



# Hitachi's Storage Management Vision Expands Reach and Range

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## Executive Summary

In July 2005, Hitachi announced the Network Storage Controller NSC55, a midrange version of the TagmaStore Storage line first announced in September 2004. The NSC55 is a rack-mounted version of the Universal Storage Platform (USP), smaller in size and throughput, but with all of the functionality and benefits of virtualization and storage management. It builds on the original TagmaStore value proposition of:

- The possibility of controlling all storage imaginable (up to 16 Petabytes) within a single management architecture.
- The ability to mix, match, and manage different storage technologies from different vendors within the architecture.
- An architecture that provides true virtualization for all storage volumes under management.
- A set of centralized software that can be used to manage, copy and secure all virtualized volumes on an as-required basis.

This white paper looks at three in-depth case studies to help identify and quantify the economic value proposition of the NSC55 in mid-sized data centers. These studies show that relative to best-of-breed mid-range competition, the NSC55 has the potential to reduce total cost of ownership up to 32% depending upon configuration size, degree of replication and type of competitive platform.

The scenarios analyzed in this study include:

1. **Case 1** The value of managing all storage assets of a data center from the NSC55 by virtualizing all data, as well as providing high-performance storage for performance critical workloads. In addition, the NSC55 provides software services for all storage. This is compared to the traditional method of managing different storage pools with different configurations using today's best-of-breed competitive midrange storage products.
2. **Case 2** The value of using the NSC to manage all storage, compared with an appliance virtualization solution.
3. **Case 3** The value of using the NSC55 and Hitachi's Universal Replicator to provide asynchronous replication of all data over extended distances.

ITCentrix concludes that:

- Hitachi has a clear and compelling vision for managing data center storage, with an inclusive and cooperative approach.
- Customer interviews confirm Hitachi's multi-vendor virtualization works, and provides the basis to apply a common set of storage management software functionality where and when needed.



- For many workloads and environments, Hitachi's TagmaStore architecture is more scalable, compelling, and architecturally sound than the virtualization appliance approach seen in IBM's SAN Volume Manager or EMC's recently announced Invista products. ITCentrix believes Hitachi has achieved key advantages by placing the locus of control close to the data.
- Hitachi's Universal Replicator provides a new and exciting approach to asynchronous backup over distance. Case study 3 shows the cost of telecommunications lines is halved, and the recovery characteristics significantly enhanced. This will bring remote copy within the budget of many more organizations, and significantly improve the business resilience.

Alternatively, the NSC55 is not the best strategic fit for very small data centers that have little or no mission critical workloads or have workloads better suited to the lower cost attributes of modular storage. Customers with NAS-friendly workloads (e.g. technical) may choose to consider the NAS blade capabilities of the NSC. In general, however customers that can effectively maintain silos of homogeneous workloads with limited multitasking requirements may be better served with modular arrays (unless there is a requirement for medium to high volume remote copying of data or for low cost SATA storage on mainframes).

As well, the NSC55 is not an ideal strategic fit for larger data centers with workloads that may exceed the overall throughput capacity of NSC55. For these the USP 100/600/1100 is better choice.

Overall, the TagmaStore architecture provides IT management with the best of two worlds; the ability to use almost any storage available to meet optimal price/performance characteristics, and the ability to manage storage across the entire data center with a single set of software. This clearly changes the dynamics of how mid range data centers can be organized to meet business priorities versus IT necessities.

IT executives of all medium and large data centers should examine the Hitachi TagmaStore offerings, and include them in storage evaluations.

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## ***Hitachi's TagmaStore NSC55 Value Proposition***

### ***Hitachi TagmaStore NSC55***

The Network Storage Controller NSC55 provides two distinct functions:

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

The NSC55 is based on the same third-generation Universal Star Network™ crossbar switch found in the Hitachi Universal Storage Platform. It is a very high function, high performance controller. The design allows scaling up to 72TB of internal storage, and the management of up to 16 Petabytes of external storage. The functionality support is the same as the USP, including the new Universal Replicator, Universal Volume Manager, and Virtual Partition Manager, and enhanced versions of Volume Migration, TrueCopy remote replication, and ShadowImage in-system replication software.

2. The ability to manage “external storage” from different vendors and of different types, providing the same functionality as directly supported storage.

This is a radically different approach to providing management across all storage classes. The NSC55 provides virtualization support for all the volumes (internal and external), so that users can ensure management of these resources is centralized using common storage management software. Specific additional software functionality can then be applied to any of the volumes in the overall storage pool.

Hitachi is supporting its own storage -- Lightning, Thunder (Fibre and SATA), and the newly introduced Workgroup Modular Storage and Adaptable Modular Storage for external management, and supports a range of storage products from other vendors, including EMC and IBM.

### ***Benefits of NSC55***

The new storage management capabilities from Hitachi allow a different management approach to be taken. Data Centers will be able to adopt and manage the most appropriate strategic choice, using the most cost effective storage for a particular application. Allowing non-disruptive data migration between tiers and a single management framework will minimize storage costs dramatically. The Universal Storage Platform will also allow all 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 basis. For example, some replication capability could be provided for particular tier 3 & 4 operational applications (bottom left in Figure 1). Alternatively, 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 offers the potential to reduce the cost of storage management by providing, on a controlled basis, enriched functionality to storage with

*This is a radically different approach to providing management across all storage classes.*



minimal disruption. 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).

## **ITCentrix Data Center Storage Topology**

### *Strategic Fit of Storage Solutions to Application Requirements*

Figure 1 below shows the ITCentrix Data Storage Topology, and 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 3 & 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.

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.

*The importance of Figure 1 from a storage management perspective is a single storage solution is almost never appropriate for the entire data center.*

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 grows, the challenge for storage management staff is how to manage and optimize the different types of storage.



