A Strategic Blueprint to Increase Return on Assets

A Hitachi Data Systems Global Solution Services Data Migration and Storage Reclamation Engagement

Case Study

By Rob Zwick, Larry Korbus and Vijay Ramaswamy

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Executive Summary

One of the world's leading global financial institutions (GFI), distressed by the economic downturn and challenged with increasing shareholder value, was looking for ways to optimize its data center strategy. In particular, the GFI was looking for a strategic partner offering long term support for a cross platform storage consolidation and reclamation strategy that involved nearly 2,000 servers and 76 EMC frames located in multiple regions around the world.

The GFI contracted with Hitachi Data Systems for a two-phase technology refresh as part of the Storage Reclamation Service. The client's storage challenges included underutilized storage capacity, allocated but unused storage and fragmented storage. Previous time consuming, host-based migration strategies had proved unsuccessful, but through virtualization, thin provisioning with Hitachi Dynamic Provisioning software and a managed residency engagement, the GFI's data migrations have been completed online and transparently, without any user disruption. The Hitachi technology refresh required significantly less application downtime and fewer server reboots, as well as limited involvement by client system administrators and SAN teams. Also, Hitachi Data Systems was able to reclaim stranded capacity through consolidation and thin provisioning.

Hitachi Data Systems was able to help the GFI save US$4 million through a 40 percent to 60 percent reduction of physical storage, 40 percent reduction of environmental requirements, 40 percent reduction of real estate needs, and significantly reduced maintenance and operational costs.

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Introduction

The global financial institution (GFI) referred to in this case study is one of the world's largest banks, providing businesses, consumers, governments and institutions with a wide range of financial products and services.

Global Financial Institution Profile

- More than 200 million customer accounts

- Presence in 100 countries

- More than US$40 billion in annual revenue

- Large, diverse portfolio

  - Credit cards

  - Mortgages

  - Insurance

  - Global wealth management

  - Hedge funds

  - Corporate finance

Every few years, the GFI, like similar institutions, must move data from one storage system to another because of next generation upgrades, server and storage equipment replacements or consolidations, lease renewals and/or load balancing. In the past, the GFI utilized host-based migrations that proved slow and time consuming for system administrators and SAN teams. When confronted with the need for a major technology refresh of nearly 2,000 servers worldwide, the company decided to make a significant commitment to a new approach to data migrations.

The GFI sought a vendor that could provide experienced personnel familiar with cross platform data migration across storage vendors and required a services vendor competent with both EMC and Hitachi technology. The company wanted trusted technicians who could become an extension of their own teams, with full access to their systems. The technology refresh needed to occur on a tight timeline, through coordination with hundreds of GFI team members worldwide, and the cross platform, multiserver data migrations needed to involve minimal downtime or business disruption.

The GFI chose Hitachi Data Systems to lead the technology refresh and storage reclamation project using proven Hitachi storage virtualization technology.

Challenges

As is true for any corporation in need of a technology refresh, the GFI faced numerous IT infrastructure and migration challenges, each of which was addressed by the Hitachi Data Systems team.

Challenge #1: Large and Complex IT Infrastructure

The GFI has data centers spread around the world in the Americas, Europe and Asia Pacific, including nine data centers in the U.S. Along with the multiple data centers and tens of thousands of servers, the company's IT infrastructure includes multiple storage systems, with each server connected to multiple frames and storage systems.

In all, the company has 6PB of stored data, which is increasing at a 20 percent to 30 percent growth rate. Much of that data was stored on servers up to six years old, and the older frames held as much as 2TB to 3TB of data. An additional challenge was posed by the fact that many of the frames were siloed or standalone frames sold by EMC to different parts of the business units and were not connected to the same SAN fabric.

Challenge #2: Overarching Business Challenges

The worldwide financial crisis that began in 2008 exacerbated existing pressure on the GFI to lower costs, improve efficiency and increase profitability both immediately and over the long term. Through its technology refresh and other measures, the GFI needed to increase shareholder value and identify a plan to return to profitability through better expense management and increased efficiencies.

