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Tiered Storage and Virtualization in the Real World

Calculating the ROI and Cost Savings of a Move to Tiered Storage by Fidelity National Information Services

Case Study

By Vijay Ramaswamy and David Merrill

October 2009

Executive Summary

Does a transition to virtualized tiered storage deliver true value, a fast return on investment (ROI) and verifiable cost savings?

Can the foundational virtualization technology and intelligence of the Hitachi Universal Storage Platform® produce an attractive payback period and reduce total cost of ownership (TCO)?

While industry analysts and Hitachi Data Systems both answer a resounding “Yes” to such questions, this case study offers a deeper perspective: the quantifiable economic benefits achieved by Fidelity National Information Services, a FORTUNE 500® company, in its recent move to Hitachi tiered storage.

This case study documents the specific business and economic value realized by one enterprise company after its first year using new storage architecture built on Hitachi tiered storage. Details include several capital expenditure (CAPEX) and operational expenditure (OPEX) savings achieved or anticipated within the first three years of deployment.

Some of the most compelling findings include:

- Payback on investment in 12 months
- 188 percent ROI
- A three year CAPEX/OPEX savings valued at over US\$27,000,000

Within the first year of deployment, the company had already realized payback on the investment. The company is also on track to reap the projected savings for deployment years two and three. Perhaps most compelling is the comment made by the company’s vice president of enterprise storage:

This new solution did pay for itself in less than a year, as we had hoped. In all actuality, the payback time was probably just a few months¹.

— Brad Cargile
Vice President of Enterprise Storage
Fidelity National Information Services

¹ Estimates made earlier by Fidelity National Information Services vice president of enterprise storage place the actual payback period at “just a few months.” Differences between the documented payback period of 12 months and that of the Fidelity National Information Services vice president stem from a conservative estimate made by the Hitachi Data Systems team regarding related cost of an hour of scheduled or unscheduled downtime. Although industry averages for an hour of unplanned downtime at a financial service center tend to define a cost of US\$4,000,000 per hour, this cost was adjusted down by the Hitachi Data Systems team to one percent of the typical downtime cost, to an estimated \$40,000 per hour, in order to reflect a more conservative payback and ROI profile that could be realized by other industries as well.

About the Customer

The subject of this case study is Fidelity National Information Services (FIS), a respected FORTUNE 500 firm in the financial and insurance sector.

Fidelity National Information Services faced a number of infrastructure challenges, which ultimately lead to its decision to implement an integrated, tiered storage architecture based on the Hitachi Universal Storage Platform. Challenges included reducing a large number of planned and unplanned outages plaguing the current environment, which consisted of isolated storage area network (SAN) islands of various EMC storage systems, and reliance on tape-based data protection. Other challenges involved cutting storage infrastructure costs while offering internal customers a more competitively priced set of support levels and services for hosting and managing their application data.

After the tiered storage solution had been in production for 12 months, a Hitachi Data Systems team versed in storage economics worked with Fidelity National Information Services to measure the ROI and payback of their move to tiered storage. Details of the subsequent findings appear in this report. These include attaining a series of significant CAPEX and OPEX savings over the first three years.

Key financial metrics of this assessment prove realization of early and significant ROI from a move to tiered storage.

Table 1. High Level Financial Metrics

Category	FIS Key Financial Metrics*
Investment	\$4,835,310 (total three year investment)
Estimated Payback Period	12 months after implementation
Savings	\$27,271,902 (total three year savings) \$9,296,458 (Net Present Value/NPV)
Internal Rate of Return (IRR)	25% (IRR goal for FIS)
Return on Investment (ROI)	188% ROI (savings/number of years/investment)

* All monetary figures are in US dollars.

Details regarding the specific cost savings, calculations and assumptions used in creating the Fidelity National Information Services economic model are available in the remainder of this report.

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Customer Profile

This case study highlights the tangible economic impact and benefits achieved by one Hitachi Data Systems customer following the move to a virtualized, tiered storage infrastructure based on the Hitachi Universal Storage Platform®.

Business Focus and Priorities. The customer is Fidelity National Information Services, a large and diverse FORTUNE 500® company with a range of services and products spanning the financial, real estate and insurance sectors. A strong focus on the internal development and maintenance of several critical, database driven enterprise applications and the associated processes involved in supporting the company's core business functions contributed substantially to the company's continued success.

Characteristics of the IT Organization. The group spearheading the tiered storage implementation is a centralized team responsible for serving the IT support needs of various business groups in the organization. In the past, each business group had budgeted and purchased its own hardware (tape, disk storage, network fabric, console, backup circuits, etc.), often on an "as needed" basis. The centralized team was then charged with the subsequent hosting and support of the business group's resources in production. Chargebacks to each business group for IT services rendered included the costs of management labor, physical space, environmental factors and the delivery of specific service levels regarding performance, availability and recovery.

High Level IT Infrastructure. The customer's IT infrastructure includes three technical centers, which serve as its primary production data center, an offsite disaster recovery data center and a development and testing lab. Each technical center is located in one of three U.S. cities, including the primary technical center at the company's corporate headquarters.

The Issues

The IT team involved in this project faced several issues prompting its search for a more flexible, robust and cost effective storage infrastructure.

Pressure to Reduce Costs. In order to maintain and grow its customer base, Fidelity National Information Services' IT team needed a way to offer improved quality of service (QoS) levels for its support at continuously aggressive and attractive prices for customers.

Backup and Restore Issues. Fidelity National Information Services viewed dependence on tape-based infrastructure for primary backup and recovery as one target for overhaul in this project. Relying primarily on tape for most backup and restore functions required:

- More labor to manage the process
- A longer, frequently disruptive backup process leading to extended backup windows for protecting key application data

- An equally long time to recover key data in the event of any disruption (recovery time objective or RTO). The predominantly tape infrastructure also contributed to a longer recovery point objective (RPO) that did not often meet the needs of the customer.

The Need to Embrace a More Adaptive, Efficient Mode of Operations. As part of its efforts to retain and grow its current customer base, the IT team was committed to rooting out and correcting any obvious areas of waste or inefficiency it could find in the current infrastructure, then applying those efficiencies to a trimmer bottom line. The team recognized that its current storage area network (SAN) architecture limited Fidelity National Information Services and resulted in stranded hosts, stranded storage resources and unused storage capacity that could not be easily reassigned to other business applications falling outside of the established SAN fabric.

Frequent Interruptions in Application Data Availability. Customer perception of the service levels achievable by the IT team was negatively impacted by several downtime events (both planned and unplanned outages) in the year prior to the tiered storage implementation. Although Fidelity National Information Services had designed its EMC-based storage architecture with all devices attached to the SAN, storage resources — such as logical unit numbers (LUNs), capacity and utilization — on the various storage systems could not be shared or pooled with other devices located on a different part of the network fabric. Each system still had to be managed and provisioned on a standalone, device-by-device basis. Accommodating the changing data needs of business groups, by adding new storage or rewiring the composition of existing systems to reflect new data priorities, still required substantial downtime.

