



Managing Storage across the Data Center with Hitachi TagmaStore Universal Storage Platform

Executive Summary

Hitachi Data Systems' announcement of the TagmaStore Universal Storage Platform provides organizations with a different way to manage storage. There are two key components of the Hitachi offering: 1) Storage controllers with advanced functions to provide traditional high-end storage for mission critical applications; and 2) Virtualization capabilities to provide storage management for all of the storage in the data center. Management of service levels is further enhanced by the ability to partition controllers, and provide multiple storage pools with different performance and functionality.

The business case is compelling, with break-evens of 6 months or less, triple-digit ROI, and a more than 30% reduction in the total cost of storage and storage management.

ITCentrix has looked in detail at the business case for this new approach to storage management in two environments, a banking organization, and a large manufacturing firm. The business case in both is compelling, with break-evens of 6 months or less, triple-digit ROI, and a more than 30% reduction in the total cost of storage and storage management.

Some of the concepts introduced by Hitachi are new, and the performance and functionality of the platform have yet to be proven other than in early installations. However, many functions are evolutionary and Hitachi has an impressive track record of delivering promised functionality over the last few years.

ITCentrix recommends users investigate this new approach, which potentially offers the best of both worlds; a choice of hardware platform best suited to the cost, performance, and functionality requirements of the application and user budget, and a single simplified storage management infrastructure, with significant reductions in management and operational savings.

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Storage Trends in the Data Center

Rapidly advancing technologies in storage networks have been part of the enabler of a swing back towards computing centralization. Storage networks have resulted in the ability to separate servers and storage and allow distinct management of the two resources. There have been two main types of storage network:

1. Fibre Channel networks (including ESCON/FICON channels for IBM Mainframes), which offer very good performance, availability and recoverability characteristics but are more expensive to connect.
2. Network Attached Storage, which has used traditional communications networks to provide very cheap connectivity, with lower performance, and service characteristics than Fibre Channel networks.

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Within the data center there are multiple solutions for different types of workloads, from expensive high-end controllers providing advanced functions for managing and controlling storage, to midrange storage with limited controller function but lower prices, to low-end SATA solutions.

Strategic Fit of Storage Solutions to Application Requirements

Figure 1 below helps explain where different types of storage are used in a typical data center, and the strategic fit of a corresponding storage approach. On the vertical axis is the importance of data availability and performance. Storage in tiers 1 & 2 support the most important applications to the organization, and tiers 2 & 4 support less mission critical applications. On the horizontal axis is the type of application that uses the data (operational or reference). In general there is a trend towards more data being mission critical, and a higher growth rate of reference data particularly driven by increased governance and regulatory requirements that mandate keeping data for longer periods of time.

The mission critical operational applications are in the top left hand corner. These are often database transactional systems, with a lot of reusable data suitable for caching, with high performance and recoverability requirements. Larger servers are driving the applications in this segment. The bottom right hand corner is often characterized by a large number of smaller servers and greater emphasis on connectivity.

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The importance of Figure 1 from a storage management perspective is a single storage solution is almost never appropriate for the entire data center. Having all storage with high functionality for example is not necessary or cost effective. Typically, one size does not fit all in the data center.

As the amount of information in the data center grows, the challenge for the storage management staff is how to manage and optimize the different types of storage.



Figure 1– Data Center Storage Topology

Importance of Data	Operational		Type of Data	Reference
	Tier 1 & 2	Storage Class: Hi End Market Penetration: 20% Growth Rate (CAGR): 37% Price relative to Hi End: 100% TB Managed / Admin: 40 Avg. Connections/Server: 6 High Storage Controller Function		
Tier 3 & 4	Storage Class: Midrange Market Penetration: 15% Growth Rate (CAGR): 24% Price/TB relative to Hi End: ~50% TB Managed / Admin: 16 Avg. Connections/Server: 2 Medium Storage Controller Function			Storage Class: SATA Market Penetration: 40% Growth Rate (CAGR): 32% Price/TB relative to Hi End: ~30% TB Managed / Admin: 20 Avg. Connections/Server: 1.5 Low Storage Controller Function

Strategic Choices in Managing Data Center Storage

The Strategic choices for managing this diverse and complex set of storage are:

1. Mix, Match and Manage

This is the most common approach taken in data centers. The best fit of storage is applied to each appropriate application and the storage staff manages a diverse set of resources

2. One storage system for all storage

Assuming high-end storage is used, this approach provides the lowest cost of administration and highest service levels to the user. However, it creates capital budget “sticker shock.” Alternatively, using low-end storage for all creates the reverse scenario – lower capital outlays, much higher overall TCO.