Figure 1– Data Center Storage Topology

Importance of Data	Type of Data	
	Operational	Reference
Tier 1 & 2	Storage Class: Hi End Market Penetration: 20% Growth Rate (CAGR): 37% Price relative to Hi End: 100% TB Managed / Admin: 50 Avg. Connections/Server: 6 <b>High Storage Controller Function</b>	Storage Class: Midrange Market Penetration: 25% Growth Rate (CAGR): 46% Price/TB relative to Hi End: ~50% TB Managed / Admin: 15 Avg. Connections/Server: 2 <b>Medium Storage Controller Function</b>
Tier 3 & 4	Storage Class: Midrange Market Penetration: 15% Growth Rate (CAGR): 24% Price/TB relative to Hi End: ~50% TB Managed / Admin: 20 Avg. Connections/Server: 2 <b>Medium Storage Controller Function</b>	Storage Class: SATA Market Penetration: 40% Growth Rate (CAGR): 24% Price/TB relative to Hi End: ~30% TB Managed / Admin: 25 Avg. Connections/Server: 1.5 <b>Lower Storage Controller Function</b>

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

**Methodology Used to Analyze the Customer Examples**

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 streamlined 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). The Hitachi improvements are then compared to those generated by competitive best-of-breed solutions, a “delta business case” is constructed, meaning the differences in costs, and benefits between the two proposed solutions are analyzed in financial terms. See Appendix A for a list of variables used as input for this analysis.

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 and best practices. More information on the methodology can be obtained from the ITCentrix website ([www.itcentrix.com](http://www.itcentrix.com)).



The final step of the process is to validate the conclusions by interviewing storage management professionals in three medium sized storage operations and adjusting the model accordingly.

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 - NSC VS. Competitive Best-of-breed Midrange Storage

Organization: Manufacturer with \$2B in revenue

Current IT Environment: Part of one data center, with Open Systems and 30TBytes of high performance Storage, with 30Tbytes of general-purpose storage.

Challenge and Objectives: Provide cost effective solution for part of the data center, allowing central control of all data to contain management costs. Provide better ability to make changes to systems.

Potential Project Scope: Centralized management of storage for this part of the data center, and show users it is cost-effective

Solution with Hitachi TagmaStore Network Storage Controller:

- Provide 30TB of High Performance storage (NSC55) for Tier 1 & 2 Operational systems, and provide controller functionality for managing 30TB of external storage already installed.
- Create a single management process for provisioning, allocation, monitoring, protection, and recovery in order to meet the revised RTO objectives.
- The projected Total financial benefit of providing the Hitachi NSC55 solution system (the delta case vs. competition) was \$1.98M, with a payback of 2 months and an IRR of 743%. The NPV was \$1.78M.

### Case Study2 – NSC against Competitive Best-of-breed Midrange with Virtualization Appliances

Organization: Manufacturer with \$2B in revenue

Current IT Environment: All of the Open Systems in one data center, with 30TBytes of high performance Storage, and 200Tbytes of general-purpose storage supporting a large number of servers.

Challenge and Objectives: Provide cost effective solution for the entire data center, allowing central control of all data to contain management costs. Provide better ability to make changes to systems. Ensure there is remote copy capability for some key applications.

Potential Project Scope: Centralized management of storage for the entire data center, and show users it is cost-effective. Provide the ability to replicate remotely a small proportion of mission critical systems (8% of all storage). Provide better ability to make changes to systems.

Solution with Hitachi TagmaStore Network Storage Controller:

- Provide 30TB of High Performance storage (NSC55) for Tier 1 & 2 Operational systems, and provide controller functionality for managing 200TB of external storage already installed.
- Create a single management process for provisioning, allocation, monitoring, and protection.
- Install Universal Replicator and remote storage 300 miles from the main site at another data center.
- The projected Total financial benefit of providing the Hitachi NSC55 solution system (the delta case vs. Virtualization Appliance competition) was \$5.69M, with a payback of 1 month and an IRR of 1648%. The NPV was \$5.13M.



### **Case Study3 – NSC Universal Replicator against Traditional Asynchronous Remote Copy**

Organization: Small Regional Bank

Current IT Environment: Open Systems with 10TBytes of high performance Storage, and 10Tbytes of general-purpose storage.

Challenge and Objectives The bank is growing larger, and coming under SEC scrutiny. In compliance, the business has mandated a second site 300 miles away, and that the RPO (Recovery Point Objective, see figure 8 ) be reduced from 18 hours to 15 minutes, and the RTO (Recovery Time Objective) be reduced from 4 days to 4 hours. To achieve this requires data center operations establish control over service levels and management of storage on all systems in the Data Center, which are inter-related.

Potential Project Scope: Asynchronous Remote Copy from the production site to the secondary site 300 miles away, and improved storage management on all systems.

Solution with Hitachi TagmaStore Network Storage Controller:

- Provide 10TB of High Performance storage (NSC55) for Tier 1 & 2 Operational systems, and provide controller functionality for managing 10TB of external storage already installed.
- Create a single management process for provisioning, allocation, monitoring, protection, and recovery in order to meet the revised RTO objectives.
- Provide significantly reduced line costs (50%) and significantly better RPO (15 vs. 50 minutes) than traditional asynchronous solutions.
- The projected benefit of providing the Hitachi Universal Replicator (UR) asynchronous remote backup system was \$5.6M (NPV), with a payback of 4 months and an IRR of 67%.
- The projected benefit of the delta case for using Hitachi's UR system over traditional asynchronous systems was \$1.15 million from the reduced cost of running IT (\$.31M), and increased value to the users (\$0.84M) by meeting the RPO objective.



## Proof Points – Case Studies

This section provides details of three case studies of mid-sized data centers. ITCentrix worked with customers to understand the potential impact of a new way of managing storage.

### Case Example Details

#### Case 1 – Manufacturer – 30TB/30TB versus Traditional Midrange

The manufacturer has revenues of \$2 Billion, with 10,000 employees with an average salary of \$45,000. The data center is one of several in the organization. About 50% of the staff use this center, and are active 30% of their time using applications supported by the center.

The current Data Center environment includes a typical manufacturing mix of ERP UNIX Open Systems for Tier 1 and 2 systems, and a mixture of Tier 3 and 4 operational systems. There are a large number of small servers for reference and collaborative systems.