Significant Delays in Critical Development Projects. Because the development team shared storage space with other day-to-day production data, it was often required to work around production schedules, or stop its efforts entirely, especially when it came to stress testing the performance of a developing application in a production setting. One critical application stalled in development for a period of five years, due largely to back end infrastructure inflexibility.

The team's quest to resolve these issues led to a critical new IT initiative called NexGen. NexGen proposed an updated infrastructure that could help Fidelity National Information Services achieve the aggressive goals it had set for each line of business.

The Solution


In 2005, Fidelity National Information Services embarked on a new integrated, tiered storage infrastructure based on the Hitachi Universal Storage Platform.

The Universal Storage Platform is an intelligent, networked storage controller-based solution designed to unify and simplify the management of high growth enterprise data environments, while reducing the cost of managing such environments and their heterogeneous (multivendor, multi-operating system) storage.

Through virtualization software, the Universal Storage Platform allows all internal and externally attached storage resources (up to 332TB and 32PB, respectively) to be managed as one virtual pool of storage from within a single management pane of glass. This functionality creates an optimal foundation for large capital expenditures (CAPEX) and operating expenditures (OPEX) savings with tiered storage, including the ability to transparently migrate and centrally replicate data sets from any-to-any heterogeneous storage attached to the Universal Storage Platform.

Virtualization: The "Engine" Behind Today's Robust Tiered Storage Architectures

Fidelity National Information Services realized significant operational and capital savings by using the virtualization functionality built into Universal Storage Platform installations.



The concept of tiered storage is often discussed in terms of using lower cost storage systems as second or third “tiers” to complement high-performance storage systems that have been already installed in the data center.

While access to lower cost/lower performance storage is certainly a part of tiered storage, setting up separate storage “boxes” or “siloes” in the architecture as Tier 1, Tier 2 or Tier 3 only allows today’s IT environment to go so far in developing its own data lifecycle management strategy and implementing its own view of tiered storage.

Fidelity National Information Services experienced several issues with its prior EMC-based architecture:

- Multiple management tools for different storage systems
- Stranded storage capacity that could not be reused or reprovisioned into a larger available pool
- An inability to easily move, migrate or replicate data as needed without using multiple software tools

While still espoused by many vendors, this type of “network-attached-but-isolated” view of storage tiers misses the mark and the true potential of a tiered storage infrastructure. This potential can only be achieved with the use of a robust virtualization layer like that offered by the Universal Storage Platform.

This virtualization layer allows heterogeneous storage hardware assets, from multiple vendors and multiple operating systems, to be managed with:

- One set of management tools and one universal operator console
- One virtual pool of storage that can be combined, split apart, recombined and provisioned across multiple tiers of storage on an at will basis, with different QoS characteristics defined per tier in regards to availability, performance and recovery
- A simplified view, and simplified management, of all storage resources
- A single set of software tools for performing seamless moves, migrations or replications of data as needed between tiers

While such distinctions may appear surprisingly simple, the impact of this type of integrated, tiered architecture is often extraordinary.


The remainder of this case study itemizes the impact on Fidelity National Information Services of using virtualized, tiered storage infrastructure. The following statement by Fidelity National Information Services’ vice president of enterprise storage highlights virtualization’s effect on the project:

The Hitachi tiered architecture is more flexible with what my customers want — in terms of service, price and performance.... We now want to exploit the virtualization and tiering even further by offering our clients five to six different tiers, and with a storage-on-demand utility pricing model. We have to take tiers to all new levels at Fidelity National Information Services.

— Brad Cargile, Vice President of Enterprise Storage, Fidelity National Information Services

The Architecture: Before and After

Prior to the Hitachi Data Systems solution implementation (as of June 2005), Fidelity National Information Services used a predominantly EMC-centric storage architecture in its three data centers. The EMC storage had been deployed into loose tiers of different price/performance storage systems attached to the SAN (see Figure 1). The current SAN architecture was limited by the construct of the existing SAN fabric and the fact

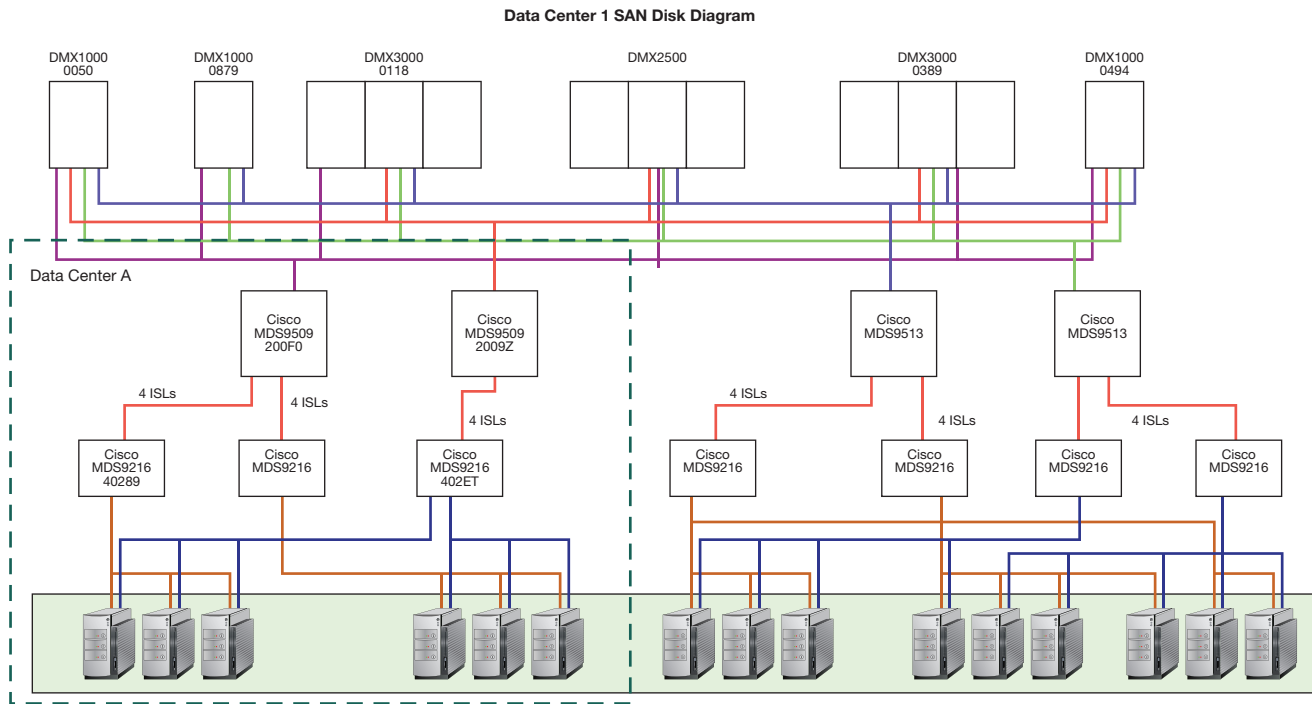


that each of the various EMC solutions had its own operating systems and management tools, which often required them to be managed in isolation of other resources on the storage network.

