



# ESG Lab Report™



## Hitachi HiCommand® Tiered Storage Manager

A validation study  
by  
ESG Lab  
November 2005

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### ESG Validation Reports

ESG Lab does hands-on testing of storage and storage-related products and technologies and develops ESG Lab Validation reports. The goal of the ESG Lab Validation reports is to educate customers about specific storage-related products including storage systems, backup-to-disk solutions, storage management applications, backup/recovery software, storage virtualization platforms, etc. The ESG Lab reports are not meant to replace the necessary evaluation process that end-user customers should conduct. The ESG Lab reports are designed to provide insight to what is compelling about various products and how they can solve customer problems. ESG Lab reports also recommend areas upon which we feel the vendor should improve. ESG Lab provides third-party expert perspective based on our own hands-on testing in a lab and interviews with customers using these products in production environments.

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## Intelligent Tiered Storage

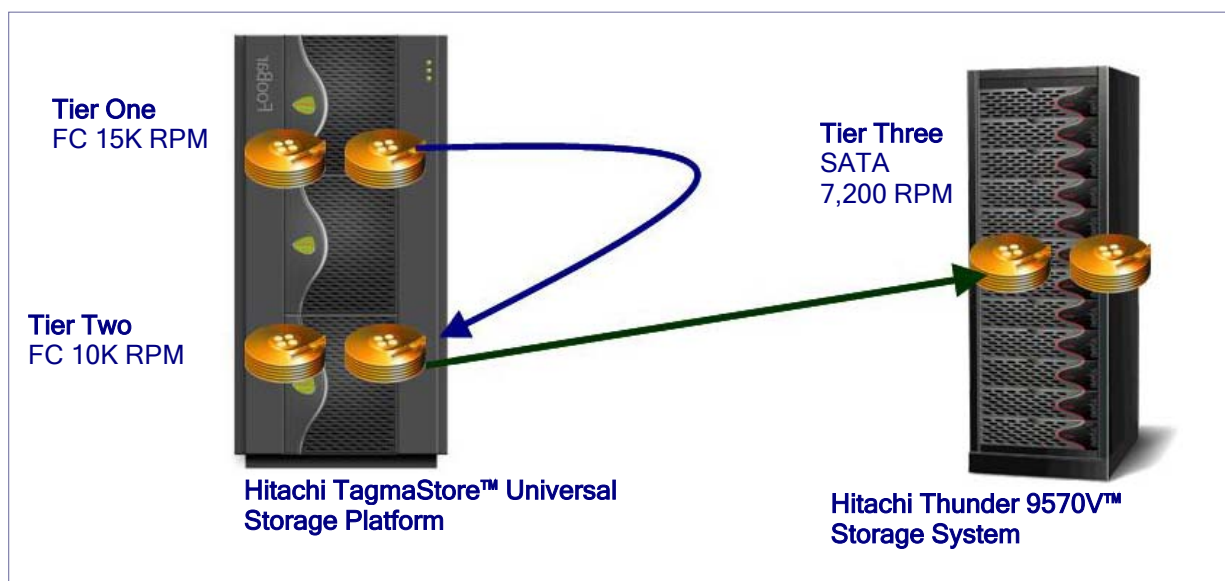
The Hitachi TagmaStore™ Universal Storage Platform and Network Storage Controller both provide storage virtualization capability, which, among other things, enables an intelligent tiered storage network. An intelligent tiered storage network consists of multiple storage systems with different price/performance/protection capabilities. Additionally, using the Hitachi HiCommand® Tiered Storage Manager allows data to be moved between these different tiers transparently and online.

Different storage tiers are often associated with particular disk types such as FC and SATA. However, drive types are only one aspect of a tiered storage environment. The type of storage system (enterprise-class, midrange, and entry-level) must also be taken into consideration. For example, the Universal Storage Platform is a Tier One storage system, the Hitachi TagmaStore Adaptable Modular Storage is Tier Two, and the Hitachi TagmaStore Workgroup Modular Storage (all SATA) is a Tier Three system. Additionally, the various tiers can also consist of heterogeneous storage systems, for example, the Universal Storage Platform for Tier One, EMC CLARiiON CX700 for Tier Two, and HP MSA for Tier Three. The Universal Storage Platform and the Adaptable Modular Storage may contain the exact same drives, but they still remain different tiers with different levels of availability, performance, and cost. Customers may also want to enforce different protection policies as part of a tiered storage environment. For instance, Tier One storage may support point-in-time copies, more frequent backups, a remote mirroring configuration, RAID-6, etc., while customers may wish to implement fewer levels of protection for lower tiers of storage, based on their relative importance to the business.