Challenge #3: Operational Issues

For several reasons related to operations, the GFI had excessive waste in its allocated but unused storage capacity. The lack of a demand management process and tools led to poor forecasting of business requirements, limited visibility into historical trends and, until recently, no visibility into allocated versus utilized storage. In addition, the GFI's elongated procurement process impacted time to market and resulted in overbuying and overprovisioning. The company was slow to adopt new technologies, and workforce reductions led to resource constraints that further hindered overall operations.

Challenge #4: Inefficient, Costly Data Storage

Like many companies, the GFI struggled to manage its storage in an efficient and cost effective manner. The full storage capacity of the company's servers was not fully utilized. Allocated storage was frequently unused, and storage was fragmented, creating costly inefficiencies. As a result, maintenance costs were high, and the total cost of ownership for the aging storage assets placed an added burden on the company.

Challenge #5: Migration Across Platforms

The GFI wanted to migrate its stored data from older EMC frames to a Hitachi Data Systems solution. Doing so required a cross platform data migration managed by a vendor possessing expertise and experience in both technologies, as well as experience with similar types of data migration events.

Challenge #6: Scheduling and Coordination Complexities

One of the biggest challenges, particularly in a large scale technology refresh, is scheduling and coordination with numerous business managers, line managers and system administrators to ensure each server goes through a complete data migration process on the expected date and time. Data center availability, as well as business outage timeframes, end-of-month timeframes and end-of-month processing must all be taken into account.

Challenge #7: Extended or Unexpected Downtime

Depending on factors such as the amount of storage to be moved and the number of ports, data migration is prone to both human and IT risks, resulting in potential application downtime and loss of productivity.

Challenge #8: Technical Compatibility Issues

Most of the GFI's storage systems were three years old, but some were as much as six years old. As servers age, drivers and software must be kept up to date in order to be compatible with new technology. Particularly with older servers, the data migration path can be more complex and time-consuming because the servers have not been kept to a recent compatibility index.

Challenge #9: Data Corruption and Loss

One of the greatest risks in data migration is that data could be corrupted during the move, or would be overlooked or lost. Hands on data migrations are prone to human error and can result in one or more of these problems.

Challenge #10: Application Performance Issues

During some data migrations, servers are focused for as much as 24 hours on physically copying data. The servers can become so busy that CPU utilization rises and, depending on how much data is being moved, application and performance issues result. For businesses, this means lost productivity with every data migration event.

Hitachi Data Systems Global Solution Services

Diagnosing the Problem

Even after identifying their challenges, many organizations struggle to determine where exactly they should start and how to select a solution that addresses their precise requirements. The GFI utilized Hitachi Data Systems Global Solution Services (GSS), for a comprehensive portfolio of enablement services organized into strategic phases that help businesses begin precisely where they need to with Hitachi hardware and software.

Figure 1. Global Solution Services Value Chain
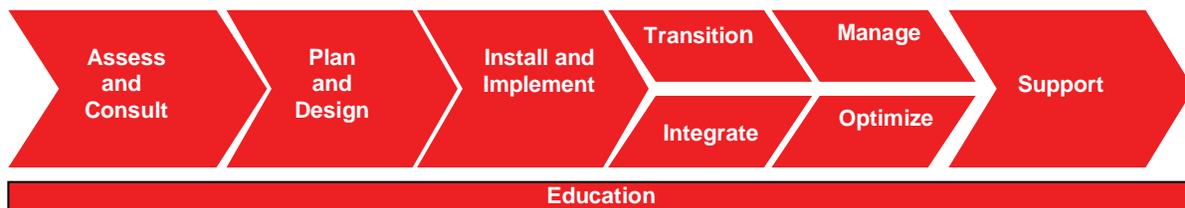
GSS offerings allow a business to begin exactly where it needs to with Hitachi products.