Early in the customer assessment phase, some key challenges with this infrastructure became apparent:

- **Current storage utilization rates were hard to measure, even harder to improve.** Because each storage system was often managed as an independent island of storage, it was hard for the Fidelity National Information Services IT team to gauge the amount of storage capacity it was currently using across the board. It was also difficult to develop a universal way to streamline and increase the amount of storage capacity currently in use. The architecture's inability to present one "virtual" pool of storage capacity for management or utilization reporting hindered Fidelity National Information Services in its ability to reduce storage CAPEX costs.
- **Migrating data from one "tier" to another was too complex.** Since data was housed in its own storage silo on the network, Fidelity National Information Services had to invoke multiple, host driven workarounds whenever it wanted to move data from one tier to another. Usually involving some application downtime, this was time intensive and a prospect generally avoided by the IT team. The team was left with a mixture of often unmatched data classes coexisting on the same production systems and storage.
- **Common storage management tasks took too long to complete.** When an application needed more storage capacity, it became a complex task, often involving manipulating the hardwiring of logical unit numbers (LUNs) assigned on a specific storage system. Instead of managing storage on each storage system in isolation, Fidelity National Information Services wanted to centralize the management of storage tasks like provisioning new storage by exploring a unified management interface that touched all storage systems on the network.
- **Vendor lock-in and scalability created limits.** The current infrastructure left few choices for adding other, heterogeneous vendors or storage price points to expand the lower tiers without adding management overhead and application downtime.
- **Inability to replicate data across various storage tiers.** Fidelity National Information Services could not use storage systems on the SAN for disk-based replication of data residing on different tiers. Instead, the company relied on a tape library for primary data protection and backup. The results included slowdowns in performance, overlapping backup windows, lower success rates on backup jobs and no rapid data recovery method in the event of a disruption.

Figure 1. High Level “Before the Universal Storage Platform” Configuration



Prior to the new Hitachi Data Systems implementation, Fidelity National Information Services had been using a predominantly EMC-centric storage architecture deployed in loose tiers in its three data centers.

After the Move to Hitachi Tiered Storage

In mid-2005, Fidelity National Information Services worked in conjunction with Hitachi Data Systems and Datalink (a Hitachi Data systems partner) to upgrade and modify its early Fibre Channel SAN infrastructure by implementing an integrated, tiered platform built on the Universal Storage Platform (see Figure 2).

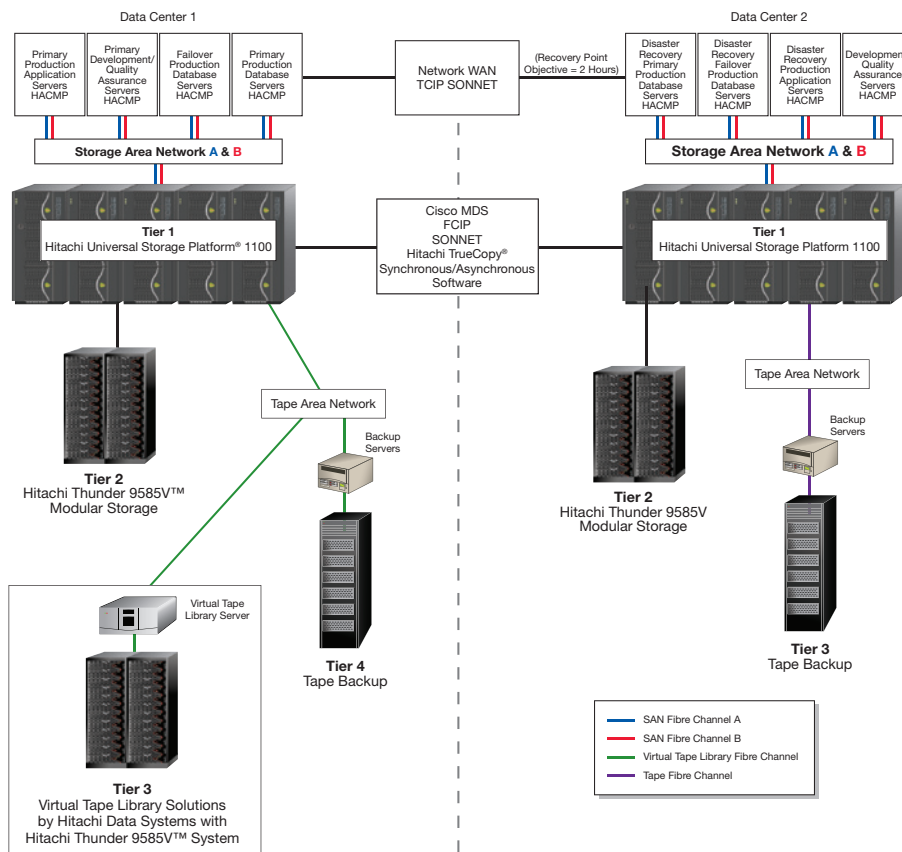
This upgraded platform offered significant improvements in operation, agility, provisioning time and total cost. It allowed the IT team to more firmly develop and apply a set of services and storage to a specific class of data in the organization.

Several specific benefits appeared early in the implementation, including:

- **Storage utilization rates increased and it became easier to manage and monitor.** Because of the ability of the Universal Storage Platform to combine underlying storage capacity into its own virtual pool, Fidelity National Information Services was able to make significant savings in OPEX and CAPEX costs by freeing stranded storage capacity, then dynamically shrinking or growing the overall pool of storage available into virtual volumes of various sizes. The Fidelity National Information Services team’s ability to report on and manage this activity also became an easier proposition.
- **Data migration between storage tiers became seamless and nondisruptive.** With data now managed in virtual pools, data sets could be earmarked and dynamically copied to other volumes on the network, and other underlying tiers of storage, without the need to disrupt production applications. When the development data needed a higher level of storage in order to perform stress testing, the IT team could now dynamically move the data up to Tier 1, then back down to Tier 2 or 3 when stress testing was completed.