3. A software storage management overlay

Some data centers have tried taking traditional storage management software solutions to provide an overall umbrella of functionality to all storage. For example, storage virtualization functionality can be provided by this type of software independent of the storage devices. The advantage of this approach is minimized storage costs, and common storage management processes and procedures across all types of storage.

The disadvantage of this approach is that server-based software is not adept at driving high storage function. Performance and recoverability are challenges, as well as overall cost. From a storage architecture perspective, this approach is a less than ideal; the software needs to be much more closely integrated with the storage systems to provide effective performance and key functions such as recoverability.

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Hitachi's Storage Management Value Proposition

Hitachi TagmaStore Universal Storage Platform

Hitachi recently announced a different approach to storage management. With the Universal Storage Platform product line Hitachi has provided two distinct functions :

1. The traditional high performance, high function support for directly controlled storage.

The Universal Storage Platform, based on the third-generation Universal Star Network™ crossbar switch is a very high function, high performance controller, with the ability to drive two million IOs per second. The design allows scaling up to 332TB of internal storage. The functionality support is best of breed within the storage industry, including new Universal Replicator, Universal Volume Manager, and Virtual Partition Manager, plus enhanced versions of Volume Migration (formerly known as CruiseControl), TrueCopy remote replication, and ShadowImage in-system replication software.

2. The ability to manage “external storage” of different types, and provide them with the same functionality as the directly supported storage.

This is a radically different approach to providing management across all storage classes. Some of the functionality that makes this approach viable is the very high performance of the Universal Storage Platform and the delivery of logical partitioning.

Partitioning has been familiar to mainframe users for twenty years since Amdahl first introduced it and is now common on open systems servers from all the major vendors. It has been successfully used to help break-up large-scale resources and allocate them to specific workloads. This is a notable introduction of the concept for storage, and allows the storage controller resources (cache, connection ports, and storage capacity – internal and external) to be portioned into up to 32 different “pools,” or Private Virtual Storage Machines. This allows finer control over the resources allocated and the level of service provided.

Hitachi is initially supporting its own storage -- Lightning, Thunder (Fibre and SATA), and older 7700E -- for external management, and has announced plans to extend this support to a range of storage products from other Vendors.

New Storage Management Strategies with the Universal Storage Platform

The new storage management capabilities from Hitachi allow a different management approach to be taken. Data Centers will be able to adopt a different strategic choice, which offers the best of both worlds. Using the most cost effective storage for a particular application will minimize the cost of storage. The Universal Storage Platform will allow all of the storage to be managed as a single pool, with common processes and procedures for provisioning, enablement, chargeback, protection, recovery, and monitoring. Additional functionality can be provided to the external storage on an as-required

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basis. For example, some replication capability could be provided for particular tier 3 & 4 operational applications (bottom left in Figure 1). Or Volume Migration could be used on a one-off basis to move data from operational to reference and from high performance storage to lower performance lower cost drives.

This allows the potential to reduce the cost of storage management, by providing, on a controlled basis, enriched functionality to storage with minimal functionality. In addition, this provides significant improvement to the user experience through improved performance, availability, security, and flexibility (the ability to update and introduce new function as the business changes).

Methodology Used to Analyze the Customer Examples

ITCentrix uses a two dimensional methodology to assess the impact of different storage management strategies on organizations.

ITCentrix uses a two dimensional methodology to assess the impact of different storage management strategies on organizations. The method includes a total cost of ownership (TCO) approach that captures a customer's current equipment, software, and staffing costs and projects potential change based on complexity of environment, staff skills, and technology deployed.

To evaluate availability and flexibility benefits (so-called "intangibles"), ITCentrix uses a Value Flow methodology that establishes the value of service levels and flexibility to the organization today, and projects potential improvement based on a consolidated infrastructure.

ITCentrix evaluates a business case by taking as a starting point the existing storage management environment and assessing its current costs and business value; and then projecting the case for using the new Hitachi approach by forecasting the potential for benefit and the cost of achieving that benefit over a planning horizon (three years for this study). See Appendix A for a list some of the variables used in the ITCentrix Storage Model.

The process is automated by using a proprietary and patent-pending ITCentrix Storage Model independently developed by ITCentrix. Use of the model also ensures that inputs are used to create results in a consistent, objective, and repeatable manner. As a sanity check, ITCentrix uses its ValueBase industry database of cost and value metrics to compare results against industry averages. More information on the methodology can be obtained from the ITCentrix website (www.itcentrix.com).