As shown in Figure 1, the Hitachi Data Systems Global Solution Services value chain includes:

- Assessment and consulting services to help organizations assess potential capacity reclamation and reconcile what they have with what they need
- Planning and design services to create a solution to address unique requirements
- Installation and implementation services to deliver the solution based on Hitachi Data Systems expertise and unique tools
- Transition and integration services
- Management and optimization services
- Support services

Through the comprehensive assessment conducted by GSS, the GFI was able to confirm the degree of under-rutilized storage capacity in its servers and identify Hitachi Data Systems solutions, which were then used to address the challenges, resulting in:

- Reclamation of 40 percent of previously unused storage capacity
- Reductions in maintenance costs
- Reductions in power and cooling costs
- Improved utilization and ease of management through consolidation

Technology Options for Data Migrations

Organizations have a variety of technology options to choose from to conduct technology refreshes (see Table 1). Each option offers advantages and disadvantages, depending on the company's specific needs and challenges.

Table 1. Technology Options

	Virtualization	*Replication Technologies*	*Host-based Migration*
Cross Platform	Y (any to any)	N	Y
Application Downtime per Server	<30 minutes	2–3 hours	2 hours (two outages)
Number of Outages	1	2 (second outage is managed/ scheduled)	2
System Administrator Involvement per Server	30 minutes	High due to BULK transfer	3–4 hours (two outages)
IT Risk (human involvement)	Low	Medium	High
Impact on Server Performance	None	None	High
Tech Investment	High	High	Low

Option #1: Host-based Migration

In host-based migrations, a server is used to copy data from one location to another, much in the same way as a PC's data may be copied from a hard drive to a USB drive. Mirroring or other methods are used to physically move the data to its new location and validation must then be conducted by system administrators or other team members to ensure all files have been moved and are available in the new location.

Pros:

- Limited downtime
- Allows for changes in LUN size or geometry

Cons:

- Very slow because of reliance on network rather than fiber connection (60GB/hour, or 1TB–1.5TB per day)
- Requires heavy system administrator involvement
- Prone to human error
- High IT risk
- Remote replication pair needs to be broken
- Additional cycles necessary on host

Used for:

- One-off migrations

Option #2: Migration Using Replication Technologies

In this data migration strategy, which has largely been replaced by other methods, replication tools such as EMC SRDF or equivalent technologies are used to migrate across platforms. Mirror images of data are used to transfer data from the source to the target location.

Pros:

- Takes advantage of existing investment in technology and processes
- Relatively short business outage window

Cons:

- Cannot migrate across vendor platforms
- Cannot migrate across platforms from the same vendor
- Requires bin file changes
- Requires EMC change control process
- Requires geometry changes of the box

Used for:

- Migration across generations of the same platform

Option #3: Virtualization

When virtualization is used to perform data migrations, the process is fast and completely transparent, even in heterogeneous storage system environments. The data migrations can happen online while users and applications are accessing data on the platforms, which makes scheduling easier and leads to overall faster data migrations.

Pros:

• Seamless, scalable architecture for cross platform migration

• Significantly less application downtime than alternatives

• Scalable process for simultaneous multiserver migration

• Least amount of involvement by system administrators

Cons:

• Requires upfront technology investment

• Effective only for like-sized LUNs

Used for:

• Best technology for cross platform migrations

Hitachi Data Systems Provides Solution for Data Migration

The GFI chose Hitachi Data Systems to conduct the technology refresh because of the unique combination of people, processes and technology offered by Hitachi Data Systems.

People

The GFI entered into a managed residency engagement with Hitachi Data Systems, with six Hitachi Data Systems employees becoming, in effect, a part of the GFI's internal team. Every Hitachi Data Systems employee who worked on the project was familiar with both EMC and Hitachi Data Systems technology and was interviewed and vetted by a management group at the GFI to ensure they met the company's internal requirements. Over the course of the two-year project, the Hitachi Data Systems team collaborated with more than 750 people at the GFI's data centers worldwide.

The Hitachi Data Systems team was given full access to the GFI's SAN environment, which greatly reduced the overall time necessary to complete the data migrations, as well as reducing the time commitments of system administrators and other GFI employees. As trust was established, the Hitachi Data Systems team was allowed to manage and maintain control of more aspects of the data migrations, successfully completing the migrations and maintaining the GFI's procedural requirements with little or no oversight.