- **Common storage management tasks could be performed in record time.** Provisioning extra storage capacity now occurs quickly, from within a single set of management tools, and via a unified management interface. Instead of taking an average of 25 hours per week to perform storage management, managing the centralized Universal Storage Platform virtual storage pool was now expected to take only seven hours per week.
- **Flexibility in scaling to support heterogeneous storage.** Inherent in the new, Universal Storage Platform–based infrastructure were the abilities to quickly add storage from different vendors onto other tiers and to manage it as part of the existing virtual pool. Of special interest to Fidelity National Information Services was the ability to attach other low cost midrange storage systems, such as Hitachi Adaptable Modular Storage systems, to the existing infrastructure.
- **Quick, disk-based replication across storage tiers.** A strong, tiered disk-based backup component was added as part of the new infrastructure — with the use of the Hitachi In-System Replication heterogeneous software bundle (includes Hitachi Copy-on-Write Snapshot software and Hitachi ShadowImage® Heterogeneous Replication software), Hitachi TrueCopy® Synchronous/Asynchronous remote replication software and the Virtual Tape Library Solutions by Hitachi Data Systems, specifically the IBM® VTF® Open module. This infrastructure now allowed data to be copied seamlessly across the tiers, reducing Fidelity National Information Services’ downtime events dramatically and making it realistic to perform rapid recovery of data, whenever needed.

Figure 2. “After” Implementing Tiered Storage with the Hitachi Universal Storage Platform



After implementing an integrated, tiered platform built on the Hitachi Universal Storage Platform, Fidelity National Information Services saw significant improvements in operations, agility, provisioning time and total cost.

Critical Savings from Fidelity National Information Services' Move to Tiered Storage

After the tiered storage project was in place at Fidelity National Information Services for more than a year, a Hitachi Data Systems team versed in storage economics theory² was dispatched to work with members of the Fidelity National Information Services IT team. The goal of the collective members was to measure and quantify the subsequent benefits and cost savings resulting from Fidelity National Information Services' infrastructure upgrade and move to Hitachi tiered storage.

A detailed, three year ROI model was developed to highlight the cash investment required each year, along with any Fidelity National Information Services tangible cost savings year-over-year from deployment of the tiered storage architecture. Details of this model appear later in this report. Savings were calculated to include reductions in both CAPEX and OPEX. An estimated payback period for the investment was also derived from these calculations. (All monetary amounts in the following figures and tables are shown in US dollars.)

According to practices outlined in one foundational storage economics white paper³, a three question "CFO litmus test" for economic viability of IT investments was also applied to the Fidelity National Information Services case. The following table shares some of the Fidelity National Information Services project's most compelling findings.

Table 2. Key Financial Metrics Identified in the Fidelity National Information Services Project

Financial Metric	Questions	Quantifiable Results
Investment	<i>CFO Litmus Test #1:</i> How much investment is required to lower OPEX?	\$4,835,310 (total three year investment)
Estimated Payback Period	<i>CFO Litmus Test #2:</i> How fast can the investment be recovered with a lower OPEX run rate?	12 months after implementation ⁴
Savings	<i>CFO Litmus Test #3:</i> How much net savings will the organization realize with this investment?	\$27,271,902 (total three year savings) \$9,296,458 (net present value/NPV)
Internal Rate of Return (IRR)	Based on the net present value (NPV) of savings, what is the compound annual rate of return on this investment over the next three years?	25% (IRR goal for FIS)
Return on Investment (ROI)	What is the estimated ROI?	188% ROI (savings/number of years/investment)

Actual cost savings observed within one year of Fidelity National Information Services' implementation surpassed the forecast developed at the project's start.

² Hitachi Data Systems has invested years in the evolution of storage economics theory and modeling, including the best practices and computations required to measure and evaluate real returns on investment (ROI) and the total cost of ownership (TCO) for enterprise storage related acquisitions. White papers on Hitachi Data Systems "storage economics" and "tiered storage economics" theory can be found at: <http://www.hds.com/tools/whitepapers.html>.

³ See *Storage Economics: Identifying and Reducing Operating Expenses in the Storage Infrastructure*, a Hitachi Data Systems white paper at <http://www.hds.com/pdf/StorageEconomicsWHP-153.pdf>.

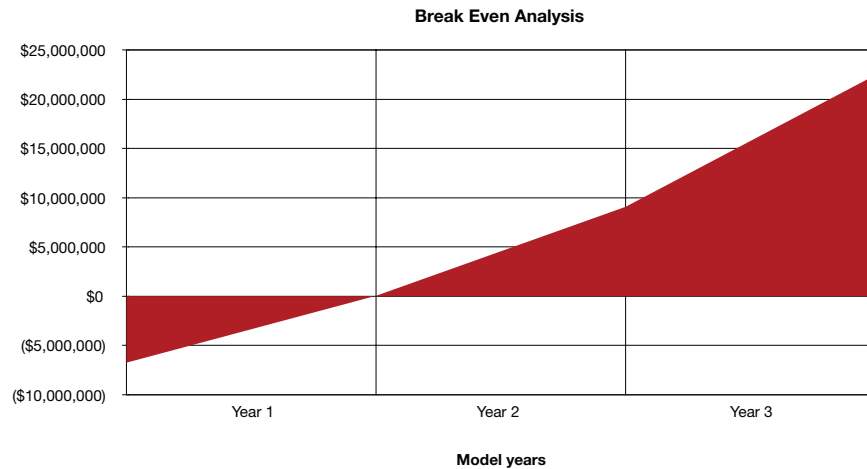
⁴ See Reference Note #1.

Other Findings in the Move to Tiered Storage

Like many organizations that benefit from a Hitachi tiered storage infrastructure, Fidelity National Information Services was able to realize significant CAPEX and OPEX savings in areas related to technical, business and operational benefits. These are summarized in the following figures and tables.

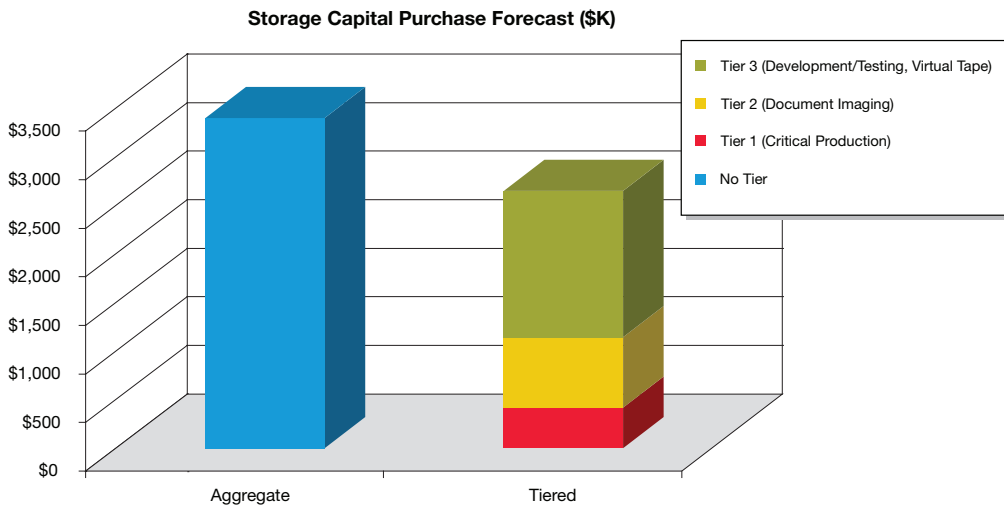
Research on tiered storage economics⁵ indicates that tiered, integrated architectures are usually less expensive to buy and own than comparable, standalone or monolithic architectures. Fidelity National Information Services enjoyed a 12 month break even point on their investment.