The final step of the process was to validate the conclusions by interviewing the storage management professionals in two large storage operations.

The quantifiable benefits from storage enhancement fall into three main categories:

- **Operational Costs Benefits** – Savings from factors such as increased staff efficiencies, as well as lower acquisition, maintenance, software, and space/power/cooling costs.
- **Service Level Improvements** – Additional user productivity from higher application availability and costs associated with planned and unplanned downtime and security enhancements.



- **Flexibility Enhancements** – Additional benefit from speeding the time to develop and introduce new applications or application function that customers, employees, and constituents can exploit.

Case Study Snapshots

Case Study 1: Medium-sized Bank

Current Data Center Environment: Mainframes for Tier 1 & 2 operational systems, UNIX Open Systems for Tier 3 & 4 operational systems, and a mixture of small servers for reference systems.

Challenge and Objectives: Establish confidence in users that centralized IT storage is cost effective

Potential Project Scope: Consolidation of Storage Management

Solution with Hitachi TagmaStore Universal Storage Platform:

- Provide 100TB of High Performance storage (Universal Storage Platform) for Tier 1 & 2 Operational systems and provide controller functionality for managing 300TB of external storage already installed
- Create a Storage Management hierarchy that can be managed by the appropriate skill level
- Create a single management process for provisioning, allocation, monitoring, protection, and recovery
- Provide improved service to end users in availability, security, performance and flexibility (ability to implement change quicker)
- Projected benefit of \$14.6 million from the reduced cost of running IT (\$8.2M), and increased value to the users (\$6.4M), with a payback within IT in 5 months and an IRR of 296%

Case Study 2: Large Manufacturer

Current IT Environment: Mainframes & UNIX (ERP) for Tier 1 & 2 operational systems, UNIX Open Systems for Tier 3 & 4 operational systems, and a mixture of a large number of small servers for reference systems

Challenge and Objectives: Establish control over Service levels and management of storage on the large number of small systems in the Data Center due to increased focus on compliance.

Potential Project Scope: Storage Management on smaller systems

Solution with Hitachi TagmaStore Universal Storage Platform:

- Provide 200TB of High Performance storage (Universal Storage Platform) for Tier 1 & 2 Operational systems, and provide controller functionality for managing 800TB of external storage already installed
- Provide significantly reduced costs for connection of a very large number (4,000+) of small servers
- Create a single management process for provisioning, allocation, monitoring, protection, and recovery
- Provide improved service to end users in availability, security, performance and flexibility (ability to implement change quicker)
- Projected benefit of \$22.8 million from the reduced cost of running IT (\$18.5M), and increased value to the users (\$4.3M), with a payback within IT in 4 months and an IRR of 307%



Proof Points – Case Studies

This section provides two case studies of complex data centers. ITCentrix worked with customers to understand the potential impact of a new way of managing storage.

Case Example Details

Case I – Medium-sized Bank

The medium-sized bank has assets of \$40B (nearly \$1B in revenue), with 4,000 staff at an average salary of \$55,000. Almost all the staff uses the banking systems. The organization is highly dependent on IT applications spending about 50% of their time actively using systems.

The current customer Data Center environment includes a number of mainframes for Tier 1 and 2 operational systems, UNIX Open Systems for some Tier 1 and 2 systems and most Tier 3 and 4 operational systems, and a mixture of small servers for reference systems. One hundred percent of the mission critical operation data is replicated to meet SEC requirements. Storage management is highly automated for mission critical operational data and less automated elsewhere in the data center. Additional information is shown in table 1

Table 1

	Case Study Data			
	Operational Data		Reference Data	
	Tier 1 & 2	Tier 3 & 4	Tier 1 & 2	Tier 3 & 4
Usable TB	100	80	100	120
% Replication	100%	10%	0%	0%
Number of Servers	100	133	500	1,200
TB/ Storage Administrator	30	12	9	15

Challenge and Objectives:

- Establish confidence in users that centralized IT storage is cost effective
- Reduce the cost of storage to users

New Universal Storage Platform Solution Objectives

- Provide 100TB of High Performance storage (**Universal Storage Platform**) for Tier 1 & 2 Operational systems, and provide controller functionality for managing 300TB of external storage already installed
- Create a Storage Management hierarchy that can be managed by the appropriate skill level
- Create a single management process for provisioning, allocation, monitoring, protection, and recovery

Projected Benefits

- A projected \$14.6 million benefit from the cost of running IT (\$8.2M), and increased value to the users (\$6.4M), with a cost savings payback of 5 months and an IRR of 296%



- Improved service to end users in availability, security, performance and flexibility (ability to implement change more quickly)
- A simpler more stable storage management environment

Potential Future Plans

- Provide additional granularity for storage services
- Provide same approach for other data centers

Model Outputs

The following examples quantify the incremental business case for the **Universal Storage Platform** as compared to competitive best-of-breed solutions in the marketplace today.