### The Value of Tiered Storage

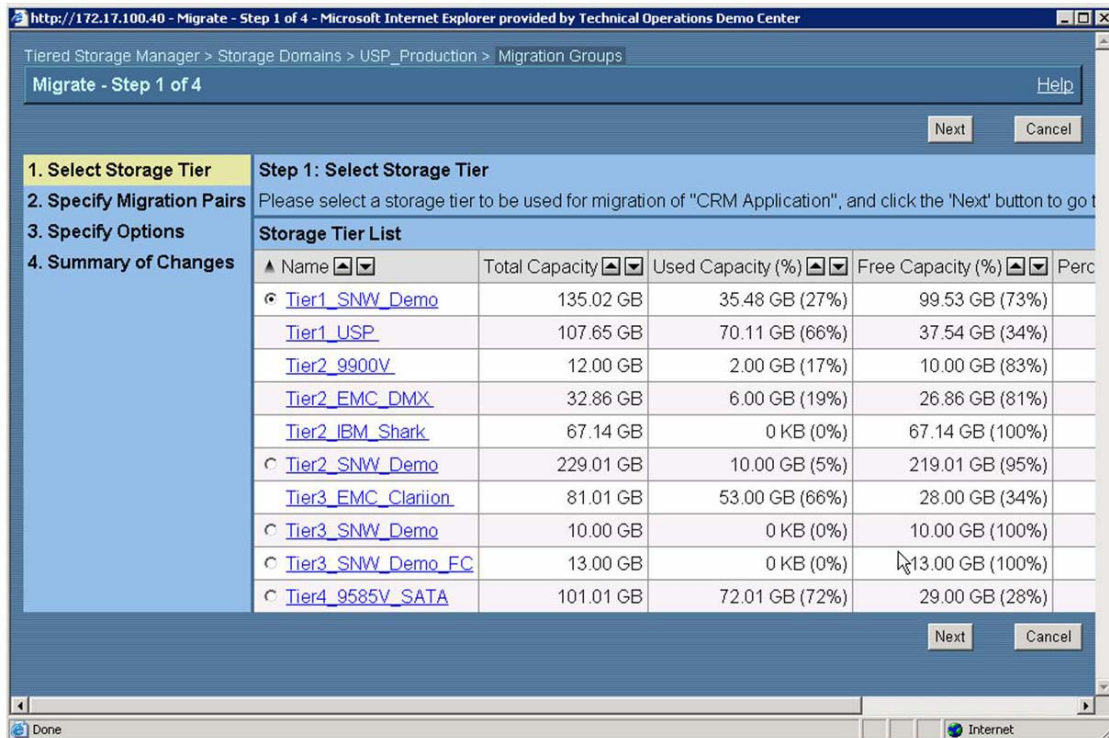
Why move data between different tiers? One reason is that the value of information changes over time. The frequency and urgency of requests for information tend to peak shortly after the information is created. The number of requests, and the value derived from those requests, will usually diminish over time. Moving data to more cost-effective tiers of storage as it ages can reduce the overall cost of storage capacity. Another reason to use tiered storage is to better optimize the storage infrastructure. Why keep data running on the fastest tier of storage if it does not require high performance? Even if the data is frequently accessed and mission-critical, it may not benefit from residing on fast (and expensive) 15,000 RPM FC disks.

Figure 1: Migrating Between Three Tiers of Hitachi Data Systems Storage



ESG Lab testing has shown that Tiered Storage Manager is not only capable of managing on-line migrations and tracking free/used space across migration groups, but is also easy to use. Tiers of storage are easily defined and managed at the application level, migration candidates are automatically detected, and migrations are performed using a simple four-step wizard. Tiered Storage Manager includes Hitachi Volume Migration software as the data mover.