Additional information is shown in table 1:

Table 1 – Case 1: Case Study Data

Case Study Data					
	Operational Data		Reference Data		
	Tier 1 & 2	Tier 3 & 4	Tier 1 & 2	Tier 3 & 4	
TB	30	9	6	15	
% Replication	0%	0%	0%	0%	
Number of Servers	23	12	22	115	
TB/ Storage Administrator	50	20	15	25	

#### Challenge and Objectives:

- Provide a cost effective solution for a portion of the data center, for which there is no remote copy requirement, but does include some mission critical and demanding workloads.
- Simplify overall management of storage across this portion of the data center to improve the utilization of storage assets.
- Provide storage management services to all storage in a consistent and cost effective manner.
- Improve the time to implement change (flexibility).

#### New NSC55 Solution Objectives

- Provide 30TB of High Performance storage (NSC55) for Tier 1 & 2 Operational systems, and controller functionality for managing 30TB 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.
- Be cost effective against best-of-breed mid-range competition.



### Projected Benefits

- The projected Total financial benefit of providing the Hitachi NSC55 solution system (delta case vs. competition) was \$1.98M, with a payback of 2 months and an IRR of 743%. The NPV was \$1.78M.
- The projected TCO reduction (versus best-of-breed competition) financial benefit of providing the Hitachi NSC55 solution system was \$0.46M, with a payback of 6 months and an IRR of 199%. The NPV was \$0.41M.
- Improved service to end users in availability, security, performance and flexibility (ability to implement change more quickly).
- A simpler more stable storage management environment that would enable changes within the data center to be accomplished more easily.

### Model Outputs

The following examples quantify the incremental business case for the NSC55 as compared to competitive best-of-breed solutions in the marketplace today.

- **Figure 2 below** – For Hitachi’s NSC configuration, the costs reflect the business case for providing 30TBytes of high performance storage, and the additional storage to manage the virtualization of the previously installed 30TB. The competitive best-of-breed solution is not virtualized. The TCO benefits shown come from better storage utilization for the NSC, easier administration, better connectivity through virtual ports, and better storage operational costs.
- **Figures 3 and 4 below** – Shows the overall business case for providing Hitachi’s Network Controller Storage compared with a competitive best-of-breed traditional midrange storage solution. The most important benefits over and above the TCO benefits were the improvement in flexibility that accrues, and the improved security benefit. The flexibility benefit was calculated by assessing the value contribution of employees while they are using IT. For this organization, the application value is assessed as approximately \$300M. Maintenance of hardware and software is required to maintain the functionality of applications and infrastructure, and maintain the productivity of the end-users. If nothing is maintained, ITCentrix has found that the productivity of the users of an application will be reduced by about 10% per year. The overall benefit of Hitachi’s NSC controller was assessed as reducing the time to apply maintenance by 1.5 days, and therefore accelerating benefits to users by 1.5 days. This calculates to a value of \$1.2M over the 3 years. A similar methodology was used to calculate the business value of improved security.



Figure 2 – Case 1: The 3 year TCO case for Hitachi NSC55 against Competitive Mid-range

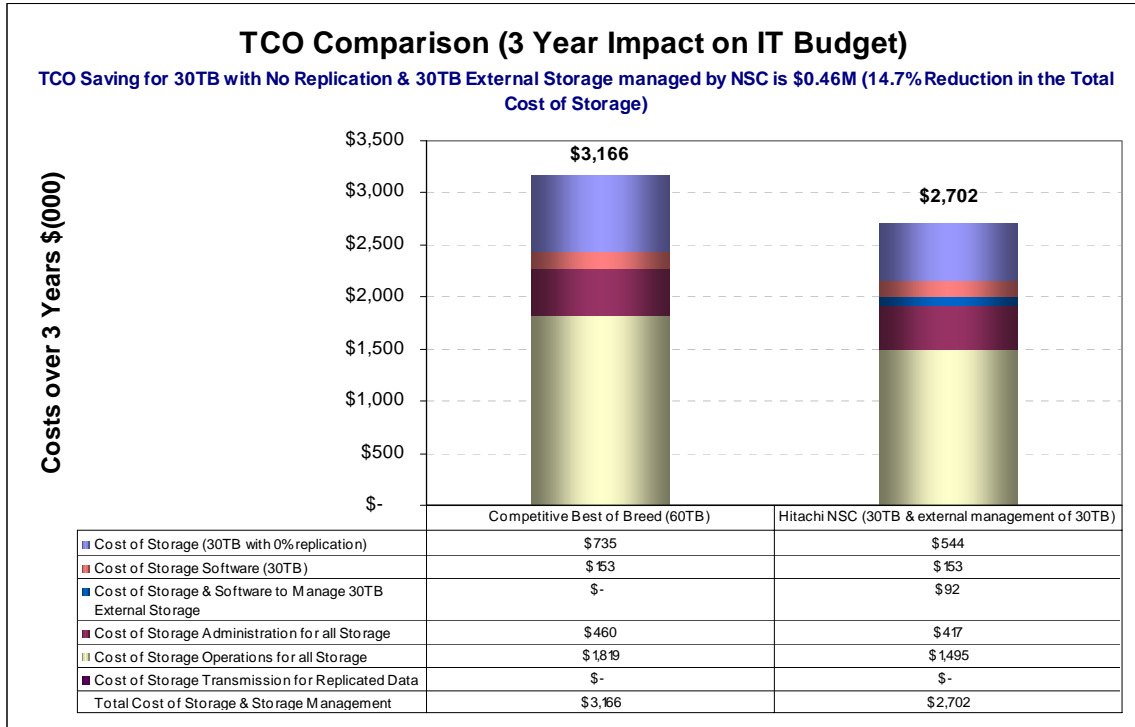




Figure 3 – Case 1: Total Business Impact of Hitachi NSC over Competitive Midrange