- **Figure 2 below** – Shows the overall incremental value of centralizing storage management and providing 100TB of **Universal Storage Platform** storage versus providing industry best of breed for the 100TB of new storage and continuing with low cost minimal storage controllers for the other storage requirements. It shows the operational savings and the benefits from improved availability, performance, flexibility and security.
- **Figure 3 below** – Reflects the Operational cost differences and the line items for both the current storage management model and the more centralized storage management model.
- **Figure 4 below** – Shows the overall financial data and cash flow for the business case to invest additional funds in the Universal Storage Platform above and beyond conventional competitive storage. Figure 4 displays the initial incremental startup cost for enabling the Universal Storage Platform to manage an additional 300TB of external storage. It also shows the cash flows for both the TCO-only case (IT cost savings benefits) and the overall business case (IT cost savings and business cost savings/productivity benefits) to invest additional funds in the Universal Storage Platform above and beyond conventional competitive storage.



Figure 2 – Overall Delta Value of Universal Storage Platform in Case I

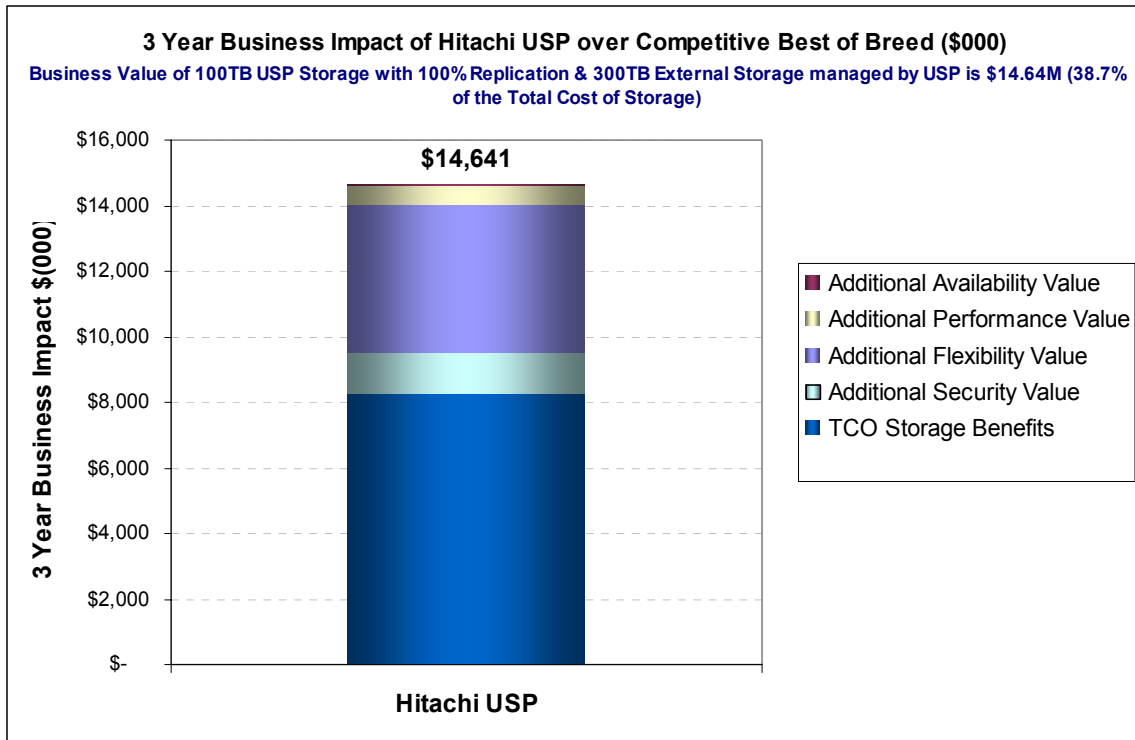
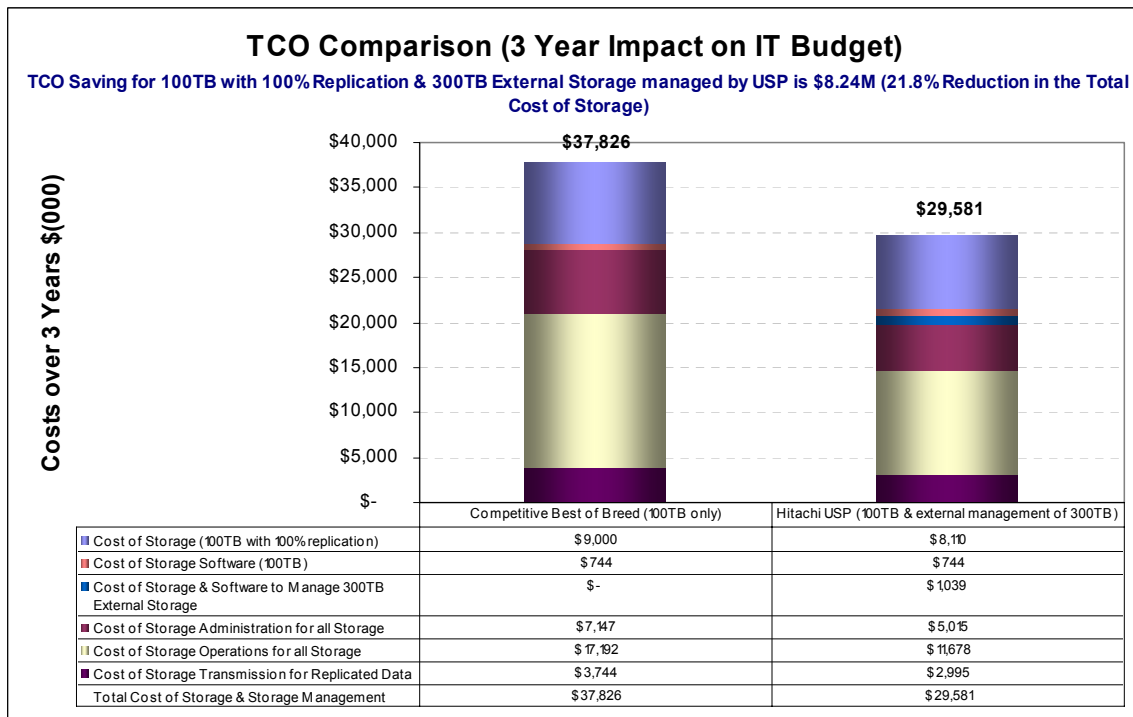