**Figure 2: HiCommand Tiered Storage Manager Migration Manager Wizard**



## ESG Lab Testing

ESG Lab used Tiered Storage Manager to migrate an order-entry database application between three tiers of storage (Figure 1):

1. A Microsoft SQL database residing on 15K RPM drives within a Universal Storage Platform (Tier One) was migrated to 10K RPM drives within the same Universal Storage Platform (Tier Two).
2. ESG Lab then moved the data from the Universal Storage Platform (Tier Two) to an attached Hitachi Thunder 9570V™ high-end modular storage system onto SATA drives (Tier Three).
3. HiCommand Tiered Storage Manager was used to configure, execute, and monitor the progress of migrations.
4. Database queries during migrations ran without error.

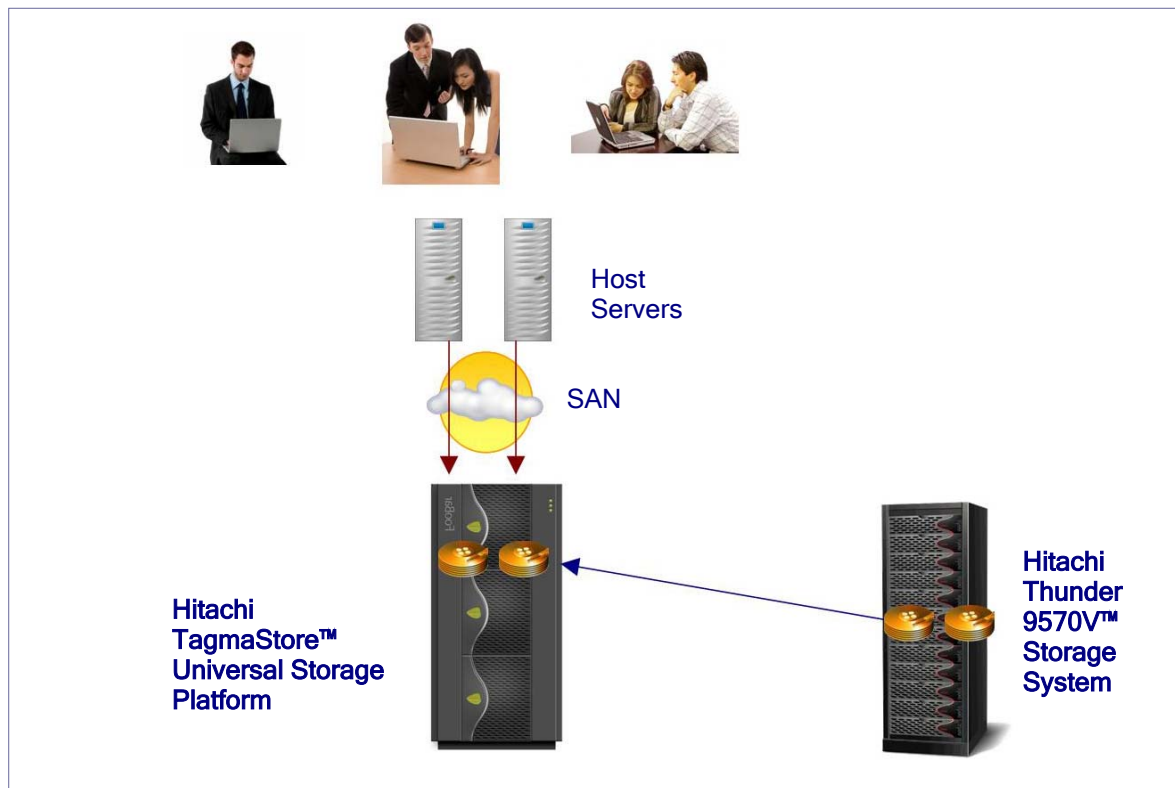
## Why This Matters

Intelligent tiered storage can save tens of thousands, hundreds of thousands, and even millions of dollars. Additionally, moving data to different tiers enables companies to better optimize their storage assets. The key is to implement various tiers of storage in combination with intelligent software that can manage the tiers and migrate data transparently and without disruption.