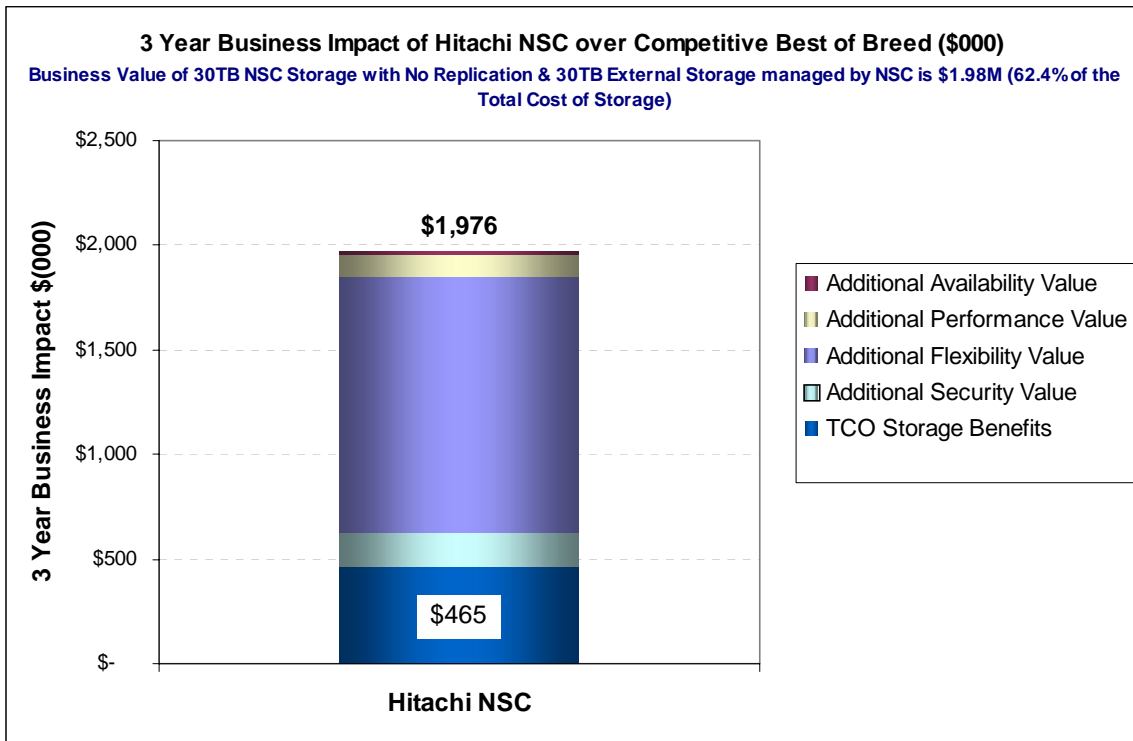
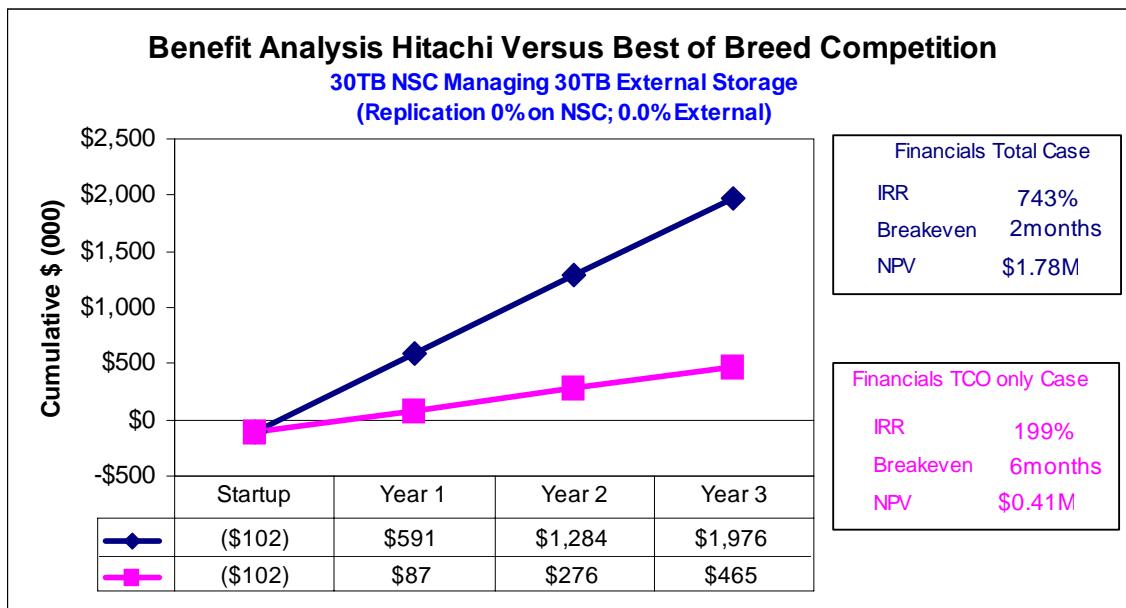


Figure 4 – Case 1: Financials of Business Case





**Case 2 – Manufacturer – 30TB/200TB versus Appliance**

Case 2 looks at the same manufacturer with a different application, a larger configuration with some replication (8% of storage under management). The case compares the Hitachi solution to a competitive virtualization appliance. Again, the manufacturer has revenues of \$2 Billion, with 10,000 employees with an average salary of \$45,000. The data center is one of several in the organization. About 50% of the staff use this center, and are active 30% of their time using applications supported by the center.

The current Data Center environment includes the typical manufacturing mix of ERP UNIX Open Systems for Tier 1 and 2 systems, and a mixture of Tier 3 and 4 operational systems. There are a large number of small servers for reference and collaborative systems.

Additional information is shown in table 2:

**Table 2 – Case 2: Case Study Data**

Case Study Data					
	Operational Data		Reference Data		
	Tier 1 & 2	Tier 3 & 4	Tier 1 & 2	Tier 3 & 4	
TB	30	63	38		100
% Replication	50%	5%	0%		0%
Number of Servers	23	80	144		769
TB/ Storage Administrator	50	20	15		25

**Challenge and Objectives:**

- Provide a cost effective solution for the entire data center, which includes some mission critical and demanding workloads.
- Simplify the overall management of storage across a portion of the data center to improve the utilization of storage assets.
- Provide storage management services to all storage in a consistent and cost effective manner. In particular, provide remote copy of data from key applications (50% of NSC is replicated, 1.6% of external is replicated which weights to 8% of all data replicated).
- Improve the time to implement change (flexibility).