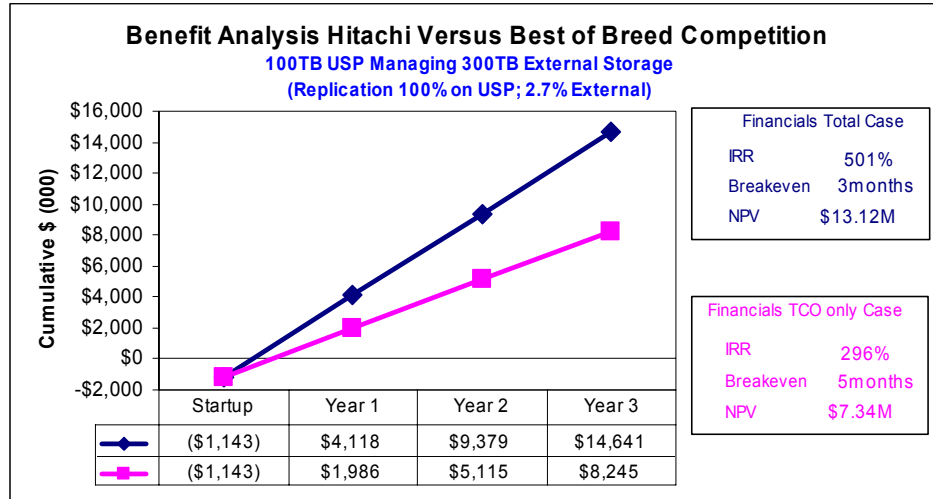
Figure 3 – TCO in Case I



Cost of storage and software to manage external storage = 0 for vendors that do not have capabilities for attaching or managing external storage. The reduction in TCO (Cost of storage and storage management) on 100TB Universal Storage Platform/300TB External was as high as 32% on some configurations.



Figure 4– Business Analysis for Case I



Case II – Large Manufacturer

The large manufacturer has revenues of \$2B, with 10,000 staff at an average salary of \$45,000. Fifty percent of the staff are users, using the manufacturing systems 30% of the time.

Current IT Environment: A mixture of mainframes and UNIX (ERP) systems for Tier 1 & 2 operational systems, UNIX Open Systems for Tier 3 & 4 operational systems, and a mixture of a large number of small servers for reference systems. Fifty percent of the mission critical operation data is replicated for disaster recovery.