### Tiered Storage Promotion

When discussing intelligent tiered storage, the conversation tends to focus on moving data off Tier One onto a lower tier to save on cost. However, it may become important to move data onto upper tiers as required by the business operations. For example, an event-driven project may experience only intermittent activity. The project data may be unused for long periods of time until the project suddenly becomes a priority. Promoting the data to an upper tier may become necessary based on performance requirements during peak activity.

Figure 3: Tiered Storage Promotion



### ESG Lab Testing

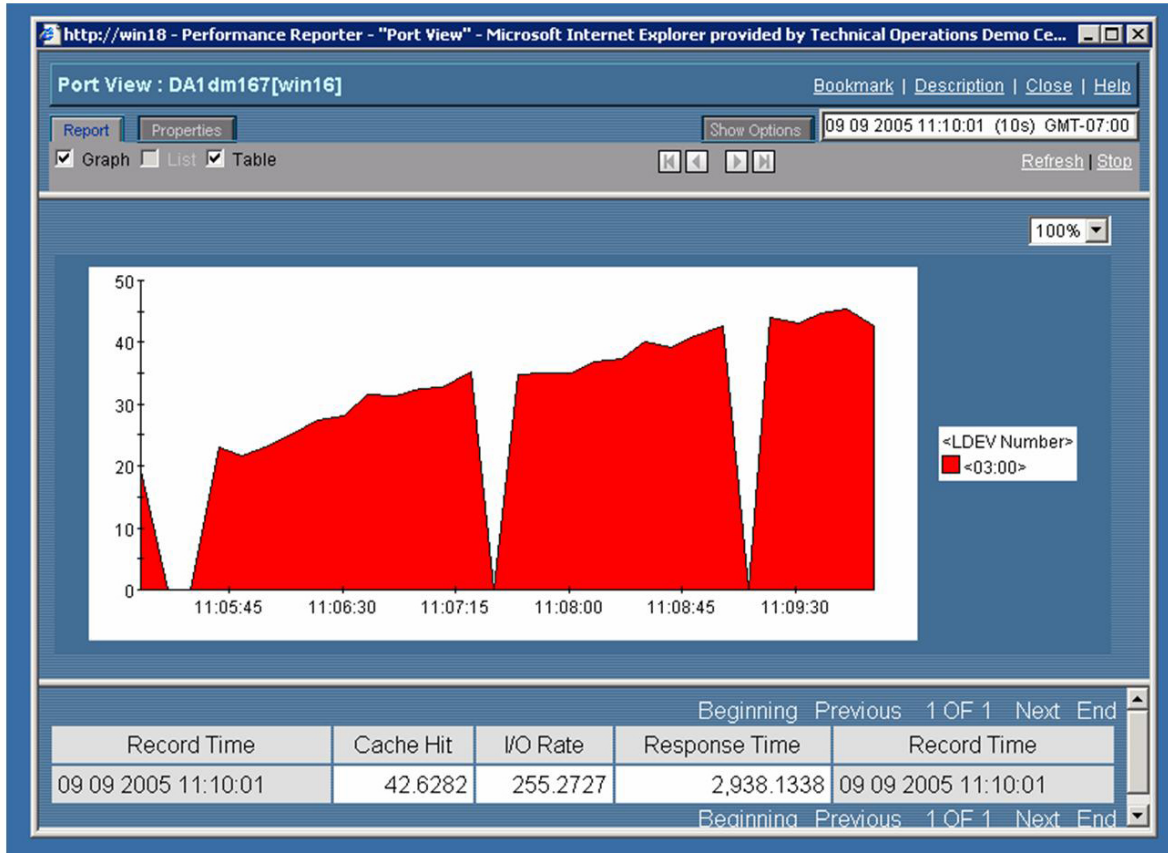
For the next test, ESG Lab used additional software products in conjunction with Tiered Storage Manager: Hitachi Virtual Partition Manager and HiCommand Tuning Manager.

- Virtual Partition Manager allocates physical hardware resources including host ports, cache memory, and internal and external capacity in order to create independently managed virtual storage systems. This ensures that applications can access the resources that they need without contending with other applications and can have their own Quality of Service parameters.
- Tuning Manager provides reporting capability to help users better understand why applications are not performing to the best of their ability.

