

High Capacity, High
Performance, Highly
Available Modular
Storage for the Mid-Sized
Enterprise

*An Introduction to the Hitachi
TagmaStore™ Network Storage
Controller Model NSC55*

Executive Summary

IT managers at mid-sized organizations are in an unenviable position. Of all areas of IT, the storage environment is facing the most dramatic onslaught of change. Demand for capacity is escalating, with no signs of slowing. Business requirements for application availability, and, consequently, storage system availability, are at an all time high. The prospect of regulatory compliance and legal discovery are introducing new requirements that threaten to wreak havoc on the storage environment. And, yet the IT budget and staff availability remain as tight as ever. Mapping the business needs for storage to the reality of an IT environment is a tremendous challenge.

Further complicating this picture is the frustrating lack of functionality available from traditional midrange modular storage solutions. Designed to meet the needs of yesterday's applications, most modular storage offerings provide capacity, but little else. With limited scalability, restricted access to advanced functionality, and architectural limitations that constrain availability and robustness, these systems often create as many problems as they solve.

According to IDC, many of the issues facing mid-sized organizations today were challenges for large enterprises as little as ten years ago. Then, as now, the ability to effectively manage available storage, maximize use of existing capacity, and apply advanced functionality were critical to overcoming the problem. Hitachi Data Systems has applied the lessons learned from large enterprise storage environments to the issues facing modular storage and has solved the problem with a generational leap in technology.

The Hitachi TagmaStore™ Network Storage Controller Model NSC55 offers IT managers at mid-sized organizations a radical new approach to modular storage. Supporting 32 processors, for non-stop availability, a switched global cache, for scalable performance, and the industries top virtualization engine, for connectivity and management of up to 16PB of internal and external disk, the rack-mounted NSC55 provides mid-sized organizations with enterprise-class availability, performance, scalability, and advanced functionality on a modular storage budget.

Table of Contents

<i>Executive Summary</i> _____	2
<i>Meeting the Challenge of Storage Growth</i> _____	4
<i>The Hitachi Network Storage Controller Model NSC55</i> _____	4
Managing Constant Growth of Business Data _____	5
Reducing the Risk of Downtime _____	5
Configured for High Availability _____	6
Protecting Investment in Existing Storage _____	6
Easing the Burden of Storage Management _____	7
Storage Area Management _____	7
Data Replication _____	7
Tiered Storage _____	7
<i>Clean Green Modular Storage</i> _____	7

Meeting the Challenge of Storage Growth

The storage environments of mid-sized enterprises are rapidly evolving, presenting IT managers with a series of new challenges. The escalating pace of storage capacity growth is taxing the ability of IT staff to effectively provision and manage available resources. Throwing more storage at the problem—the traditional approach—only aggravates the situation, as staff scramble to integrate and administer more and more capacity. In addition, new business requirements for advanced storage functionality add further complexity, increasing the burden on already stretched IT resources. These issues are combining to expose design limitations in existing modular storage products.

The constant demand for more capacity, from file server, database, and email applications, is frustrating IT management's ability to effectively administer storage resources. As more terabytes are added to the storage farm, routine tasks, like nightly backups and system maintenance, take longer, threatening to interrupt availability of critical business applications. Integrating new capacity into an existing environment takes time and administrator resources, and often becomes a continuous ongoing task. The limited connectivity offered by traditional modular devices also restricts sharing of storage resources, leading, inevitably, to spare capacity sitting unused and unusable by applications.

New business requirements are also complicating the task of managing the storage infrastructure of a mid-sized organization. Heightened awareness of the critical role played by IT in business continuity is pushing demand for advanced storage functionality, like remote data replication. Once available only to the large enterprise budget, replication is being considered by many mid-sized organizations as a means of protecting critical operational data and ensuring swift business resumption from unforeseen outages. Legal discovery and regulatory compliance are also contributing new functional requirements to the storage environment. Tape-based archival, once the norm, cannot support new demands for advanced search and retrieval, leading many organizations to deploy disk-based solutions. These systems add even more capacity for already overburdened IT staff to manage.

The reality of the today's mid-sized organization storage environment is very different to that originally anticipated by the designers of existing modular storage systems. As managed storage capacity has increased, the capabilities of these storage systems are being pushed to their limits, and this is exposing inherent design weaknesses in the technology. The two-controller architecture, favored by many vendors, provides a rudimentary level of modular storage redundancy. But, as demand for capacity escalates, the dual-controller design proves to be inflexible and has severe performance, availability, and scalability limitations. The alternative to the traditional two-controller architecture is a resilient, high-performance, switch-based controller offering shared cache and massive connectivity. This technology, common to top-of-the-line storage systems, has only been available to the lofty budgets of large enterprise data centers, until now.

The Hitachi Network Storage Controller Model NSC55

Based on the award winning technology of the Hitachi TagmaStore™ Universal Storage Platform, the NSC55 is a new modular storage system designed for the non-data center environments of mid-sized organizations. The 19-inch rack mounted NSC55 operates on the same microcode as the industry-leading Universal Storage Platform, giving mid-sized organizations access to the high-availability, performance, scalability, and advanced storage functionality benefits previously only available to large enterprise IT departments.