**New NSC55 Solution Objectives**

- Provide 30TB of High Performance storage (NSC55) for Tier 1 & 2 Operational systems, and controller functionality for managing 200TB 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.



- Be cost effective against competitive best-of-breed Virtualization Appliance solutions.
- Provide remote copy for 8% of overall data.

### **Projected Benefits**

- The projected Total financial benefit of providing the Hitachi NSC55 solution system (delta case vs. Virtualization Appliance competition) was \$5.69M, with a payback of 1 month and an IRR of 1648%. The NPV was \$5.13M.
- The projected TCO reduction financial benefit of providing the Hitachi NSC55 solution system (versus best-of-breed competition) was \$4.01M, with a payback of 2 months and an IRR of 174%. The NPV was \$3.61M.
- Dramatically reduced transmission costs (by 50%).
- Improved service to end users in availability, security, performance and flexibility (ability to implement change more quickly).
- A simpler more stable storage management environment that will enable change within the data center to be accomplished more easily.

### **Model Outputs**

The following examples quantify the incremental business case for the NSC55 as compared to competitive best-of-breed solutions in the marketplace today.

- **Figure 5 below** – For Hitachi’s NSC configuration, the costs reflect the expense of 30TBytes of high performance storage, and the additional controller capacity and software to manage the virtualization of the already installed 200TB. The main benefits derive from the lower cost solution of the integrated Hitachi approach (no separate virtualization appliances are required). In addition, the maximum number of Terabytes that can be supported by the competitive solution is 64 Terabytes, so that multiple appliances are required. Benefits also include about \$0.5M from decreased cost of telecommunication lines for remote copy (see Case 3 for a more complete discussion).
- **Figures 6 & 7 below** – Shows the overall business case for providing Hitachi’s Network Controller Storage compared with a competitive best-of-breed traditional midrange storage solution. The most important benefits over and above the TCO benefits were the improvement in flexibility that accrues, and the improved security. The flexibility benefit was calculated in the same way as in case one. In this case, the comparative benefit of Hitachi’s solution was lower, because the Virtualization appliance provided some benefits to the speed to change.
- **Table 3 below** – displays some of the detailed assumptions made in this case concerned with replication.