Processes

Hitachi Data Systems has conducted thousands of data migrations and has developed a process that is predictable and scripted. Servers are typically taken offline for no more than an hour, so that Hitachi Data Systems can make modifications that accommodate the data movement, which then occurs online, after the server has been rebooted. The process is repeatable and is scalable, allowing migration of multiple servers at a given time.

System administrator involvement is minimal — generally consisting of little more than rebooting the server. No physical data movement or oversight is necessary. Hitachi Data Systems provides all zoning and migration related activities, including providing all configuration file changes, and a thorough validation process limits the amount of oversight required.

Technology — Data Migration

Hitachi Data Systems provides high-performance data migration technology, combining best-in-class storage systems such as the Hitachi Universal Storage Platform™ with the Hitachi Tiered Storage Manager software. Combined, Hitachi Data Systems products provide a comprehensive solution that solves the major challenges of data migrations.

The GFI's technology refresh was based upon Hitachi Data Systems virtualization and data mobility software — specifically, the Hitachi Tiered Storage Manager. In Phase 1 of the project, which was completed within six months, 38 EMC frames connected to 584 servers and two mainframes were migrated to four Universal Storage Platform 1100s. In Phase 2, 1,295 servers and 38 EMC frames were migrated to seven Universal Storage Platform Vs.

Virtualization and Tiered Storage

Through the GSS process, data migration takes place twice as fast as competitive solutions, resulting in significant savings throughout the technology refresh process. Additional benefits of conducting migrations using virtualization and the Tiered Storage Manager software include:

• Superior scalability

• Any-to-any platform migration

• Least downtime

• Fewest server reboots

• Least involvement by system administrators

• Highest level of productivity during migration

Planning and Execution of Multiphase Technology

The successful completion of the GFI's technology refresh required a coordinated, multiyear strategy that can be broken down into four basic phases (see Figure 2).

Figure 2. GSS Migration Process
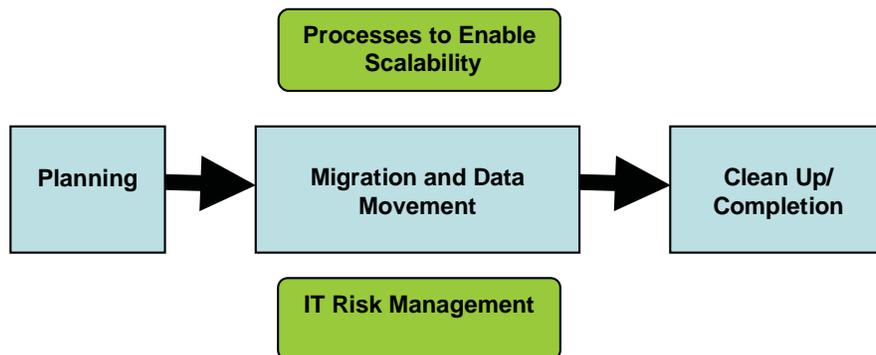
Phase #1: Planning

Because the actual data migration and movement is such a brief event, the planning phase is the most time consuming and complex element in Hitachi Data Systems data migrations. During the planning phase, Hitachi Data Systems technicians precisely map which applications and servers are being migrated and what data is going to be moved where. A target LUN sheet is completed and targets are established.

About one to two weeks before the actual data migration, the Hitachi Data Systems team completes a series of tasks that do not require client input or time. These tasks include:

- Validating source LUN devices

- Updating target LUN sheets

- Creating target LUNs

- Conducting pre-stage externalization

- Creating zoning scripts

- Creating masking and unmasking scripts

Phase #2: Data Migration and Data Movement

Hitachi Data Systems is one of the few vendors capable of segregating the migration process from the actual data movement phase (see Figure 3). The migration process, in which the server is taken offline, typically takes about 30 minutes — regardless of the amount of data being transferred. Total time involvement by system administrators is typically less than 30 minutes. The migration is complete once the scripts are run, storage is externally connected and applications are up and running. This nondisruptive data movement happens after the initial virtualization process, as volumes are available via the Universal Storage Platform.