Figure 3. Return on Fidelity National Information Services Tiered Storage Project: 12 Months



Fidelity National Information Services realized significant CAPEX and OPEX savings, as shown in the estimated payback period calculation outlined above.

Figure 4. The CAPEX Reduction Impact of Tiered Storage on Fidelity National Information Services

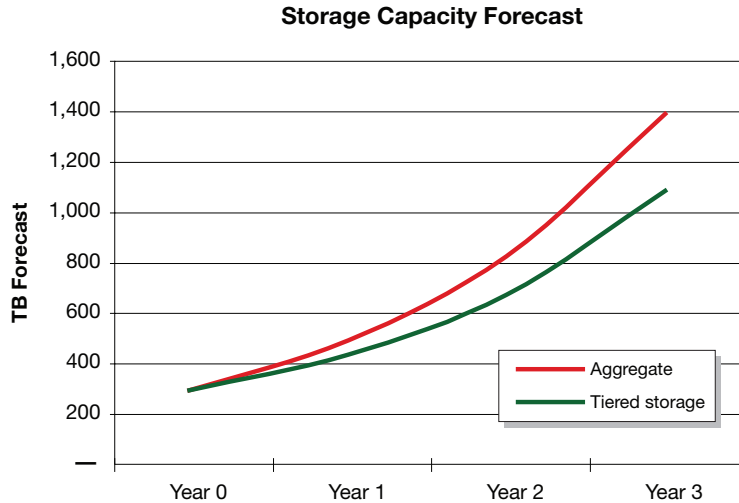


CAPEX savings result from reduced purchasing costs for new storage over the next three years.

⁵ See Tiered Storage Economics: Defining and Calculating the Economic Benefit of Tiered Storage Solutions, at <http://www.hds.com/tools/whitepapers.html>.

While Fidelity National Information Services' total storage "appetite" remains the same, using lower cost storage systems to satisfy most of the capacity growth will reduce acquisition costs.

Figure 5. The Effect of Tiered Storage on Fidelity National Information Services' Growth Plans



The tiered storage infrastructure's utilization of previously stranded storage should lead to a small-to-moderate decrease in total storage capacity demand versus that of a nontiered (or aggregate) environment.

Tiered storage has a huge advantage over monolithic architectures since the growth can be allocated to several tiers of storage, each with different service levels and purchase price/cost levels, as shown in the three year CAPEX forecast depicted in Figure 5.

In even the first year of deployment, Fidelity National Information Services' savings associated with a reduced purchase cost for new storage have already been realized. Fidelity National Information Services is also currently on track to achieve the Year 2 and Year 3 forecasted savings shown in Figure 5.

Table 3. CAPEX/OPEX Savings Achieved by Fidelity National Information Services After Implementing Tiered Storage

Type of Cost Reduction or Savings	Estimated Amount Saved or Reduced Over Three Years	
Administrative Cost of Labor	\$8,396,261	FIS will save this amount in total labor and manpower over three years, by using a single operator console and unified storage area management tool set. FIS can effectively avoid hiring 10.1 full time equivalent staff.
Storage Area Management	\$745,882	This three year OPEX savings reduces management time from 25 hours per week down to 7 hours per week. With a centralized console, centralized resources and virtual tiers managed by the same tools, FIS can dramatically reduce the time it takes to perform basic storage area management tasks, such as storage provisioning and problem resolution.
Backup/Recovery Time	\$1,500,00	Replacing many tape functions with tiered, disk-based backup, FIS' backup improvements will save an estimated \$500,000 per year. ⁶ Improvements include use of Hitachi In-System Replication heterogeneous software bundle, Hitachi TrueCopy® Synchronous/ Asynchronous remote replication software and IBM® VTF® Open, part of Virtual Tape Library Solutions by Hitachi Data Systems (see Appendix A – Figure 1).
Backup Related Hardware Acquisition Costs	\$214,000	This figure is the amount FIS would have spent on new tape libraries and backup servers if it had not implemented the new tiered backup infrastructure.
Unplanned Storage Downtime	\$11,920,896	Unplanned downtime events have decreased from the prior year's 99.84 hours per year to 0.5 hours per year. This is equivalent to \$3,973,632 per year in savings. ⁷ Data availability of 98% was the average experienced in the prior storage infrastructure. Data availability of 99.995% is anticipated with the new Hitachi Data Systems infrastructure solution, with dual path core/edge Fibre Channel topology.
Planned Storage Downtime	\$394,484	Planned downtime events are now fewer in both quantity and duration, saving more than \$100,000 per year. ⁸
Cost of Waste	\$751,227	The CAPEX costs FIS will save by freeing stranded storage capacity and reassigning it within the Universal Storage Platform's virtual pool of storage (see Figure 4).
Cost of Growth	306TB	By allocating the right data to the right cost or tier (see Figure 5), projected storage capacity growth needs should be reduced by 10% to 15% versus the projected growth needs of a single tiered infrastructure. The company will save purchasing 306TB of added storage, ⁹ based on spreading the aggregate growth across tiers.

⁶ Fidelity National Information Services' IT team based its estimated backup savings on a combination of witnessed RPO and RTO improvements, a greater percentage of backup successes (versus prior failures) and significant improvements in backup windows.

⁷ Cost of an hour of unplanned downtime was estimated conservatively at US\$40,000 per hour, calculated at 16 hours per day, 6 days per week. Fidelity National Information Services experienced an average of four unscheduled outages per year from 2003 to 2005, with a range of 4 to 20 hours per outage. See Reference Note 1 earlier in this case study for further details regarding these calculations.

⁸ Business impact costs of an hour of planned downtime were estimated at one-tenth the cost of unplanned downtime, or US\$4,000 per hour. Prior to the implementation, scheduled downtime events had been occurring four times per year, and lasted six hours each. With the new integrated, tiered infrastructure, scheduled outages will decrease from four times per year to once every two years.

⁹ The compound annual growth rate (CAGR) of storage growth rate is 50 percent, with a single, aggregate storage base of 280TB originally projected to grow to 1.3TB over the next three years. That growth rate has since been adjusted to 1.07PB.

