

Agile Storage Infrastructure for Mainframe Environments

Fully Compatible with IBM® Mainframe Operating Systems,
the Hitachi Virtual Storage Platform Delivers Leading-edge
Scalability and Performance.

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Executive Summary

Hitachi Data Systems has over 20 years of experience supporting IBM mainframe environments. A large portion of our installed base of Hitachi storage systems connects to IBM® z/OS® and S/390® mainframes via ESCON® and FICON® networks.

The new Hitachi Virtual Storage Platform builds on this experience and introduces new features and packaging to improve performance and lower the total cost of ownership (TCO). In addition to its new 3D scaling architecture it features lower power and cooling requirements, high density packaging based on industry standard 19in. racks, faster microprocessors and the choice of disk drives types, including solid state disk (SSD), serial attached SCSI (SAS) and SATA. This new storage platform provides an industry leading, reliable and highly available storage system for mainframes in IBM z/OS environments.

The Virtual Storage Platform can scale up to provide increased performance, capacity, throughput and connectivity. It can scale out by dynamically combining multiple units into a single logical system with shared resources. It can also scale deep by dynamically virtualizing new and existing external storage systems. This 3D scaling means that the Virtual Storage Platform can grow nondisruptively to meet changing needs within the data center. It minimizes outages to extend the platform and enhance functionality while providing flexibility in the configuration and choice of disk technology to meet the specific needs of each environment.

The deep scaling enabled by Hitachi controller-based storage virtualization supports connectivity to external storage. This enables organizations to further extend the life of existing storage assets, including storage from a variety of other vendors. It also provides IBM mainframes the ability to connect to both enterprise and midrange storage platforms, some of which can be configured with lower cost SATA drives. This virtualization of external storage can potentially extend the life of existing storage assets and reduce costs.

This storage platform is designed to increase the efficiency and productivity of storage administrators in both mainframe and open systems environments. It automates more of the traditional storage management responsibilities and provides enhanced management tools that reduce the time it takes storage administrators to complete those tasks that must be done manually.

With its new packaging, enhanced features and improved manageability, the Hitachi Virtual Storage Platform provides mainframe users with a cost-effective, highly reliable and available storage platform that delivers outstanding performance, capacity and scalability.

Background

Storage has always been a critical element in computing environments, beginning with the mainframe. Companies entering the mainframe storage market faced the challenge of being completely (100%) compatible with the IBM owned mainframe operating systems.

In many environments, mainframes continue to be used as a cost-effective platform for business critical applications. These applications demand outstanding performance, the highest availability and standards of service that preclude scheduled or unscheduled outages. This means that hardware and software maintenance or migration to new hardware must be accomplished without interrupting normal operations. Mainframe environments have large investments in hardware and software. Extending the life of these legacy assets can reduce the need for additional investment and reduce the TCO.

Compatibility is still extremely important for mainframe environments. However, storage companies are developing innovative approaches to delivering solutions designed to address specific needs, such as virtualized storage, enhanced backup and recovery, replication and automatic movement of data between storage tiers. For example, in the area of replication, Hitachi Data Systems offers two internal replication solutions — Hitachi ShadowImage® and our functionally compatible IBM's FlashCopy® v02 solution as well as three remote replication solutions — TrueCopy® Synchronous, Hitachi Universal Replicator, and Hitachi functionally compatible XRC which offer superior added value to IBM's comparable z/OS Metro Mirror (previously known as PPRC) and z/OS Metro/Global Mirror (previously known as Extended Remote Copy - XRC) solutions.

Hitachi Data Systems was the first storage vendor to offer virtualized storage in the mainframe environment, including the ability to virtualize external multivendor storage. With the introduction of the new Hitachi Virtual Storage Platform, Hitachi continues to provide the best storage performance, virtualization and scalability for mainframe environments.

Businesses and organizations have always been focused on improving system performance and return on investment. Now they are also focused on creating a greener data center. Hitachi Data Systems provides support in these important endeavors, most recently with the Hitachi Virtual Storage Platform.

Hitachi Virtual Storage Platform and the Mainframe

The Hitachi Virtual Storage Platform is a high performance, large capacity disk storage system that builds on and enhances the virtualization, performance, dynamic provisioning and replication capabilities of the previous generation Hitachi Universal Storage Platform® V. With 3D scaling, the Virtual Storage Platform can scale up and out in performance and capacity as well as deep to manage multivendor external storage systems. As a result of its flexible, high performance architecture, it can be configured to provide high speed access and enable excellent response times to support any workload for both mainframe and open systems environments.

With industry leading virtualization capabilities, the Virtual Storage Platform can provision storage "on the fly." With its tiering software, it ensures that your data is on the most cost-effective type of

storage. It is able to manage external storage, which means that you can improve the return on your storage assets. You can leverage your existing storage assets as tier two or tier three storage for less critical, less frequently accessed data.