Figure 5 – Case 2: 3-year TCO for NSC case against Virtualization Appliances

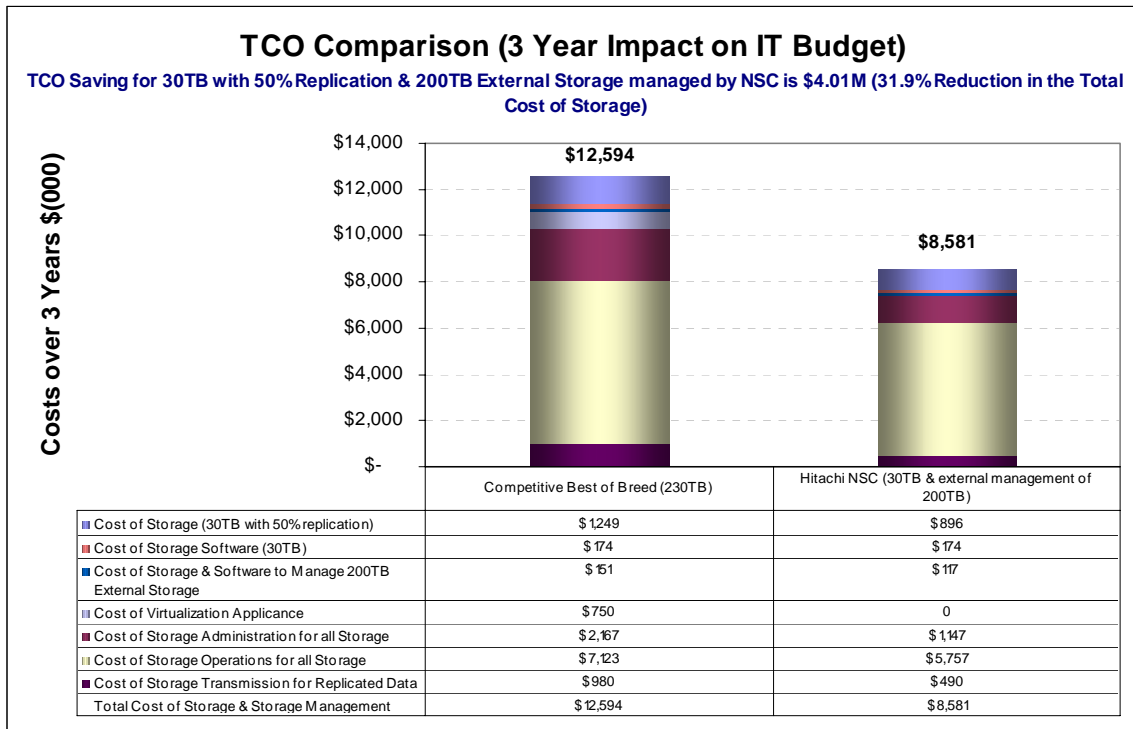


Figure 6 – Case 2: Impact of Hitachi NSC over Virtualization Appliances

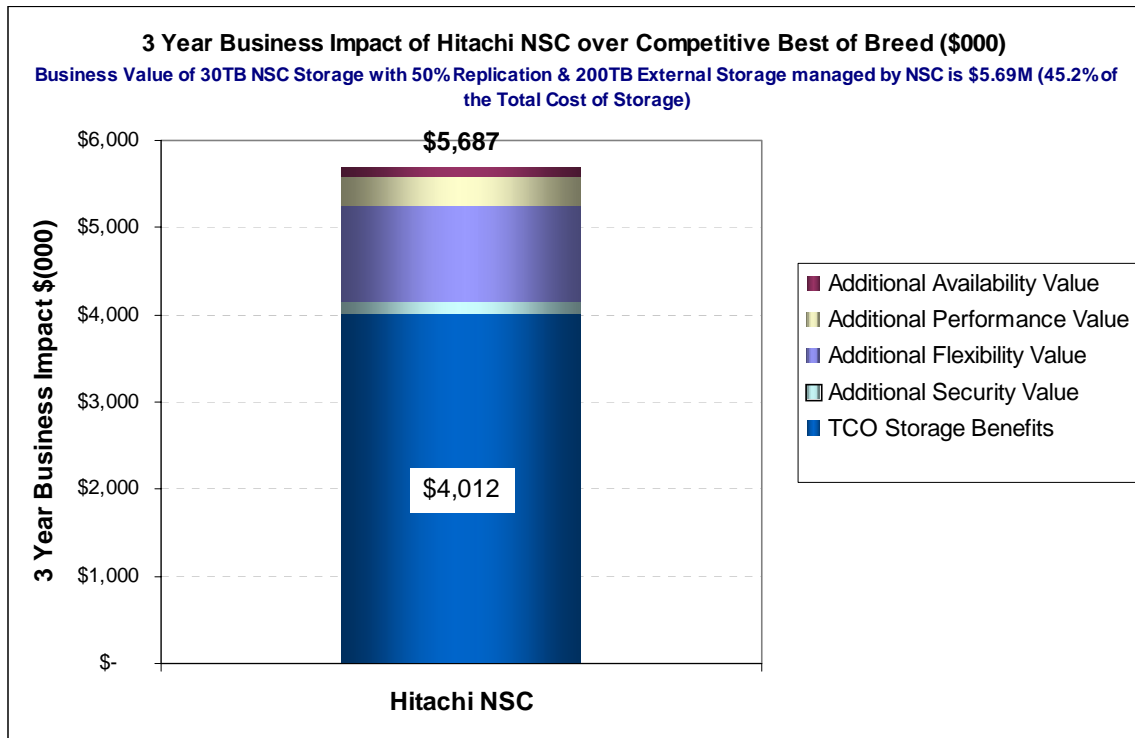
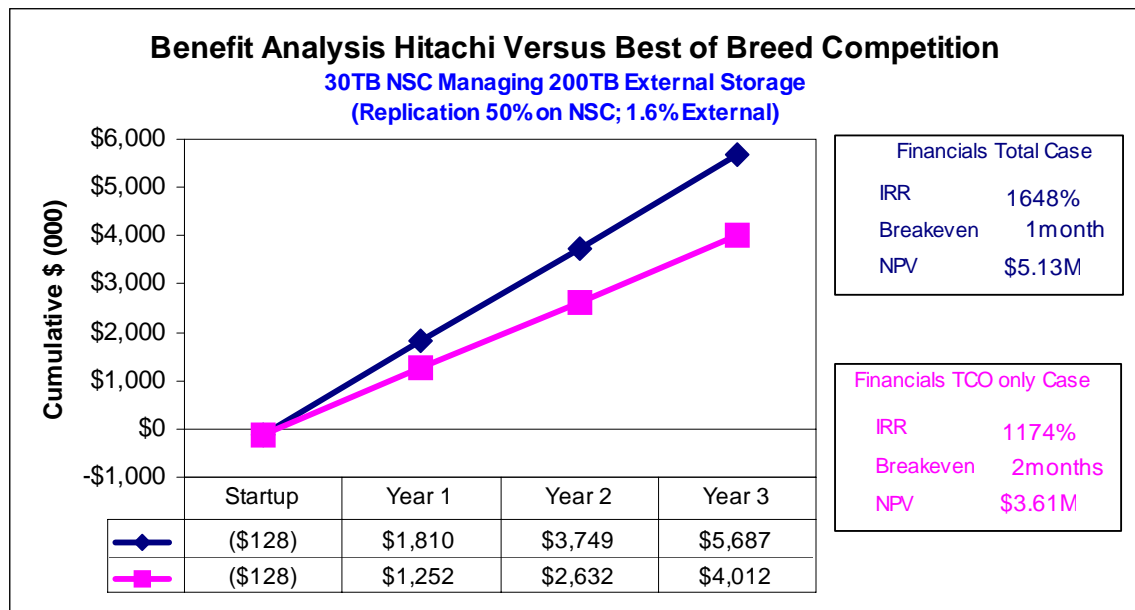


Figure 7 – Case 2: Financials of Business Case





**Table 3 – Case 2: Assumptions for Remote Copy Element \***

75% of data is read-only
25% of IOs are writes
Peak rate of 100 IOPs/TByte (3,600 IOPs overall)
300 miles between data centers
Current Recovery is via tape to remote site
Current Recovery Point Objective (RPO) – 15 hours
Current Recovery Time Objective (RTO) – 4 days (Reality from Internal Study)
Required Recovery Point Objective – 15 Minutes
Required Recovery Time Objective – 4 hours
Cost of 1 hour of downtime estimated to be \$4.0M
Cost of 1 hour of lost data estimated to be \$3.0M
Requirement for Data lines is 10 OC3 lines with Hitachi Universal Replicator Asynchronous
Requirement for Data lines is 19 OC3 lines with traditional Asynchronous Solution
Additional 4% of Storage required for disk journaling with Universal Replicator
Implementation time is 4 Months

*\* Note: See Case 3 for a more complete discussion*

***Case 3 – Small Regional Bank – 10TB/10TB Replicated Versus Traditional Asynchronous Solution***

The small regional bank has assets of \$6 Billion (approximately \$240M in revenue), with 1,300 staff at an average salary of \$60,000. About 70% of the staff uses the systems in this data center, and spend about 40% of their time actively using the systems.

The current customer Data Center environment includes UNIX Open Systems for Tier 1 and 2 systems and most Tier 3 and 4 operational systems, and a mixture of small servers for reference systems.