Business Values Beyond Technology

This section describes other benefits and achievements noted by Fidelity National Information Services' IT team following its tiered storage implementation. Beyond the economic findings already described in this study, Brad Cargile, Fidelity National Information Services' vice president of enterprise storage, correlated the following business values and outcomes to this implementation:

An Emergence of Other, Unexpected Benefits. The vice president of enterprise storage went on to note that the Universal Storage Platform has enabled further storage capabilities that cannot be fully quantified in economic terms at this time, surrounding:

- Replication
- Virtualization
- Single image management and control
- Simplified migration

Development team issues resolved. Issues experienced by Fidelity National Information Services' development team with the prior architecture had since been resolved after introducing Hitachi tiers of virtual storage. Now, developers have the flexibility to be able to quickly migrate their data up to Storage Tier 1 when they need to perform stress testing in real world settings, and move the data back down to a lower tier when the testing phase is complete. No longer do production resources need to compete with development resources on the same fabric. Just six months after the Hitachi Data Systems solution was implemented, a key development project that had been stalled for five years was able to be completed and rolled out to production.

Short payback, high ROI led to a promotion and added responsibilities. Success with Hitachi tiered storage and a high satisfaction rating with customers led directly to the current promotion within Fidelity National Information Services' IT team to vice president of storage. When asked about the payback period, the vice president responded, as follows: *"This new solution did pay for itself in less than a year, as we had hoped. In all actuality, the payback time was probably just a few months.... The payback with real business numbers (based on opportunity loss) produced too high of an ROI. We had to take one percent of the business impact per hour for these results. If we were to take a conservative view at 10 percent, the savings — which I believe are closer to reality — would be at a three to four month payback."*

Improvements in availability. The vice president of enterprise storage said this about implementing Hitachi tiered storage, *"The availability of the Hitachi system has been solid this past year. No outages."*

Meeting customer needs more aggressively and competitively. In response to questions about customer satisfaction, the vice president of storage said, *"The Hitachi tiered architecture is more flexible with what my customers want — in terms of service, price and performance.... We now want to exploit the virtualization and tiering even further by offering our clients five to six different tiers with a storage-on-demand utility pricing model. We have to take tiers to all new levels at Fidelity National Information Services."*

Concrete Expansion Plans for Now — and in the Future. According to the vice president's initial plans to extend the current architecture beyond its NexGen system, Fidelity National Information Services went on to expand the same architecture to include three more departments within the first year. It has also begun the process of bringing eight more departments online.

An In Depth Look at the Three Year ROI Model

In an effort to quantify different types of savings and develop a more detailed three year ROI model, the combined Hitachi Data Systems, Datalink and Fidelity National Information Services teams had to first agree on some common assumptions and measurements for use in the economic model. This section describes these assumptions and offers another set of measures and calculations deemed important by Fidelity National Information Services.

Assumption #1: Purchase Price Does Not Equal Cost of Ownership

From the start, it was important to recognize that the purchase price of the tiered storage solution reflects only one fourth to one fifth of the total cost of storage ownership (TCSO) over the life of the storage asset. This is a common TCO metric often quoted by analyst firms like IDC and the Gartner Group. In order to gain a good measure of TCSO, Hitachi Data Systems, in its storage economics methodology, has defined 32 distinct types of storage ownership cost categories. These reflect both hard costs (such as the cost to purchase new hardware or software licenses) along with more soft costs (like the reduced time the solution now offers administrators when performing a basic storage management function).

Assumption #2: Use Only Meaningful Cost Categories

Specific cost categories used to develop an ROI model are best selected with the help of a company's IT team, accountants, CIOs or CFOs. This ensures that the standards for measuring success on a storage infrastructure project will be best understood and more likely to be received by members of the Executive Team.

For the purposes of this economic review, the Fidelity National Information Services team broke the relevant cost categories down into three different types:

- **Hard Costs**, defined as budgeted costs. These indicate numerical savings with demonstrable impact on financial reports.
- **Firm Costs**, defined as beneficial costs that may (or may not) have a direct impact on the IT budget. Firm costs are generally recognized as important to the overall business, but may not have verifiable reduction cost benefits associated with the category.
- **Soft Costs**, defined as "good things to do" that may not have tangible cost savings. The summation of soft costs may help to sway an investment decision, but the savings are more abstract.

Table 4 shows the Fidelity National Information Services specific cost categories and a comparison of the company's values before and after implementation.

Table 4. Fidelity National Information Services' Cost Estimates — Before and After Implementation of Hitachi Tiered Storage

Hard Costs — Over Three Years		
Cost Type	Previous Architecture	With Hitachi Tiered Storage
Initial Purchase of Hardware and Software License Fees	N/A The old architecture did not have an upfront investment to be made in hardware or software. The status quo would have been maintained to meet the growth costs at FIS.	\$4.8 million This is the after tax CAPEX investment to move to the Hitachi architecture. By receiving the first three years of prepaid hardware maintenance for free, FIS was able to offset much of this CAPEX (see "Hardware Maintenance" below).
Hardware Maintenance	More than \$3 million Continuing with the current architecture would have yielded hard costs for both hardware and software maintenance of over \$1 million per year.	N/A The initial investment included three years of prepaid maintenance, so this OPEX cost did not exist. This is the offsetting impact of CAPEX (as listed above) replacing maintenance OPEX.
Unplanned Outage Cost (includes disaster protection)	~300 hours unscheduled downtime ~\$12 million (business impact of loss) FIS experienced approximately 100 hours per year of unscheduled outages. A conservative rate of \$40,000 per hour (one percent of the industry average) is estimated as the business impact loss/cost.	1 hour unscheduled downtime \$40,000 (business impact of loss) With a highly available storage architecture and front end SAN, the rated availability dropped to one half hour per year, with no outages in the first 15 months, and resulting in a business impact savings of nearly \$4 million per year.
Storage Downtime Due to Capacity Problems or Human Error	60 hours of added system downtime Storage operators, with a myriad of consoles and operational tools (or lack thereof), were estimated to contribute an additional 20 hours per year in system downtime (performance, oversubscription, configuration problems, etc.). The \$40,000 per hour rate was again used for this business impact figure at FIS.	0 hours of added system downtime New management tools and improved best practices and processes reduced the probability of human management issues or errors to zero. Actual measurements post implementation support this figure.
Reduction in Total Storage Team Head Count Needed for Management	0 FIS' annual fully burdened labor rate is \$500,000. At the time, FIS was achieving 12TB per full time employee.	Reduced by 10.1 full time employees The new architecture's integrated tiers, advanced management and simplification allowed the ratio of terabytes per full-time employee (FTE) to grow. First year improvements were 10 percent of industry standard, with a projected three year savings of 10.1 man years or \$8.4 million.