This storage system is designed to lower TCO wherever possible. The physical packaging has been completely redesigned to use standard size racks and chassis instead of custom enclosures and boards. The internal layout has been updated to support front-to-back airflow, to facilitate the use of hot and cold aisles and maximize the efficiency of data center cooling. In combination with faster processors, denser packaging and smaller batteries, the physical floor space and the heating and cooling requirements are reduced, resulting in significantly lower power per square foot (KVA/sq ft.). Operating expense (OPEX) is lower than previous systems thanks to denser packaging, blade architecture, low power memory, small form factor disks, SSD disk and flash protected cache with its smaller batteries. Hitachi Data Systems is committed to continuing to deliver more efficient packaging resulting in more sustainable products.

The Virtual Storage Platform is designed to be highly available and resilient. All critical components are implemented in pairs. If a component fails, the paired component can take over the workload without an outage. With its support of multiple RAID configurations, an organization's data is protected in case of a problem with a disk drive. Additionally, with its industry leading replication software and support of FlashCopy v2 and Hitachi Compatible Replication Software for IBM XRC providing the functionality of the IBM z/OS Metro/Global Mirror, copies of data can be maintained locally and at remote locations. This ensures its availability in case the primary copy becomes unusable or is not accessible.

The move to any new storage platform must be planned and executed carefully. With the Virtual Storage Platform, Hitachi Data Systems has the tools and services to help you migrate to, and begin using the new storage in a manner that is transparent to the host. This reduces the risk and minimizes any impact on operations.

The Virtual Storage Platform is configurable to meet a full range of an organization's needs. It is available with one or two control chassis that provide from one to four pairs of virtual storage directors. It can be configured with one to six racks, providing configurations from a diskless controller to a maximum of 2,048 2.5in. disk drives or 1,280 3.5in. disk drives or a combination of both drive sizes. The Virtual Storage Platform supports RAID-6, RAID-5 and RAID-1, and it has a cache capacity from 16GB to 1TB.

This industry leading storage system provides 3390 disk drive support through emulation across a variety of disk drive types to meet the variety of performance and capacity needs of mainframe environments. The platform supports SSD flash drives, providing ultra high speed response with capacities of 200GB and 400GB, as well as 2.5in. SAS drives and 3.5in. SATA drives. It can control up to 65,280 logical volumes and provides an internal physical disk capacity of approximately 2.5PB per storage system and with externally attached storage can support up to 255PB of storage capacity.

This storage system uses 8Gb/sec FICON across all front end ports for connectivity to the mainframe and 8Gb/sec Fibre Channel for connecting external storage. The Virtual Storage Platform supports high performance FICON (z/HPF) for z/OS. On the back end, it supports SAS, SATA and SSD drives, which are connected using the SAS 2 protocol with 6GB/sec connectivity per back end port.

Hitachi has a wealth of experience supporting IBM mainframe environments with a large installed

base of Hitachi Universal Storage Platform, Hitachi Universal Storage Platform V, Hitachi Lightning 9980V™ and Hitachi Lightning 9960™ enterprise storage systems attached to IBM z/OS, S/390 and zSeries mainframe servers over IBM ESCON and FICON networks. The Virtual Storage Platform easily supports both mainframe and open systems environments. For mainframe environments, it supports z/OS and z/OS.e, OS/390®, MVS™/XA, MVS/ESA, VSE/ESA, z/VSE™, VM/ESA®, z/VM® and zTPF for S/390 and zSeries®. Additionally, with many organizations considering the benefits of or running LINUX on IBM zSeries processors, the Virtual Storage Platform supports this capability for both CKD and FBA disk formats.

The Virtual Storage Platform, with its vast functionality and throughput capability, is ideal for IBM mainframe environments. This platform provides a comprehensive set of storage and data services. Hitachi has implemented support for many key performance features in support of these operating systems running on zSeries and S/390, including PAV, HyperPAV, z/HPF, Multiple Allegiance, MIDAW and Priority I/O Queuing. It will provide a unique mainframe storage management solution to deliver functionally compatible Extended Address Volumes (EAV) for z/OS, Data Volume Expansion (DVE) and Volume Size as well as FlashCopy Space Efficiency (SE). The flexibility in configuring and partitioning the Virtual Storage Platform makes it ideal for mainframe environments with multiple LPARs running multiple operating systems in the same SYSPLEX.

Virtual Storage Platform Features and Capabilities

The Hitachi Virtual Storage Platform is the first 3D scaling storage platform designed for all data types. It is the only storage architecture that flexibly adapts for performance, capacity and multivendor storage.

3D Scaling

The Virtual Storage Platform can scale up, out and deep. With the ability to expand capacity and performance and partition the global cache, it can be configured to provide the best performance and data isolation for the multiple LPAR configurations typically found in mainframe environments.

Scale Up

The storage platform can scale up by increasing performance, capacity, throughput and connectivity through tightly coupling additional resources through a global cache to meet increasing server demands. It can scale performance with added resources by dynamically adding processors, connectivity and capacity in a single unit.

Mainframes that access a scale up storage system can access all the resources that are dynamically added to the base configuration and all the resources can act as one system for maximum performance and capacity. Additionally, this storage can be managed as one common pool of resources for more efficient use of resources.