Figure 3. Migration and Data Movement
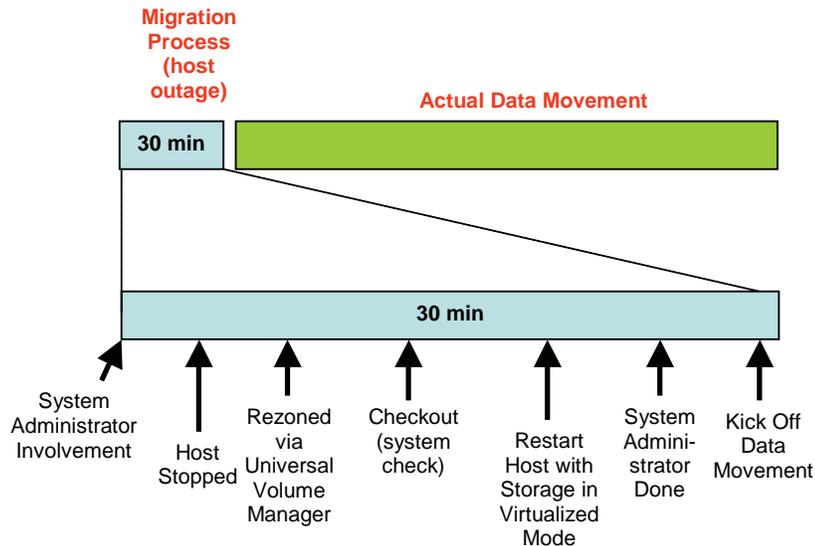
Total time required for data movement amounts to 0.25TB per hour; up to six servers can be migrated at a time.

Hitachi Data Systems follows a straightforward, repeatable process to complete the data migration and data movement (see Table 2). The data migration is, in a sense, complete once the scripts are run, storage is externally connected and applications are running. System administrators are not required for this part of the process. Data movement is then completed with application being online. The total time required for data movement is .25TB per hour. Hitachi Data Systems has a scalable process that can migrate up to six servers at a time.

Table 2. Migration and Data Movement Comparison

	Virtualization	*Replication Technologies*	*Host-based Migration*
Application Downtime/ Server	<30 min	2-3 hr	2 hrs (2 outages)
Storage Administrator Involvement/Server	30 min	1-3 hours estimated	3-4 hrs (two outages)
Number of Sever Reboots	1	2	2
Scalable Process: Number of Servers at a Time	6	1	1-3 typical
BULK Transfer (tape)	None	Yes	No

Phase #3: Completion

During the completion phase, Hitachi Data Systems completes all documentation, including an update of the LUN sheet and other configuration documents. In addition, Hitachi Data Systems validates that the targeted frame is no longer seen and validates removal of EMC storage.

## Phase #4: Risk Reduction and Escalation

Hitachi Data Systems ensures that there is an audit trail of all changes that have been made during the data migration process. If migration is, for some reason, not completed within the usual 30 minute outage window, a process is followed to escalate the concern. Hitachi Data Systems also completes scripts for pre- and post-migration work.

Hitachi Data Systems Provides Storage Reclamation Service

Technology — Dynamic Provisioning

To avoid future service interruptions, it is now common to overallocate storage by 75 percent or more. Hitachi Dynamic Provisioning, thin provisioning software that provides virtual storage capacity from a storage pool, allows companies to add disk capacity as needed, when needed, to nondisruptively address the need for additional storage capacity. Built on proven technology, Dynamic Provisioning software has no operational overhead and decreases the administration costs normally incurred to provision new storage. At the same time, the software improves application availability by reducing the downtime needed for the storage provisioning process.