Table 4. Fidelity National Information Services' Cost Estimates — Before and After Implementation of Hitachi Tiered Storage (Continued)

Firm Costs — Over Three Years		
Cost Type	Previous Architecture	With Hitachi Tiered Storage
Purchase Avoidance: Storage Hardware, Software and Maintenance	<p>N/A</p> <p>CAPEX money was still planned to satisfy the demand growth at FIS. The older architecture would have maintained the same, single tiered purchase (and waste) plan in order to meet the growth.</p>	<p>\$751,227</p> <p>Amortizing growth over three tiers instead of one, with different cost and performance values gives each tier:</p> <ul style="list-style-type: none"> a) Different entry costs (CAPEX) b) Different growth rates c) Different price erosion rates d) Different utilization rates <p>Compounding these various factors enabled FIS to grow the storage infrastructure at the same slope/ demand curve as before, but at a much lower CAPEX cost. In both the old and new architectures, the total storage capacity after three years would be nearly 1.01PB.</p>
Storage Management Tasks	<p>25 man hours per week</p> <p>FIS spent an average of 25 man hours per week in such management functions as SAN configuration analysis, application dependency analysis, capacity management and planning analysis, performance management and monitoring analysis, SAN security, productivity planning, troubleshooting, mapping, provisioning, chargeback and asset management.</p>	<p>7 man hours per week</p> <p>The new architecture and integrated storage management tool set allowed this labor effort to be reduced to just 7 hours per week.</p>
Planned Outages and Their Impact on the Business	<p>12 outages, 72 hours total downtime</p> <p>The time involved with planned outages has a lesser impact when compared to planned outages, but FIS still placed a business value of \$4,000 per hour on scheduled outages. FIS was accustomed to four outages per year, at six hours per instance of planned outages to handle capacity installed, microcode upgrades, cache, SAN install, etc.</p>	<p>1.5 outages, 9 hours total downtime</p> <p>The new architecture with its highly available design will need one scheduled outage every two years. The business impact alone (not counting labor costs) is estimated at nearly \$264,000 over three years.</p>
Shorter Backup Windows	<p>Tape-based backup and recovery involved missed backup windows, application downtime and media costs.</p>	<p>The new architecture provided disk-based backup, in which 30 days worth of backup data resided online (to meet ~95% of restore requests) before spinning the data off to tape. FIS calculated savings at \$500,000 per year.</p>
Number of Servers	<p>16-18 servers</p> <p>The old architecture depended on general purpose servers to handle backup, recovery, NFS/CIFS access, etc. FIS had four servers in the category at the time, with plans to buy four to five more each year.</p>	<p>Avoid buying 12-16 servers; 4 repurposed</p> <p>The new architecture included fit-for-purpose appliances and systems to replace external servers. Four servers were returned to the general server pool, and the company did not need to buy 12-16 more servers over the next 3 years. This savings includes the total cost of ownership for each server (\$5,000), floor space, electricity, air conditioning and management labor costs.</p>

Table 4. Fidelity National Information Services' Cost Estimates — Before and After Implementation of Hitachi Tiered Storage (Continued)

Soft Costs — Over Three Years		
Cost Type	Previous Architecture	With Hitachi Tiered Storage
Local SAN, ISL and Infrastructure Reduction Related to the SAN, WAN	80 front end SAN ports required	48 front end SAN ports required Based on eight ports per controller
Data Center Floor Space, Electricity	16 total frames needed The older storage systems and fabric elements consumed a combination of floor space, power and cooling costs.	14 total frames needed While the old run rate was not calculated in detail, estimates for the new architecture pointed to similar electrical costs, but at a much smaller data center footprint. The new architecture was also able to initially reduce the total number of storage systems by two frames.
Staff and Contractor Time Used for Planned Outages	Beyond the business impact described above, planned outages required additional staff and vendor costs were estimated at \$1,500 per incident.	With the number of planned outages dropping dramatically, the labor cost also was reduced by \$130,000 over three years. This cost of labor was for both vendor/contract labor required for the microcode and actual install, as well as the FIS staff, who were to be involved with each scheduled outage.

Other Common Assumptions Used in the Economic Model

The three year economic model, outlined in Figure 3, also included the following assumptions:

- **Acquisition costs:** These include three year hardware depreciation, straight line depreciation and a 42 percent marginal tax rate. Hardware in the plan is purchased, not leased. The street price of monolithic disk purchased today is \$4.50 per gigabyte. The purchase cost shown in the model reflects the after tax and depreciation impact of hardware, software and services.
- **Maintenance costs:** Storage hardware and software maintenance for three years is bundled into the initial purchase cost. This excludes SAN hardware and software maintenance, which is factored into years two through four. Software maintenance is a separate line item cost. Hardware maintenance savings are estimated at \$3,000,000 over three years, or \$1,000,000 per year.
- **Environmental costs:** Cost of floor space is \$125 per month per square foot. Electricity is \$0.067 per kilowatt per hour. Facility and electricity costs are rated for the current and older systems, and reflect the air conditioning, electrical and floor space cost differential with the new architecture.

Table 5. The Three Year ROI and Storage Cost Reduction Model Developed for Fidelity National Information Services


	Year 1	Year 2	Year 3
Cash Investment	(\$6,731,758)	\$948,224	\$948,224
Savings			
<i>Administrative (Labor) Resources</i>	659,615	1,870,010	5,866,636
<i>Avoidance of Unplanned Downtime (Dual Path Architecture)</i>	3,973,632	3,973,632	3,973,632
<i>3 Years' Prepaid Hardware Maintenance</i>	1,000,000	1,000,000	1,000,000
<i>Tiered Storage — Avoidance of Added Disk Purchases</i>	52,200	221,739	477,288
<i>Avoidance — Tape Hardware/Backup Server Purchases</i>	85,667	71,333	57,000
<i>Reduced Frequency of Scheduled Downtime</i>	141,150	107,556	145,778
<i>Reduction in Server Count and Reduced Expenditures</i>	48,599	29,699	30,854
<i>Improved Efficiency — Storage Area Management Tasks</i>	236,600	248,430	260,852
<i>Storage Infrastructure Availability</i>	80,000	80,000	80,000
<i>Backup Improvements</i>	500,000	500,000	500,000
Net Cash Flow	\$45,705	\$9,050,623	\$13,340,264
Cumulative Cash Flow	(\$6,731,758)	\$45,705	\$9,096,328
Total Investment	\$4,835,310		
Total Savings	\$27,271,902		
Client Supplied Internal Rate of Return	25.00%		
Calculated Internal Rate of Return	27.08%		
NPV of Savings	\$9,296,458		
ROI Method 1 — Simple ROI	188%	Savings / # of years / investment	
ROI Method 2 — Benefit over Investment	464%	Savings – Investment / Investment	
ROI Method 3 — Net Present Value	217%	NPV of Savings / NPV of investment	

Conclusion

Once Fidelity National Information Services made the decision to embark on a path involving integrated tiered storage from Hitachi Data Systems, tangible OPEX and CAPEX savings were not far behind.