Queries were run against a Microsoft SQL Server database residing on Tier Three SATA drives. The report could not be generated in time due to performance issues, which resulted in a query run time of 104 seconds. ESG Lab used Tuning Manager to monitor response time and cache hit rates. Tuning Manager revealed that there was only a 30 percent cache hit rate. The queries we ran were cache-intensive, and additional cache memory was needed to improve performance.

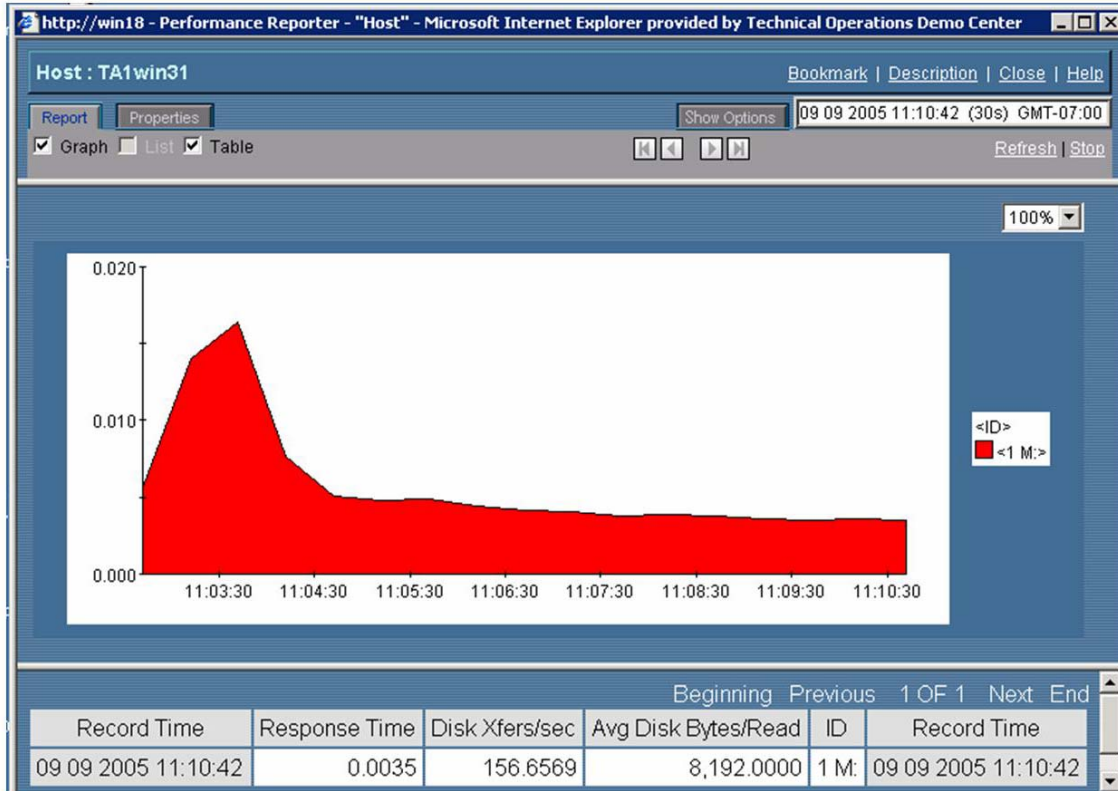
ESG Lab dynamically increased the cache size from 4GB to 8GB using Virtual Partition Manager. As cache hits rose steadily from 30 percent to 65 percent, query run times decreased from 104 seconds to 82 seconds. A 21 percent reduction in query run times due to the addition of cache is impressive. Additionally, Tuning Manager was used to monitor I/O response times, which dropped from five to three milliseconds due to the addition of cache.

Figure 4: Tuning Manager Reports Cache Hit Rates Are Rising



Although performance improved based on the increase in cache memory, ESG Lab wanted to get even better results. ESG Lab performed a migration from SATA drives on the Hitachi Thunder 9570V storage system to the Hitachi TagmaStore Universal Storage Platform running faster-spinning 15K RPM FC drives.

Figure 5: Tuning Manager Reports Response Times Dropping



The combination of increase in cache and a migration to faster drives delivered dramatic improvements while queries ran without interruption, response time was cut in half, the number of I/Os processed per second (IOPS) nearly tripled, and query run time improved from 104 seconds to 70 seconds.