Leveraging a global cache and non-blocking crossbar switch architecture, identical to that employed in the Universal Storage Platform, the NSC55 eliminates the capacity and scalability problems common to other modular storage solutions. An innovative controller-

based virtualization engine, built in to the NSC55, supports seamless growth in capacity and allows management of internal and external storage resources by a single suite of tools. Virtualization also enables functionality not previously possible on mid-tier storage solutions, such as the ability to replicate data between different back-end vendor storage platforms without impacting business applications. Each physical NSC55 fibre channel (FC) host connection supports up to 128 virtual host domains. This enables secure sharing of all storage resources and dramatically simplifies the storage network infrastructure. The NSC55 also supports ESCON and FICON connectivity for mainframe access.

Managing Constant Growth of Business Data

The near-continuous addition of storage resources to accommodate increasing demand for capacity is enormously disruptive to business applications and IT staff. Each time capacity is added it must be carefully integrated into the existing environment. This invariably requires interrupting application access to storage systems, as files and databases are moved around and network connectivity is reconfigured to balance for load and capacity.

The NSC55 eliminates disruption during the addition of storage resources, allowing IT staff to grow capacity without interfering with business applications. In addition to supporting up to 72TB of internally connected FC disk, the NSC55, with the help of the Hitachi Universal Volume Manager software, can accommodate up to 16PB of externally attached heterogeneous storage. Capacity from external systems appears in cache memory as NSC55 disks. When new resources come online, IT staff can use the Hitachi Volume Migration software (formerly Cruise Control) to seamlessly move data between disks without impacting applications. This ability to migrate data between heterogeneous storage devices is unique to Hitachi Data Systems, and allows administrators to effectively allocate all available storage resources, reducing wasted capacity.

The NSC55 also virtualizes front-end host connections, enabling new application servers to access storage resources without cumbersome reconfiguration of the network. Up to 6144 virtual host connections are supported, and each connection can be assigned a Host Storage Domain: a private storage address space that only this host can see and modify. In addition, the NSC55 supports up to 8 Virtual Private Storage Machines. This allows critical applications to share storage without the risk of performance degrading cache conflicts. Each dynamically assigned Virtual Private Storage Machine is allocated a logical cache partition. The dynamic cache partitioning capability allows the NSC55 to guarantee secure multi-tenancy for a wide range of diverse applications.

Reducing the Risk of Downtime

With competitive advantage increasingly dependent on access to technology, application availability is now a hot topic of discussion with IT managers. The two-controller design of existing modular storage devices provides insufficient resilience to the threat of downtime. At best, existing solutions offer enough redundancy to safeguard application data during a component failure. However, a failure is likely to leave a dual controller storage device crippled and unable to support business applications until the problem has been rectified.

In a traditional modular storage device, each controller has its own distinct cache memory. Access to application data is channeled through one of the controllers—active/passive configuration—or divided between the two—active/active configuration. Writes to cache on one controller are mirrored to the other, using the same FC communication protocol used to access application data on disk. If a problem occurs with one controller, applications will fail over to the remaining controller. However, after such a failover, data is exposed to potential loss from a subsequent failure. To avoid potentially catastrophic loss of business data, all access to the storage system must be halted until both controllers are fully functional.

The NSC55 is the first modular storage system not limited to a dual controller architecture. With 32 processors and a switched global cache, the NSC55 provides the redundancy to

accommodate multiple component failures, without impacting business application access to data.

The NSC55 is designed to avoid the availability limitations of existing modular storage devices. Storage system global cache is mapped across two physical memory modules and all cache writes are mirrored. Access to the global cache is through a pair of non-blocking cross bar switches. This revolutionary design enables the NSC55 to sustain the loss of multiple processors without the need to stop for repairs. Any failures, or hot spots, can be routed around without impacting the integrity of the system, and without interrupting application access to data.

The design of the NSC55 provides business applications with consistent availability and performance. And, when repairs are necessary, workloads can be dynamically switched between processors to allow non-disruptive upgrades and system maintenance. These safeguards allow the NSC55 to provide business applications with 99.999 percent availability.

Configured for High Availability

The NSC55 has a 12U high 19-inch rack disk chassis, accommodating up to 60 disks arranged in four rows of 15 disks—the first chassis requires a minimum configuration of five disks, four operational disks and a spare. Three optional disk chassis provide additional capacity, and the system supports 76GB, 146GB, and 300GB FC disk drives. Although SATA drives are not supported internally, external FC storage systems containing SATA disks—such as the Hitachi TagmaStore™ Adaptable Modular Storage and Hitachi TagmaStore™ Workgroup Modular Storage systems—can be attached and virtualized by the NSC55.

Each NSC55 chassis has four redundant FC loops—eight in total—with one redundant loop for each row. Unlike other modular storage systems, which map RAID parity groups to a single FC loop, the NSC55 stripes RAID groups vertically across loops. If a loop failure occurs it will not cause the loss of the entire RAID group.