Because the bank is growing and coming under increased SEC scrutiny, the business has recently mandated the Recovery Point Objective (RPO) be reduced to 15 minutes, and the Recovery Time Objective (RTO) to 4 hours, and that 100% of all data be replicated at a second site 300 miles away. Additional information is shown in table 4:

**Table 4 – Case 3: Case Study Data**

	Case Study Data			
	Operational Data		Reference Data	
	Tier 1 & 2	Tier 3 & 4	Tier 1 & 2	Tier 3 & 4
TB	10	3	3	3
% Replication	100%	100%	100%	100%
Number of Servers	8	4	13	26
TB/ Storage Administrator	50	20	15	25

**Challenge and Objectives:**

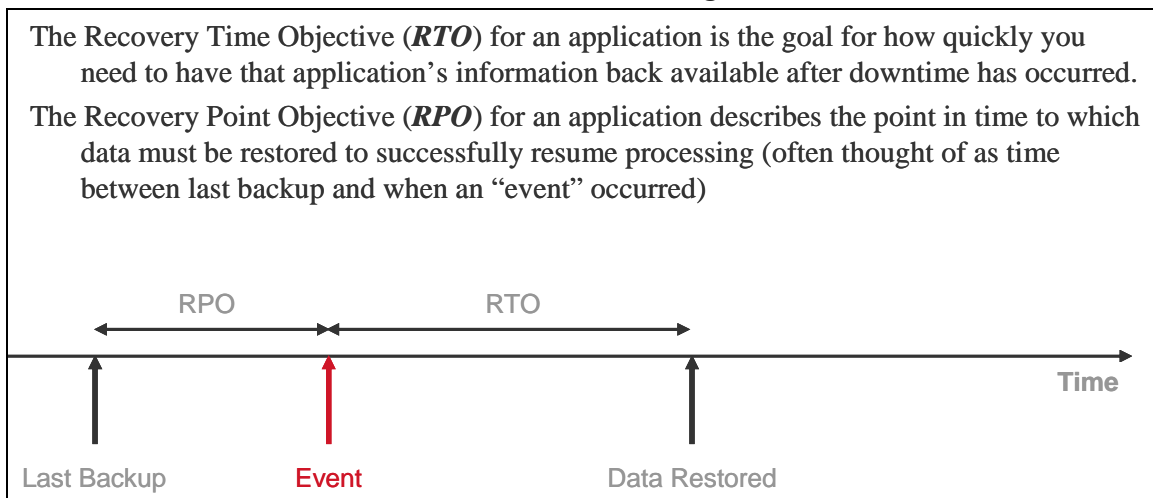
- Meet mandated RPO and RTO objectives by providing a cost effective asynchronous remote copy for all systems in the data center (applications are very interdependent) to a remote site 300 miles away.
- Improve overall management of storage across the data center to meet RTO objectives.

- Preserve investment in existing EMC Storage, which was recently purchased.

#### New NSC55 Solution Objectives

- Provide 10TB of High Performance storage (**NSC55**) for Tier 1 & 2 Operational systems, and controller functionality for managing 10TB 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, in order to meet improved RTO objectives.
- Create a remote copy capability and server functionality that will reduce the RPO from 16 hours to 15 minutes, and the RTO from 4 days to 4 hours (see figure 8 for definitions). An internal study had agreed that the cost/hour when the systems were unavailable was \$0.5M for both RTO & RPO.

**Figure 8 – Definitions of RTO & RPO**



#### Projected Benefits

- The projected benefit of providing the Hitachi UR asynchronous remote backup system was \$5.6M (NPV), with a payback of 4 months and an IRR of 67%.
- The projected benefit of the delta case for using Hitachi's UR system over traditional asynchronous systems was \$1.15 million from the reduced cost of running IT (\$.31M), and increased value to users (\$0.84M) by meeting the RPO objective.



- Improved service to end users in availability, security, performance and flexibility (ability to implement change more quickly).
- A simpler more stable storage management environment that would enable RTO objectives to be met.

### 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 9 below** –Reflects the business case for providing an asynchronous remote copy 300 miles away. Fifteen minutes was chosen for the RPO objective. The business benefits for decreasing this to 10 minutes were only \$42K (\$125K/3), and the cost for implementing this would be much higher. The overall business case yields an NPV of \$5.6M, with a breakeven of 4 months. Of course, the business case is expressed in expected loss – in reality losses either happen, or they do not.
- **Figure 10 below** – Shows the overall business case for providing Hitachi’s Universal Replicator compared to a competitive best-of-breed traditional asynchronous solution. There are a number of important differences between the two solutions. The universal Replicator leverages disk journals (as opposed to traditional technology, which stores updates in cache), which means UR takes data from the journals at the production end and transmits it to target storage at the remote end. This disk journaling allows an even flow of data to be sent, and significantly reduces the cost of transmission (by 50% in this case). Lines are one of the largest costs for remote copy, especially over a long distance.

The second difference shown in figure 10 is between the number of resynchronizations expected each year. Resynchs are time consuming (80 hours or more, because all the data has to be resent), costly (because the actual RPO is significantly extended) and prone to repeat failures. Traditional Remote copy often has a maximum time of a few minutes of network downtime before resynchronization has to be “tripped,” as I/O’s accumulate in cache. The RPO is often claimed to be 5 minutes for this technology, but the true RPO is about 50 minutes when the impact of resynchronizations is taken into account.

Because of the journaling technology used by Hitachi’s UR, the trip time can be extended without significantly impacting the RPO. In this case, 10 minutes was set as the journaling pool requirement, which reduces the probability of a resynchronization by over four times. The cost is an additional 4% of storage to keep the journal data. (A longer period of buffering would result in a greater requirement for storage – the cost of storage and the benefit of lower RPO requirement can be traded



against each other and optimized). This results in the actual RPO of the Hitachi system in this case study being within spec (15 minutes), whereas the traditional system cannot meet that spec (~50 minutes), and the expected loss due to additional downtime is calculated to be over \$250,000/year.

- **Table 5 below** – shows the detailed assumptions made in this case.