Access to all the data is currently managed by an extensive switching infrastructure, and all servers can access most of the data. Storage management is highly automated for mission critical operational data, and has a very efficient management process (40TB of storage are managed by each storage administrator). Storage administration is less automated elsewhere in the data center. Additional information is shown in table 2.

Table 2

	Case Study Data			
	Operational Data		Reference Data	
	Tier 1 & 2	Tier 3 & 4	Tier 1 & 2	Tier 3 & 4
Usable TB	200	250	150	400
% Replication	50%	5%	0%	0%
Number of Servers	200	417	750	4,000
TB/ Storage Administrator	40	16	12	20

Challenge and Objectives:

- Establish control over service levels and management of storage on the large number of small systems in the Data Center due to increased focus on compliance
- Provide significantly reduced costs and incremental business value for the organization



New Universal Storage Platform Solution Objectives

- Provide 200TB of High Performance storage (**Universal Storage Platform**) for Tier 1 & 2 Operational systems, and provide controller functionality for managing 800TB of external storage already installed
- Provide significantly reduced costs for connection of a very large number (4,000+) of small servers
- Create a single management process for provisioning, allocation, monitoring, protection, and recovery

Projected Benefits

- Improved service to end users in availability, security, performance, and flexibility (ability to implement change quicker)
- Projected benefit of \$22.8 million from the reduced cost of running IT (\$18.5M), and increased value to the users (\$4.3M), with a cost savings payback within IT in 4 months and an IRR of 307%
- A reduction in the cost/connection to a server port from \$1,397 to \$654. This is a significant contribution to the reduction in cost of Storage operations (see figure 6 below.)

Potential Future Plans

- Bring additional distributed processing into the data center as a result of more efficient management and better compliance

Model Outputs

- **Figure 5 below** – Shows the overall incremental value of centralizing storage management and providing 200TB of USP storage against providing industry best of breed for the 200TB of new storage and continuing with low cost minimal storage controllers for the other storage requirements. It shows the operational savings and the benefits from improved availability and agility.
- **Figure 6 below** – Shows the Operational cost differences and the line items for both the current storage management model and the more centralized storage management model. Of particular interest is the cost of storage operations, which is high because of high connectivity costs.
- **Figure 7 below** – Shows the overall financial data and cash flow for the business case to invest additional funds in the Universal Storage Platform above and beyond conventional competitive storage. Figure 7 displays the initial incremental startup cost for enabling the Universal Storage Platform to manage an additional 800TB of external storage. It also shows the cash flows for both the TCO-only case (IT cost savings benefits) and the overall business case (IT cost savings and business cost



savings/productivity benefits) to invest additional funds in the Universal Storage Platform above and beyond conventional competitive storage.