	Query Time (less is better)	Cache Hit (more is better)	Response (less is better)	IOPS (more is better)
Before	104 seconds	30%	5 ms	122
After cache	82 seconds	62%	3 ms	228
After migration	70 seconds	62%	2 ms	314

## Why This Matters

Promoting data from a lower tier to a higher one is an often-overlooked aspect of intelligent tiered storage. It is important to be able to move data between tiers of storage based on the needs of the business. If no one accesses the data for weeks or months, then it should be moved to a lower tier. However, if that data becomes active again, it will need to be promoted to the high-performing tier to meet the demands of the application.

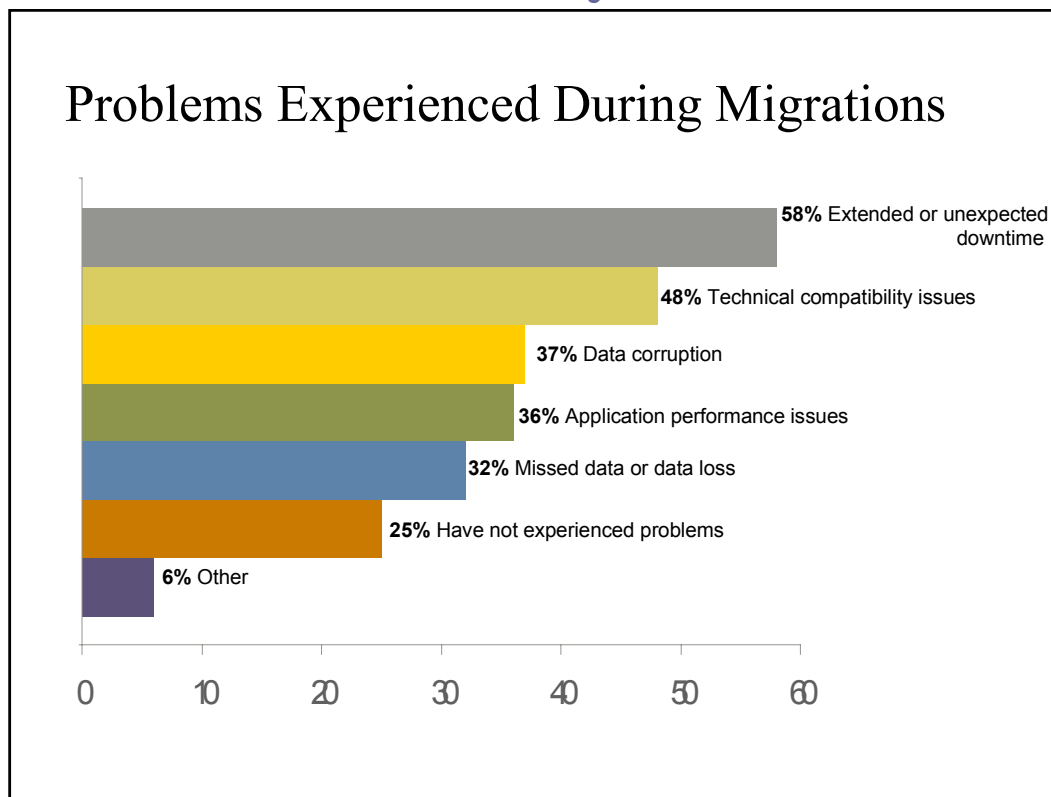
Additionally, ESG Lab was able to increase the cache size from 4GB to 8GB while online, which had a significant impact on application performance. Hitachi Data Systems provides various tools that enable system administrators to optimize performance to meet the needs of the environment.

## Data Migrations

ESG Research has found that data migrations between different storage systems are commonplace in data centers. While the general perception is that data migrations are a rare occurrence, ESG Research found that 20 percent of companies surveyed performed migrations on a weekly basis, and another 21 percent performed monthly migrations. Server and storage equipment replacements, relocation, consolidation, lease renewals, and balancing workloads drive the need to migrate data on a regular basis.

ESG Research has found that the majority of customers are performing data migrations offline, which is a disruptive process. Data migrations should be online and transparent to the applications and users accessing the data. Today, there are a handful of solutions that perform transparent migrations, including the Universal Storage Platform and/or Network Storage Controller along with the associated HiCommand Tiered Storage Manager software.