The NSC55 supports RAID-1 (2D+2D), RAID-5 (3D+1P), and RAID-6 (6D+2P). The RAID-6 configuration is striped twice across four rows and provides protection against a double fault—where a second disk fails after a first disk failure, but before the RAID rebuild of the first failed disk has completed. RAID-6 also improves the rebuild speed from a disk failure by 60 percent. This is increasingly important when deploying large capacity disk drives.

Protecting Investment in Existing Storage

For managers of mid-sized organizations, continually juggling budget resources to maximize the effectiveness of IT, the expected life span of a storage asset is a significant factor in an investment decision. The unprecedented growth in demand for capacity threatens to prematurely age storage investments before they are fully depreciated. Extending the useful life of existing storage assets can provide enormous financial benefits.

Hitachi Data Systems virtualization technology allows the disk capacity of existing storage systems, from IBM, EMC, and Hitachi Data Systems, to be incorporated into the NSC55. The external storage resources are virtualized in the NSC55 global cache and look, for all intents and purposes, as if they were internal disks. Unlike alternative approaches, NSC55 virtualization is accomplished without additional SAN based devices. It is also not restricted to proprietary disk arrays, and does not require the purchase of new appliances, intelligent switches, or additional switch ports to increase connectivity.

In addition to extending the meaningful lifespan of older storage systems, virtualization allows the advanced functionality of the NSC55 to be applied consistently across all heterogeneous pooled capacity. This consolidation brings with it enormous gains in storage management productivity.

Easing the Burden of Storage Management

Labor costs are one of the most significant ongoing expenses of maintaining a storage environment. As the amount of capacity deployed escalates, more IT staff are needed to manage the growing storage pool. Conventional modular solutions do little to ease the burden of storage management. The massively scalable NSC55 promises to redefine previous notions of productivity.

The NSC55 approach to virtualization reduces complexity of the storage environment, providing a consistent interface to all internal and external pooled capacity. Because all resources appear as internal disk, any management applications and advanced storage functionality supported by the NSC55 can be applied universally. This has a huge impact on productivity, as IT staff can apply a common set of procedures to all storage resources and need only master a single set of tools to maintain control.

Storage Area Management

Operating on the same microcode as the enterprise-class Universal Storage Platform, the NSC55 supports advanced, best-in-class software previously only available to large enterprise users. The Hitachi Storage Area Management (SAM) Suite of software offers an application-centric approach to managing the storage infrastructure. Based on open storage interface standards, the Hitachi SAM Suite tools provide the ability to visualize the entire environment, monitor and optimize performance and capacity, and provision and manage the resources of a heterogeneous pool of storage.

Data Replication

The advanced functionality provided by the Hitachi Data Systems storage software supports cost-effective remote data replication between heterogeneous storage systems. For application users demanding greater business continuity functionality this means the ability to safely host critical operational data at a secure distance without breaking the IT budget. Supported software includes in system and remote data replication capabilities from Hitachi ShadowImage™ In-System Replication software, Hitachi TrueCopy™ Remote Replication software, and Hitachi Universal Replicator for TagmaStore™ Universal Storage Platform.

Tiered Storage

Escalating growth in storage capacity has prompted many large organizations to deploy tiered strategies to more cost-effectively align the value of application data with available storage resources. In a tiered architecture, data is hosted on storage that reflects the quality of service, functionality demands, and price tolerance of the business application. High value, business critical data is hosted on appropriately high-end storage resources that can offer availability, performance, and protection to match the expectations of business users. Less critical business data is hosted on middle and lower tier storage. A tiered storage strategy can dramatically lower IT capital and operating expenditures.

The NSC55 allows IT managers at mid-sized organizations to deploy a tiered storage strategy, achieving a cost-effective balance between available resources and business application quality of service needs. The virtualization capabilities of the NSC55 support multiple tiers of storage hosted on a single platform. Volume Migration software provides the functionality to seamlessly move data between storage tiers as business requirements change. And the Hitachi HiCommand® Tiered Storage Manager software automates data lifecycle management functionality to optimize data location, for example, managing the regular archival of data that ages off high-value storage assets onto cost-effective SATA disks.

Clean Green Modular Storage

The European Union's (EU) far-reaching reduction of hazardous substances (RoHS) directive (2002/95/EC) will take effect on July 1, 2006. As of this date, electrical and electronic

equipment sold within the EU must not contain banned substances—lead, cadmium, mercury, hexavalent chromium, and the flame retardants polybrominated biphenyls (PBB) and polybrominated diphenyl ether (PBDE)—over certain given limits. The NSC55 is fully compliant with this exacting new environmental law.

The RoHS-compliant NSC55 is specifically designed to meet the modular storage needs of mid-sized organizations. A radical departure from the traditional dual controller storage architecture, the NSC55 offers availability, scalability, performance, and advanced functionality previously only available to the largest IT organizations. With enterprise-class functionality and a modular storage price tag, the NSC55 satisfies the increasingly complex demands facing the storage environments of mid-sized organizations.