Figure 5 – Overall Delta Value of Universal Storage Platform in Case II

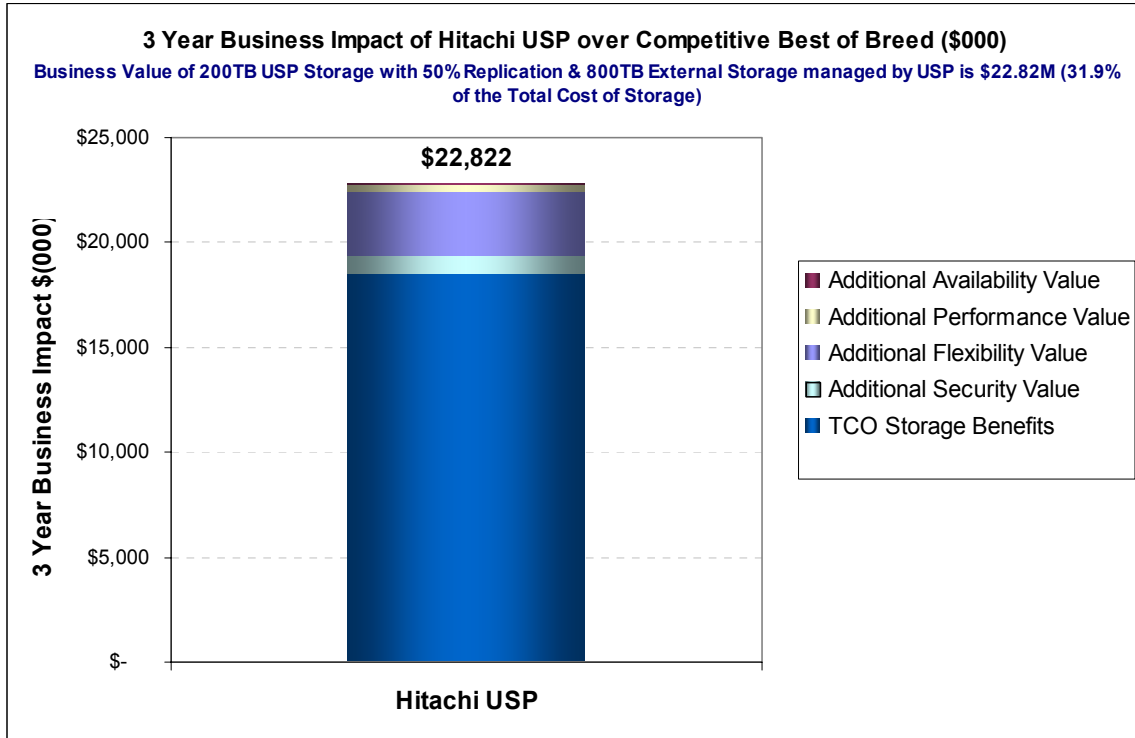
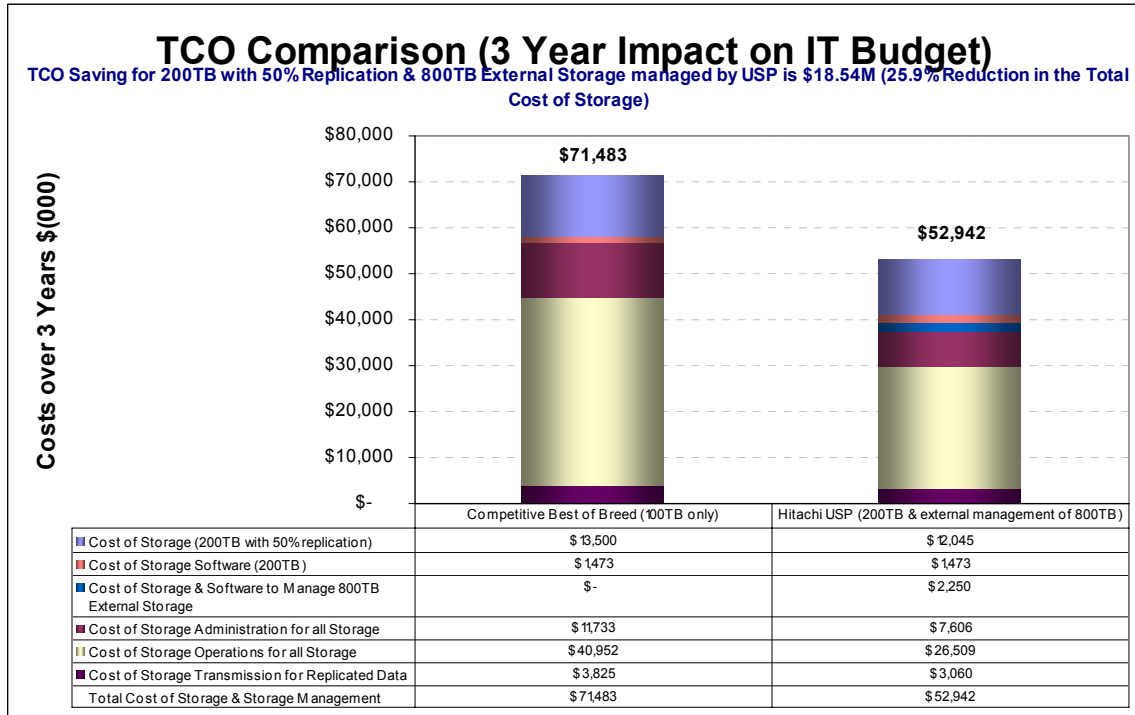
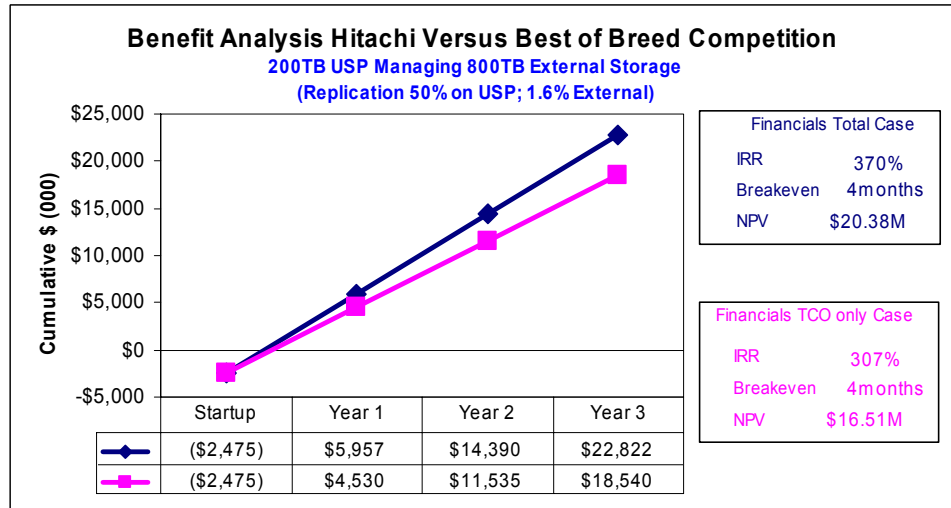