Chart 1: Customer Data Migration Problems



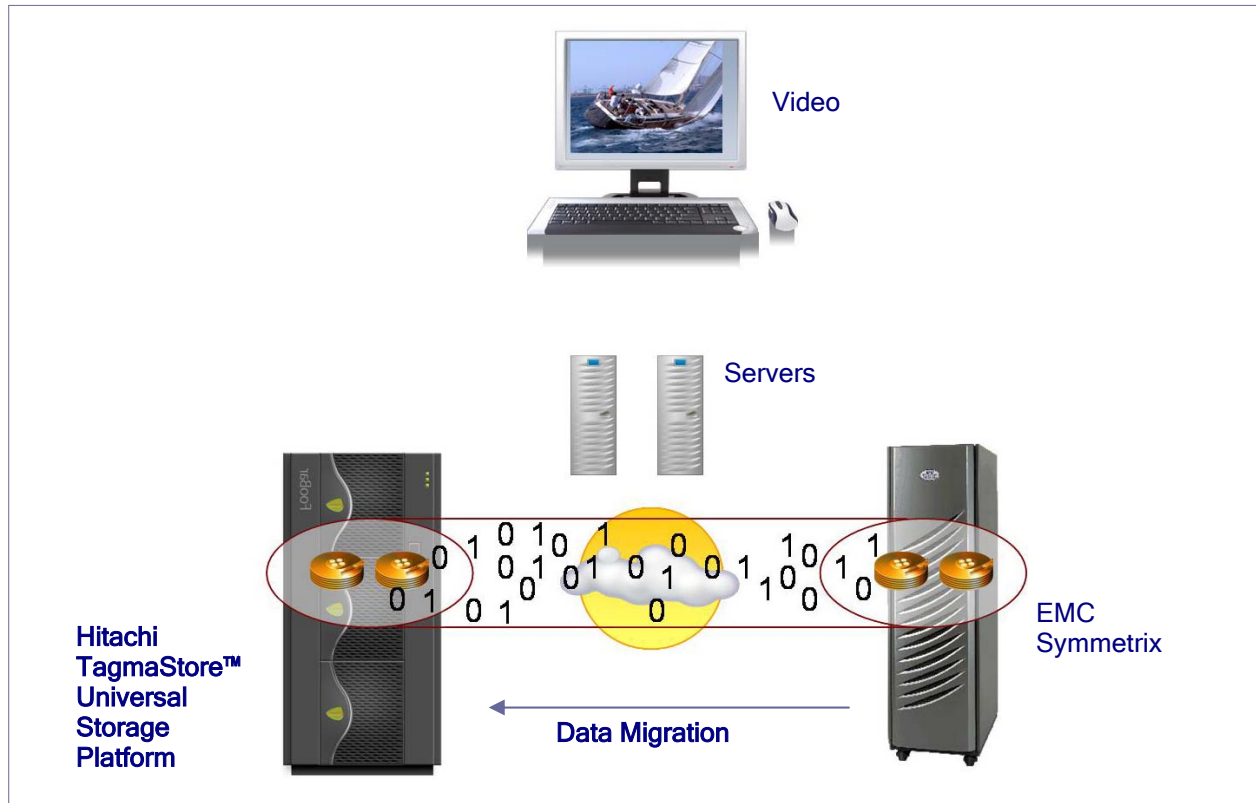
Last year ESG Research conducted a study on data migration that included over 550 end users responding from North America and EMEA. The results of the research confirmed many of the commonly held beliefs about data migrations, including the fact that the majority of migrations are done on weekends and that application downtime is the biggest overall issue.

The majority of users (75 percent) have experienced problems with data migrations, with 58 percent reporting extended or unexpected downtime, and 36 percent experiencing application performance issues (Chart 1). Many users also find migrating data to be a complex process: More than 72 percent of respondents take more than two weeks to plan an implementation, and more than 40 percent of the migrations involve more than five people to complete. In summary, traditional data migrations can be costly, disruptive, and risky. Companies stand to benefit from a greater awareness that there are much better alternatives, such as the Hitachi HiCommand Tiered Storage Manager and TagmaStore Universal Storage Platform and Network Storage Controller solutions.