Figure 4. Opportunity for Capacity Reclamation with Hitachi Dynamic Provisioning Software
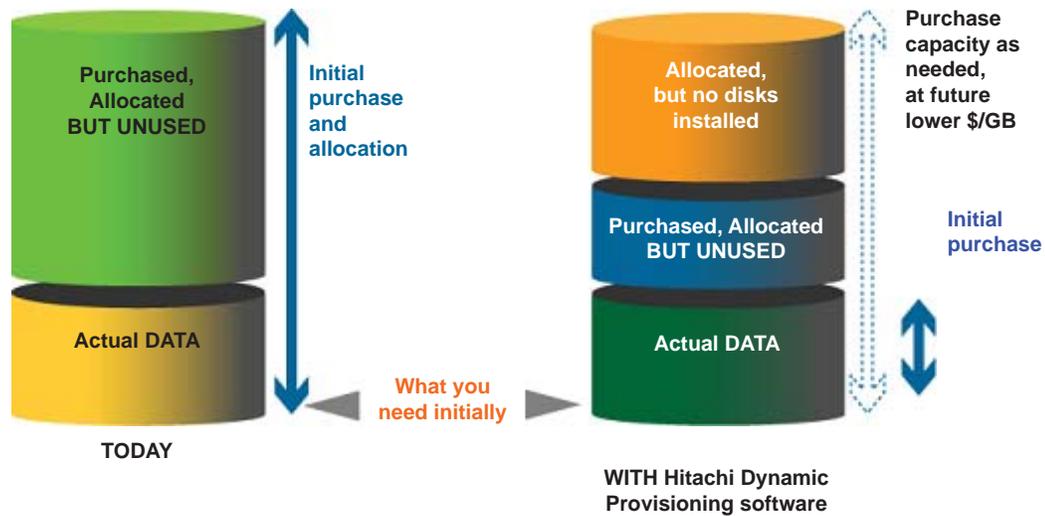
To avoid future service interruptions and improve operational efficiencies most customers use fixed size volumes, resulting in overallocation of storage by 75 percent or more.

Through the Global Solution Services assessment process, the GFI learned the extent of its potential capacity savings and the extent of its reclaim capacity. By utilizing Dynamic Provisioning, the GFI was able to reclaim 40 percent of previously unused storage capacity[1] (see Figure 5).

The additional benefits of Dynamic Provisioning software include:

• Eliminate traditional complexity of provisioning storage volumes on a "per application" basis when more storage is needed. Administrators simply draw from the Dynamic Provisioning software pool without needing to add physical disks.

• Greatly improve storage management efficiency and the ability of one administrator to manage more terabytes of data.

• Reduce downtime (planned outages) to increase physical disk capacity and change the application server and storage system configurations. With virtual storage provisioning, less physical provisioning means less application downtime.

• Employ automatic application I/O workload balancing by spreading many I/O workloads across multiple physical volumes.

• Reduce physical disk requirements (due to increased utilization of existing disks and deferred storage purchases); this can provide environmental savings in floor space, power and cooling.

• Reduce operating and capital expense; using less storage yields additional cost savings.

Hitachi Dynamic Provisioning Zero Page Reclaim Feature

Dynamic Provisioning software enables organizations (including the GFI) to perform Zero Page Reclaim.

Through Zero Page Reclaim, after data migration has been completed via Tiered Storage Manager software or other means, the volume's physical capacity can be examined. Where the firmware determines that no data

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[1] The amount of storage that can be reclaimed varies based on the operating system that is in place and the extent of storage overprovisioning.

other than zeros are found on a Dynamic Provisioning pool page, the physical storage is deemed unmapped and is returned to the pool's free capacity.

Particularly for volumes that have been "thin friendly'" but were initially set up on traditional "thick" physical volumes, Zero Page Reclaim can result in a substantial initial storage reclamation after migrating to a dynamic provisioned volume. This ability to make thick volumes thin results in significant cost savings for customers like the GFI by giving them the ability to reclaim existing storage that is allocated but unused at the volume level.

Zero Page Reclaim is highly beneficial after initial migration and restore actions in which the original volume was heavy with untouched space. The feature is run as a background task and has absolutely no impact on the application or operational overhead.