Figure 6 – TCO in Case II



Cost of storage and software to manage external storage = 0 for vendors that do not have capabilities for attaching or managing external storage. The reduction in TCO (Cost of storage and storage management) on 200TB Universal Storage Platform/800TB External was as high as 38% on some configurations.

Figure 7– Business Analysis for Case II



Conclusions and Recommendations

The Hitachi TagmaStore Universal Storage Platform provides a new strategic option for managing storage in the data center. The business case for taking this approach is very strong, as shown in the case studies. Specifically, the incremental investment required to accommodate the management of external storage is offset by the



substantial benefits of cost savings and increased business value in many environments and configurations we studied.

This new approach is not without risks, including:

- Despite the exploitation of proven technologies, the concept is new, and there will be a learning curve in how to apply the solution in practice
- Hitachi must deliver proof of functionality and performance at reference accounts
- A potential delay in the delivery of functionality, particularly for support of storage from other vendors

Hitachi Data Systems has an aggressive early adoption program and a number of customers have the Universal Storage Platform installed. ITCentrix recommends that potential customers press Hitachi Data Systems for more information on the progress of these installations.

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ITCentrix recommends that for a successful Storage Management consolidation project, the following needs to be in place:

1. An effective storage management operation. Users should consider implementing a hierarchical storage management structure with fewer central staff, and more distribution of tactical storage management closer to the applications and line of business.
2. Customers should focus the application of these new concepts on storage management challenges. In many cases the key driver will be the reduction in cost of connection of storage to server farms.
3. Software costs for storage need to be managed carefully, especially if they are based on a TB managed basis. As the cost of hardware declines at 35% per year, software becomes an increasingly significant portion of total cost. ITCentrix recommends customers exploit the partitioning capabilities to provide storage pools with different performance characteristics and software functionality. Users should pressure Hitachi Data Systems to provide increased granularity of software pricing (e.g., within a partition) and provide users with more predictable software pricing models so that budgets can be planned.
4. Users should decide on which areas to focus by producing business cases showing the direct and indirect benefits of providing a more centralized storage management approach.
5. As the concepts are new, professional services should be engaged in the early stages of planning and implementing with a trusted business partner.

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Appendix A

The model used by ITCentrix uses a very large number of variables to evaluate the business impact of changes in Technology. In tables 3, a number of these variables are highlighted.

Table 3 – Some Variables in the ITCentrix Model

Some Variables in the ITCentrix Model
% Allocation
Tbytes
% Replication
% Universal Replicator
% Cruise Control
% Shadow Image / Snapshot
Number of Logical Partitions
Installed Type of Storage
Proposed Type of Storage
Cost/Storage Administrator
Relative Efficiency of Storage Administration
Tbytes/Administrator
Number of Administrators
Cost of Administration
Number of Tbytes managed by USP Controller (Max)
% Savings in Storage Administration from USP
Savings in Storage Administration from USP
Number of Servers
Tbytes/Server
Cost of Storage (Tbyte/Year)
Storage Savings with USP
Average Number of Connections/Server
\$Cost/Connection
Cost of Server to Storage Connection
Cost of Storage Operations (Other)
Total Cost of Storage Operations
Total Storage Operational Savings with USP
Cost of Replication Transmission
Replication Transmission Savings with USP
Application Value supported by IT
Value of Inflexibility
Days earlier Impact of USP on Flexibility
Business Benefit of Flexibility from USP
Performance (impact on Response time) from USP
Business Benefit of Performance Enhancement from USP
Impact on Productivity of an outage on Users while using IT
Business Benefit of Improved Availability from USP
Opportunity Cost of Security
Business Benefit of Improved Security from USP
Cost of Hitachi Software
Cost of Competitive Software