Figure 9 – Case 3: The Business case for using Hitachi UR vs. current Tape Backup system

Yearly Costs and Benefits of providing Remote Replication with Hitachi Universal Replication					
	Loss/Hour	Recovery Time		Expected Disaster Impact	
		Current	Required	Current	With Hitachi UR
Recover Point Objective (RPO, hours)	\$500,000	15	0.25	\$7,500,000	\$125,000
Recovery Time Objective (RTO, hours)	\$500,000	96	4.00	\$48,000,000	\$2,000,000
				\$55,500,000	\$2,125,000
Probability of Disaster in 1 year				5%	5%
Expected loss from Disaster				\$2,775,000	\$106,250
Implementation Time (months)					4
Additional Cost of Storage/Year				\$0	\$ 97,369
Cost of Additional Buffering for UR				\$0	\$ 6,907
Cost of Lines				\$0	\$108,864
Services & Education					\$130,000
<b>Total Cost of Remote Replication /Year</b>					<b>\$ 343,139</b>
NPV (3 years)					\$5,585,909
IRR (3 years)					67%
Breakeven (Months)					4

Figure 10 – Case 3: Comparison of Hitachi UR against Traditional Asynchronous Remote Copy

	Traditional	Hitachi UR	% Difference (relative to Traditional)
Suspension Time Setting (Claimed RPO, hours)	0.08	0.17	=5 minutes
Maximum Buffering Time (hours)		0.17	=10 minutes
Average Buffering Time (hours)		0.11	
Time to Resynchronize Sites (hours)	80	80	
Average hours behind while resynchronizing	40	40	
Expected number of resynchronizations/year	2	0.38	81%
Actual Average RPO (hours)	0.81	0.25	69%
Cost of Additional Storage/Year	\$ 97,369	\$ 104,275	-7%
Cost of Lines/Year	\$ 217,728	\$ 108,864	50%
Services & Education	\$ 130,000	\$ 130,000	
Expected Impact of Change in RPO	\$ -	\$ (281,963)	
Total Cost of Remote Replication/Year	\$ 445,097	\$ 61,176	86%



**Table 5 – Case 3: Assumptions for Remote Copy Business Case**

75% of data is read-only
25% of IOs are writes
10TBytes high performance and 10TBytes lower performance disk at main site
Peak rate of 100 IOPs/TByte (2,000 IOPs overall)
300 miles between data centers
Business requirement for 100% of all to be replicated at remote site
Current Recovery is via tape to remote site
Current Recovery Point Objective (RPO) – 15 hours
Current Recovery Time Objective (RTO) – 4 days (Reality from Internal Study)
Required Recovery Point Objective – 15 Minutes
Required Recovery Time Objective – 4 hours
Cost of 1 hour of downtime estimated to be \$0.5M
Cost of 1 hour of lost data estimated to be \$0.5M
Requirement for Data lines is 10 OC3 lines with Hitachi Universal Replicator Asynchronous
Requirement for Data lines is 19 OC3 lines with traditional Asynchronous Solution
Additional 4% of Storage required for journaling
Implementation time is 4 Months

## Conclusions and Recommendations

*Hitachi has a clear and compelling vision for managing data center storage, with an inclusive and cooperative approach.*

The Hitachi TagmaStore™ provides a new strategic option for managing storage in the data center. The NSC55 has extended the reach and range of Hitachi’s offering to most medium and large data centers.

- Hitachi has a clear and compelling vision for managing data center storage. Hitachi has endeavored to take an inclusive and cooperative approach, which clearly resonates with IT executives. The users we interviewed particularly liked the fact that the choice of specific storage was independent of the storage management software and architecture. Additionally, mainframe users emphasized the benefits of being able to provide lower cost SATA storage for mainframe data that was infrequently used.
- Direct customer feedback indicates Hitachi’s multi-vendor virtualization works, and provides the basis for an ability to apply a common set of storage management software functionality where and when needed. ITCentrix interviewed three early customers with USPs installed, and found enthusiasm for tiered storage and virtualization.
- For many workloads, Hitachi’s TagmaStore architecture is a more scalable, compelling, and architecturally sound approach than the virtualization appliance approach seen in IBM’s SAN Volume Manager or EMC’s recently announced Invista products. Because of the high speed of IOs in storage cache and the challenges of recovering from all types of failure, ITCentrix strongly believes the locus of control should be close to the data in the controller, and not the network. Further, ITCentrix believes other manufactures such as EMC & IBM will migrate

*Hitachi’s Universal Replicator provides a new and exciting approach to providing asynchronous backup over distance. The case study 3 shows that the cost of telecommunications lines is halved, and the recovery characteristics significantly enhanced.*



their high-end virtualization appliance offerings to a similar approach over time.

- Hitachi's Universal Replicator provides a new and exciting means to asynchronous backup over distance. Because of the novel technology used to "pull" the data from the backup site, lower communications costs are required to support recovery objectives. Case study 3 shows the cost of telecommunications lines is halved, and the recovery characteristics significantly enhanced. This will bring remote copy within the budget of many more organizations, and significantly improve business resilience.

In reality, small data centers that have little or no mission critical workloads or have workloads (e.g. Technical) that are better suited to the greater connectivity and lower cost of NAS are not the "sweet spot" of the NSC. These sites can maintain silos of homogeneous workloads and typically have limited multitasking requirements. Unless there is a requirement for remote copying of data, or for low cost SATA storage on mainframes, these customers will probably not adopt NSC.

Overall, the TagmaStore architecture provides IT management with the best of two worlds; the ability to use almost any storage available to meet the best price/performance characteristics, and the ability to manage the storage across the entire data center with a single set of software. This allows for data centers to consider radically different ways of organizing storage driven by quality of service and improvement of functionality to the business, rather than incompatible storage technologies.

IT executives of all medium and large data centers should examine the Hitachi TagmaStore offerings, and include them in storage evaluations.

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## Appendix I

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 6 – 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
RTO (Recovery Time Objective)
RPO (Recovery Point Objective)
Distance for remote replications
Peak I/Os per TeraByte
Read/write ratio
Peak to average IO ratio
Cost of 1 hour of downtime
Cost of 1 hour of lost data
Cost of OC3 lines/mile
Probability of OC3 outages
Suspension Time settings
Average and Peak buffering times