Figure 5. GFI Capacity Reclamation Results
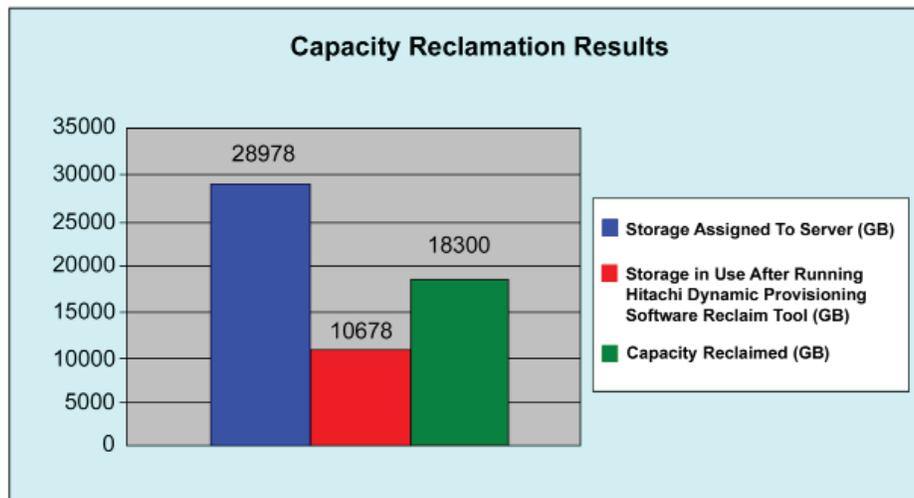
Sample capacity savings realized at GFI across 100 plus servers.

Results of Hitachi Data Systems Data Provisioning and Migration

Hitachi Data Systems has successfully completed both Phase I and Phase II of the GFI's technology refresh. Storage has been consolidated on Hitachi Universal Storage Platform V with thin provisioning capabilities.

Current results, some shown in Figure 5, include:

• 1,900 successful server migrations

• 30 minute typical downtime for each server

• 185TB capacity reclaimed

• 40 percent to 60 percent reduction of physical storage

• 40 percent reduction of environmental requirements

• 40 percent reduction of real estate needs

Just as importantly, the company has greatly enhanced operational efficiencies with a virtual volume that takes just minutes and volume size that is customizable to exact customer specifications. Performance is now optimized, with the "wide striping" functionality of Dynamic Provisioning software, which eliminates hot spots and the need for ongoing performance debugging.

Table 3. Capacity Reclamation Results

Operating Systems	Number of Servers	Average Percent Reclaimed
IBM® AIX®	14	44
Sun Solaris	23	67
Microsoft® Windows	24	51
VMware	2	50
Linux/HP-UX	27	40

On average capacity savings* of 40 percent to 65 percent was realized at GFI.
*Sample across 100 plus servers; standard deviation of capacity savings per server was high.

Benefits

The GFI had a series of requirements for its multiyear technology refresh, each of which was met by the Hitachi Data Systems virtualization strategy and Dynamic Provisioning software.

Financial benefits include:

- Savings of more than US$4 million on migration of 100 plus EMC frames connected to 2,500 servers
  - Reclamation of approximately 185TB of usable storage valued at US$2 million
  - Maintenance cost avoidance valued at US$2 million
- Reduced operational costs, with data moving at twice the speed of competitors' solutions
- Reduced storage administration and related costs
- Reduced capacity purchases and related expenses
- Reduced power consumption and heat in the data center
  - Frame consolidation
  - RAID-1 to RAID-5 conversion
  - Tiering in a box
- Reclaimed floor space in the data center

Other realized benefits include:

- Limited application downtime
- Reclamation of substantial amounts of previously unutilized storage capacity
- Minimal risk of data corruption or loss
- Coordinated data migration by lines of business
- Limited number of servers affected at one time
- Ease of maintenance — simpler administration and fewer outages
- Performance optimization — stripe using all available spindles
- Predictive tool — better sizing, monitoring and reporting
- Reduced involvement of system administrators — typically less than an hour for each migration

Summary

The GFI has successfully transitioned from host-based data migrations to a virtualization strategy utilizing Hitachi Tiered Storage Manager software. Through the managed residency engagement with Hitachi Data Systems, the GFI has successfully moved data from older EMC frames to a Hitachi environment with almost no time commitment from system administrators. In the process, the GFI has saved approximately US$4 million through maintenance, a 40 percent to 60 percent reduction of physical storage, as well as a 40 percent reduction of environmental requirements and a 40 percent reduction of real estate needs.

Hitachi Data Systems Corporation