**ESG Lab Testing**

ESG Lab migrated an active volume from the EMC Symmetrix to the Tier One internal storage on the Universal Storage Platform. We played a video on a Fibre Channel-attached S: drive residing on a Microsoft Windows server. The migration was configured and executed using Tiered Storage Manager. The video was started and viewed from a handheld HP IPAQ, which accessed the video on the S: drive over a wireless network. The video played without a hitch, and the migration completed in eight minutes.

**Figure 6: Migrating from EMC Symmetrix to a Hitachi TagmaStore Universal Storage Platform**



The HiCommand software automatically discovered and connected compatible and available tiers of storage to be migrated. The process was fast and easy and was done transparently to the users and applications.

**Why This Matters**

Data migration is a fundamental process within the data center. However, there is a great deal of misunderstanding and lack of awareness about the tools available to perform this task. System administrators can use the Hitachi TagmaStore Universal Storage Platform and Network Storage Controller in combination with HiCommand Tiered Storage Manager software to easily and transparently migrate data between heterogeneous storage systems.

## ESG Lab Validation Highlights

- ☑ A heterogeneous mix of enterprise-class and midrange storage systems from EMC, Hitachi Data Systems, and IBM were connected to a Hitachi TagmaStore Universal Storage Platform and managed as a single pool of virtualized storage using Hitachi HiCommand software.
- ☑ A heterogeneous online storage migration from an EMC Symmetrix to a Hitachi TagmaStore Universal Storage Platform was performed while video played, without interruption due to the migration process.
- ☑ A database was migrated while active queries ran without error or disruption. A migration was performed from Tier One 15K RPM FC drives to Tier Two 10K RPM drives within the Universal Storage Platform and then to 7.2K RPM SATA drives located in an externally attached Hitachi Thunder 9570V.
- ☑ A dynamic increase in cache from 4GB to 8GB was observed within a logical partition while online with increase of cache hit rates from 30 percent to 62 percent. Query times improved by over 20 percent, and I/O response times dropped from 5 ms to 2 ms.
- ☑ An online data migration from a Thunder 9570V with SATA drives (Tier Three) to a Universal Storage Platform with FC drives (Tier One) improved database query times by over 30 percent, and I/O response times dropped from 5 ms to 2 ms.

## ESG's View

While Hitachi Data Systems is known for its leadership in the storage systems arena, what is often overlooked is the comprehensive suite of storage software in its arsenal. Hitachi Data Systems has a wide range of HiCommand software that provides a great deal of value in better managing, supporting, and optimizing applications deployed in storage area networks. The majority of its suite of storage management solutions can work in heterogeneous storage environments, even in environments without Hitachi Data Systems hardware. Two years ago, ESG would have said that Hitachi Data Systems provided a mediocre set of storage management solutions. Today; we emphatically say that the HiCommand storage management suite is best-in-class.

For this project, ESG Lab specifically focused on HiCommand Tiered Storage Manager, Hitachi Virtual Partition Manager, and HiCommand Tuning Manager. Hitachi Data Systems is very focused on storage virtualization and has put a great deal of emphasis on the Hitachi TagmaStore Universal Storage Platform and Network Storage Controller. However, HiCommand provides intelligent software that, in combination with Hitachi's best-in-class storage systems, creates an even more compelling solution.

Data migrations are an important part of the data center. Most companies are unaware that a solution combining the Hitachi TagmaStore Universal Storage Platform or Network Storage Controller with HiCommand Tiered Storage Manager can provide transparent and nondisruptive data migration of heterogeneous SAN-based storage systems. Servers do not have to be taken offline, the process does not require a team of people, and the actual data migration is very fast and reliable.

ESG has spoken with customers who have saved tens of thousands, hundreds of thousands, and even millions of dollars by implementing an intelligent tiered storage environment. Hitachi Data Systems is driving hard to be the leader in storage virtualization by innovating on its storage systems and software solutions. It is game-changing technology that has obvious and quantifiable value.

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### ESG Related Reports:

ESG Analyst Brief: HDS - Advancing Storage and Data Life Cycle Management, April 2005  
ESG Lab Report: Hitachi TagmaStore Universal Storage Platform, September 2004  
ESG Analyst Brief: The TagmaStore Universal Storage Platform, September 2004