization has developed several consulting services offerings designed to accelerate the adoption of Application Optimized Storage solutions and help customers gain maximum benefit from those solutions. These offerings include the following:

- **Assessment and Planning Service.** Under this service, Hitachi Data Systems provides design and deployment assistance that takes advantage of the company's technical capabilities to better align business requirements to the storage environment. The service consists of business process mapping, archival policy development, and assistance in gaining efficiencies from tiered storage.

- **Risk Analysis Workshop.** This service represents the first step in evaluating a customer's disaster recovery investment strategy and priorities. The customer and Hitachi Data Systems identify environmental and natural risks and exposures that could cause an outage and determine expected business losses. Customers receive a Risk Analysis Summary that describes each risk and exposure and presents a prioritized matrix of exposure, projected losses, and expected occurrence. They also receive a customized operational risk model organized by corporate and regional areas.
Storage Economics Strategy Service. This offering is designed to enable customers to reduce operating expenses (opex) in the storage environment by helping customers objectively assess their current storage environment (either direct-attached or networked) and make tactical and strategic plans to take advantage of newly available storage architectures.

Challenges for Hitachi Data Systems

Hitachi Data Systems’ focus on Application Optimized Storage represents an important new trend for the storage industry: the tighter linkage of storage systems and applications. As companies seek to more effectively leverage existing storage investments and take advantage of new technologies, they will need storage solutions that simplify IT and application management processes while boosting asset utilization and overall application performance and reducing costs.

To date, managing applications, servers, and storage has required the use of uncoordinated tools from many different suppliers. The development of standards within the storage industry and across IT sectors is a critical step. Hitachi Data Systems has long been a proponent of standards such as SMI-S for storage management. It must ensure that its storage systems and its storage management solutions continue to leverage evolving standards wherever possible.

Hitachi Data Systems, as a champion of application-optimized storage, must also take a leading role in developing new standards for storage/application intercommunications. Customers’ need for application-optimized storage won’t wait for standards. Therefore, Hitachi Data Systems must work with customers and business partners to ensure that its solutions provide deeper integration with current and future applications.

A critical next step, and challenge, for Hitachi Data Systems will be to establish strong ties with specific application vendors in critical sectors, including data protection, archiving, and digital content suppliers.

Final Thoughts and Guidance

The vision of an application-optimized enterprise storage environment that takes advantage of tiered storage; common data replication; and coordinated storage, data, and application management won’t come to pass overnight.

An advanced and integrated storage solution such as the Hitachi TagmaStore Universal Storage Platform and Network Storage Controller and the HiCommand Suite is of little use if IT departments do not implement effective storage consolidation, successfully migrate data to new systems, and change existing administrative policies and procedures. Effective implementation, always a major concern, is an especially critical issue when implementing solutions designed to boost the performance and reliability of enterprise applications.
IT managers need help from storage suppliers such as Hitachi Data Systems and its business partners as they prioritize applications, upgrade systems, provision new resources, and institute consistent replication and application recovery policies. Any company that wants to compete in this market must deliver high-quality consultative services that enable more effective deployment of tiered storage solutions. Capabilities to look for from a business partner include:

- **Understanding of the benefits and pitfalls of server and storage consolidation.** Although network-based storage solutions can improve capacity utilization and reduce complexity and management costs, an implementation partner must have well-formed and well-documented server/storage consolidation and data migration practices that don't limit future options while enabling higher returns on IT infrastructure investments.

- **Support of heterogeneous server and storage environments.** IT managers need to maximize the use of currently installed equipment whenever possible. An implementation partner must have both knowledge and contacts to identify and resolve quickly any interoperability problems. They should also make future IT infrastructure procurement decisions based on long-term investment protection to minimize interoperability issues going forward.

- **Integration of effective storage management into the deployment process.** Ongoing administration/management is the most overlooked and misunderstood issue in most IT deployment plans, regardless of company size. An implementation partner must help develop a management and provisioning process that works with existing management systems and takes advantage of the solution's new capabilities to improve management efficiency.

- **Supplier and solution selection.** Choosing the right solution and the right partner to assist in implementation is, therefore, the highest priority for enterprises that seek to align business and IT, capitalize on new applications, and fully leverage information to gain competitive advantage.

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