Findings in this case study regarding the tiered storage project's ROI, intense savings and short payback period bear witness to early Hitachi Data Systems claims that a tiered storage deployment is capable of yielding significant reductions in both OPEX and CAPEX costs.

Fidelity National Information Services realized dramatic savings across the board thanks to the development of several virtual tiers of storage and the ability to seamlessly migrate data between the tiers. Just some of the



savings included deferred expenditures in extra hard disk capacity, reductions in labor costs, improved efficiencies in storage management and faster, more reliable data protection.

Yet, success with tiered storage is still not assured in every case. Some of it depends on the relative maturity of the IT organization. Part of the challenge may also come from the way “tiered storage” is defined by various vendors in the market. For this reason, Hitachi tiered storage economics forecasting is often prefaced with a specific definition of tiered storage, as follows:

“Tiered storage is not simply storing data on various storage systems, by different vendors, each having separate operating consoles and functions. Multitiered storage implies a single image pool of storage, with integrated but segmented storage tiers, all controlled by a unified storage architecture. Data can be promoted or demoted seamlessly through the tiers. Optimization of storage to applications and business users is enabled and essential. Multiple products and vendors may be included in the technical architecture, but the storage pools are abstracted above the individual storage systems. Virtualization is implied within multitiered storage.”¹⁰

It is at this higher level of abstraction — above the heterogeneous mix of devices and price points — that significant cost reductions can be attained.

If you would like help assessing the viability and potential cost savings of implementing a tiered storage system for your environment, contact your local Hitachi Data Systems representative or go to <http://www.hds.com/solutions/storage-strategies/tiered-storage.html>.

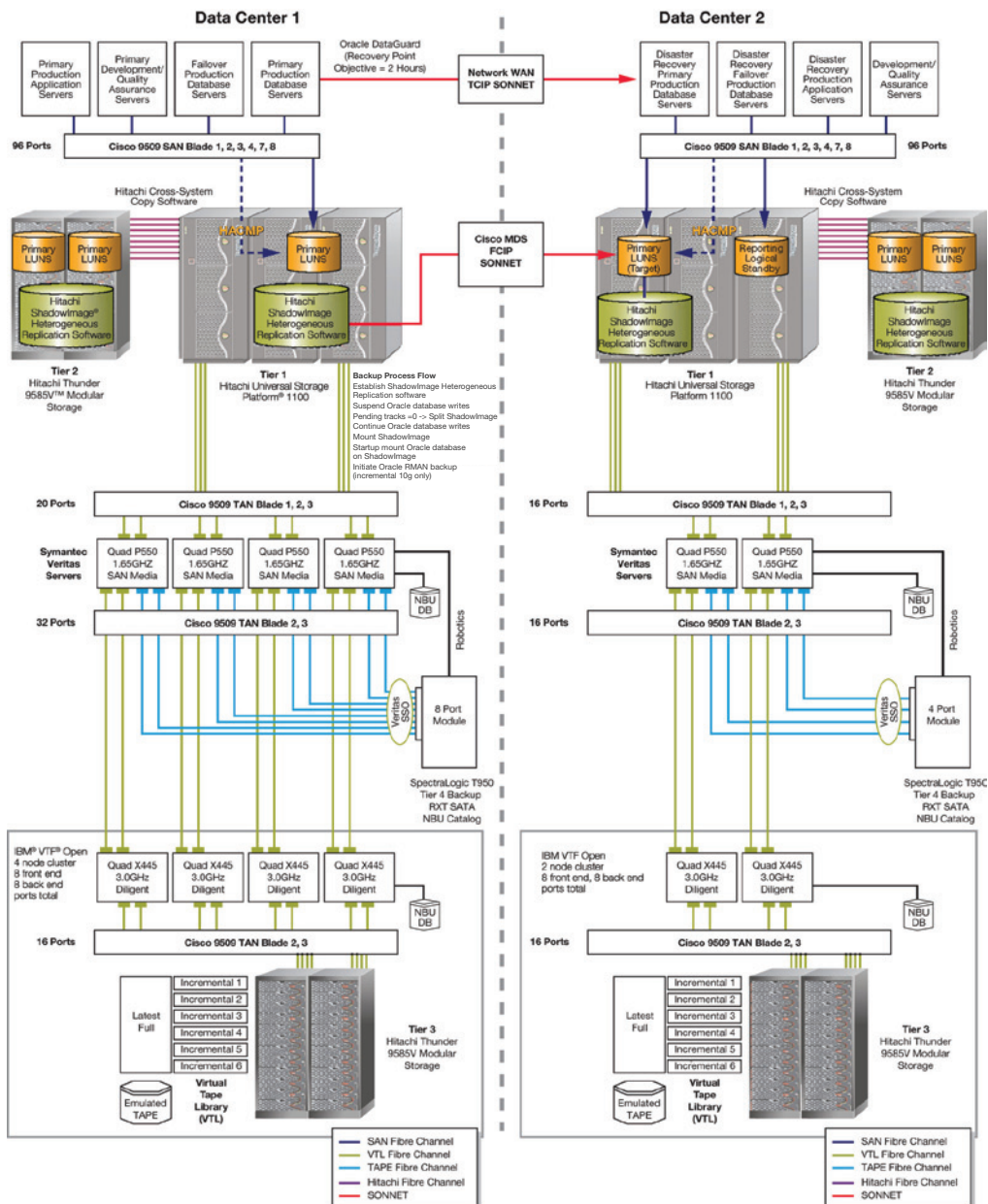
¹⁰ See *Tiered Storage Economics: Defining and Calculating the Economic Benefit of Tiered Storage Solutions*, by David A. Merrill at <http://www.hds.com/tools/whitepapers.html>.

Appendix A: Further Hitachi Data Systems Solution Implementation Details

This section provides architectural and implementation details for readers interested in a closer analysis of the Hitachi Data Systems solution installed at Fidelity National Information Services.

Specifically, the following diagram shows changes to the network switch architecture as well as the implementation of Fidelity National Information Services' tiered, disk-based backup architecture. This architecture relies on the Hitachi In-System Replication heterogeneous software bundle (including Hitachi ShadowImage® Heterogeneous Replication and Hitachi Copy-on-Write Snapshot software), and Hitachi TrueCopy® Synchronous/Asynchronous remote replication software on Tiers 1 and 2, as well as the use of IBM® VTF® Open, part of the Virtual Tape Library Solutions by Hitachi Data Systems on Tiers 3 and Tier 4.

Appendix A — Figure 1. Detailed Hitachi Data Systems Solution Architecture



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