

## Introduction

Hitachi Global Storage Technologies (GST) is extending its position in enterprise storage by introducing ultra-performance Serial-Attached SCSI (SAS) and Fibre Channel (FC) solid state drives (SSDs). These drives are the result of Hitachi's strategic collaboration with Intel and will be available in the first half of 2010. Well-suited for accelerating system performance in transaction-intensive data centers and increasing space efficiency, the new SSDs can also lower energy usage by up to 90% on a per-drive basis and reduce cooling requirements in dense server installations. The



synergistic relationship between the new throughput-enhancing SSDs and traditional hard disk drives (HDDs) in servers and storage arrays provides a cost effective, end-to-end enterprise-class storage solution, in terms of reliability, compatibility and system performance.

## Optimizing Performance and Containing Costs with SSD Storage Solutions

Today's business applications put ever-increasing performance demands on the enterprise data center. To meet these demands, Hitachi GST is creating a new line of solid state drives that deliver dramatically faster performance than conventional hard drives. Designed to optimize the performance of FC or SAS servers and storage systems, the new SSDs are capable of delivering improved system response time and application performance in enterprise data center environments.

Although the initial costs of deploying SSDs are higher than traditional hard drives, operating costs are significantly reduced. Fewer SSDs are required to support high-performance applications, helping to offset the higher purchase costs. Individual SSDs require up to 90% less power than typical 3.5-inch enterprise hard drives. The combination of fewer drives using less power reduces cooling requirements and has the potential to shrink data center space. These advantages can translate into significant total-cost-of-ownership (TCO) savings for large enterprise data centers.

## Market Analysis

Over time, SSDs will penetrate both the consumer and enterprise markets, delivering substantial improvements in performance and energy efficiency. Although SSDs have become more cost effective as the price of flash memory declines, traditional hard drives continue to post impressive gains in capacity, performance and overall price. Both storage solutions will continue to have a role in enterprise and consumer applications, and Hitachi will offer industry-leading products to both markets. Industry analysts are forecasting significant SSD volume growth, although broad adoption of the technology may take many years as costs decrease and product specifications are standardized.

First generation Hitachi enterprise-class SSDs will provide reliability, endurance and performance using single-level cell (SLC) NAND flash memory. SSD products based on multi-level cell (MLC) NAND flash memory have lower reliability and endurance characteristics. Both SLC and MLC solid state drives will continue to gain market share as costs decrease and they become a more affordable option, but SLC is currently the dominant technology for enterprise applications.

## High Performance, Fully Interoperable SSD Solutions

Enterprise data centers demand mission-critical solutions. Breakthrough performance is tantalizing, but it is essential that new solutions are highly reliable and completely interoperable with existing systems. Designed to complement and enhance the functionality of existing HDD servers and storage arrays, the Hitachi SSDs deliver mission-critical reliability and ultra high input/output operations per second (IOPS) performance. Hitachi has leveraged its extensive experience in enterprise-class drive development, qualification and system integration to design in full compatibility with existing SAS and FC interfaces.

Using SSD-based systems to remove the IOPS bottleneck facilitates the development and deployment of demanding high-speed enterprise applications. The Hitachi SSD strategy complements the enterprise HDD product line and fully supports a robust tiered-storage architecture. By using SSD-based systems to turbo-charge application performance and throughput, a more efficient hybrid data center infrastructure can be created with the appropriate

storage technology utilized for specific requirements, as well as seamless compatibility and management.

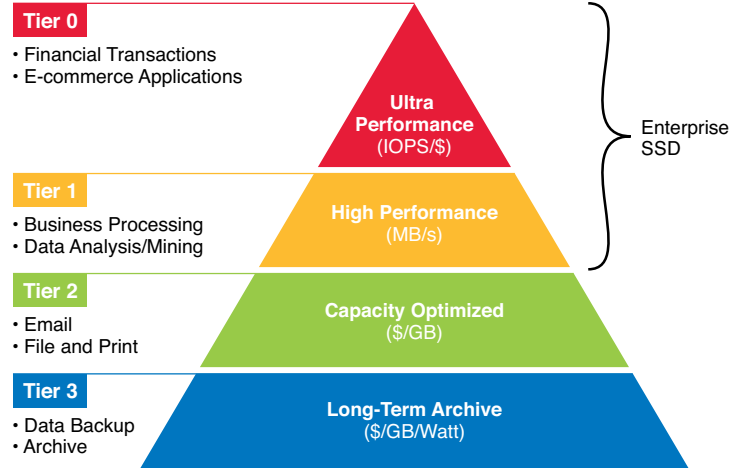
Available with either SAS or FC interfaces, the new Hitachi SSDs are expected to meet skyrocketing performance demands, while simultaneously reducing space, power and cooling costs. The result of a collaboration between Hitachi GST and Intel, the first SSD products integrate Intel's industry leadership in core NAND and controller technologies to reduce cost and enhance reliability. Enterprise-class endurance and reliability is enhanced by a superior wear-leveling algorithm that extends SSD life by evenly distributing read/write accesses.

## Applications

Developed for enterprise environments where speed is of paramount importance, SSDs are ideal for deployment in high-end financial-sector data centers. While HDDs typically provide up to 500 IOPS, Hitachi SSDs will deliver blazingly fast IOPS performance at speeds up to 100 times faster than hard drives. Financial entities with tier-0 storage requirements can accelerate the performance of their trading systems and achieve very high IOPS by connecting several SSDs. SSDs are utilized at the front-end of the transactional system to deliver a key competitive advantage, and mission-critical storage and retrieval functionality are performed by high-capacity HDDs. The result is a data center environment capable of delivering the highest levels of performance, capacity and reliability.

Beyond the real-time transaction processing environment, virtually every enterprise has applications where immediate access to "hot" data will improve productivity and operational efficiency. One of the key enabling technologies for the efficient utilization of SSDs, is the caching of data across the storage network, migrating data to the SSD storage pool based on how frequently and recently the data has been used. The ability to manage hot data is reshaping the architecture of the modern data center. Managing "virtual" environments effectively leverages tiered storage to improve the user experience in a cost-effective way. This is introducing new metrics to measure value in storage technology,

## Workloads



adding cost per IOPS and IOPS per Watt, to the traditional analysis of cost per capacity and Watts per gigabyte.

As SSD prices decline, this powerful solution will be extended to additional markets that engage in extensive transaction processing. Suitable markets include online retailers, airline reservation systems, credit card processing centers, Web 2.0 entities and other organizations that have system workloads with high IOPS requirements.

## Visualizing the Future of Enterprise Computing— Powerful SSD Solutions from Hitachi GST

Meeting the escalating demands of enterprise data centers poses a tough challenge. Next-generation SSD systems will enhance data center performance, conserve power and cooling resources and maximize space efficiency. Hitachi brings proven enterprise storage expertise in SAS and FC design, firmware, reliability, customer qualification and system integration. Intel has substantial expertise in NAND technology and global manufacturing capabilities. This combination will deliver world-class solutions with the performance and reliability that enterprise storage customers demand.

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