Scale Out

The Virtual Storage Platform scales out by dynamically combining multiple units into a single logical system. The shared resources deliver increased aggregate performance, capacity, throughput and connectivity, matching any increased demand of additional LPARs or expanding application requirements.

It can be scaled out by combining multiple units into a single logical system to support the needs of multiple LPARs through prioritization of the common storage resources. This platform ensures safe multitenancy of mainframe and open system servers and ensures quality of service through partitioning of cache and port address space.

Scale Deep

The Virtual Storage Platform scales deep by dynamically virtualizing new and existing external storage systems and extending advanced functionality to that external multivendor storage.

External storage appears to the LPAR or host as an extension of the storage system and become a part of the common storage pool with all the functionality of the storage system. The storage administrator can offload less demanding data to a lower tier of storage, which has been defined across external storage, using the Hitachi Tiered Storage Manager software in order to optimize the availability of higher performing internal storage resources defined as the highest tier. The external storage system can scale up or scale out behind the Virtual Storage Platform.

Three important benefits of scaling deep are:

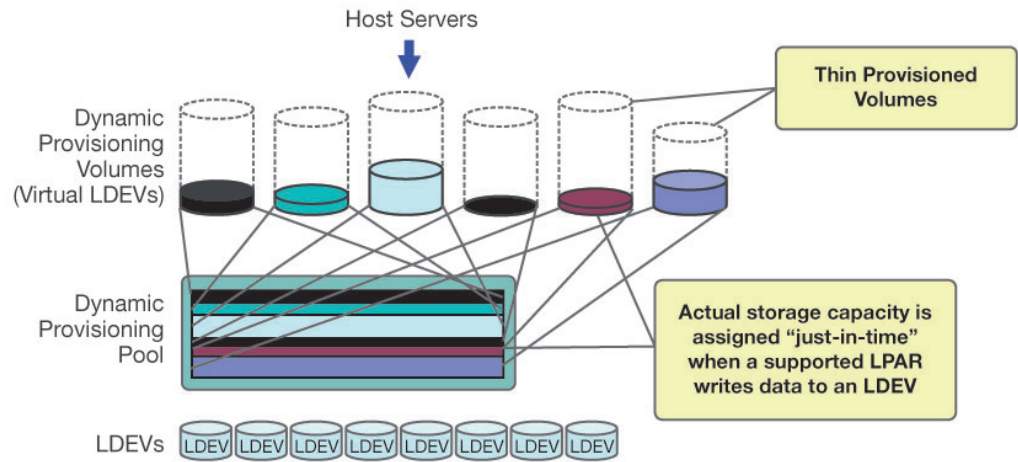
- It enables the reuse of existing or legacy assets for less critical or accessed data.
- It simplifies management of external storage with common management and data protection for internal and external storage.
- It supports the reuse of existing or legacy assets across data centers within a metro area network distance and across global distances with replication capabilities of the scale up storage system.

Virtualization

Dynamic Provisioning

Hitachi Dynamic Provisioning for the mainframe provides more effective use of storage through thin provisioning, i.e., allocating storage to an application without actually mapping the corresponding physical storage until it is used. This separation of allocation from physical mapping results in more effective use of physical storage with higher overall rates of storage utilization.

Figure 1. Hitachi Dynamic Provisioning



Storage is assigned to a virtual storage pool from which it is allocated to applications as needed.

With Dynamic Provisioning, additional physical storage can be added to the storage system non-disruptively and placed in a virtual storage pool that is used to provide storage to all mainframe thin provisioned volumes. The storage system monitors application storage usage and when applications require more physical storage capacity, it automatically allocates additional capacity to the volume from the shared virtual pool. Behind the scenes, Hitachi Dynamic Provisioning software monitors storage resources and proactively alerts administrators before more physical storage is required.

Automatically provisioning storage from a virtual pool reduces administration costs by cutting the time to provision new storage and also improves application availability by reducing the downtime needed for allocating and provisioning additional storage.

Hitachi Dynamic Provisioning balances the I/O workload of many applications across multiple physical disks. This reduces or eliminates I/O bottlenecks resulting in reduced performance and capacity management expenses.

With Hitachi Dynamic Provisioning software, an organization's overall storage utilization improves while all hosted applications are automatically performance tuned (via I/O workload balancing) for operational efficiency. This capability can provide reduced capital and operating costs resulting in a better return on investments in storage.

Hitachi Dynamic Provisioning is a prerequisite for the Hitachi Virtual Storage Platform support of the mainframe storage management functions of DVE, EAV and Volume Size.

(Note: Contact your Hitachi Data Systems representative to confirm availability of product features.)

Hitachi Tiered Storage Manager Software

Hitachi Tiered Storage Manager software provides mainframe storage administrators the tools

to easily and interactively match application quality of service requirements to multivendor storage assets. Tiered Storage Manager enables the nondisruptive movement of data volumes to match application-driven price, performance and availability characteristics through an easy-to-use interface. With Tiered Storage Manager, storage administrators can define storage tiers within the virtualized storage pool that is managed by the storage system. Storage tiers can be defined for both internal Virtual Storage Platform storage and external storage managed by Virtual Storage Platform. The storage administrator can also define groups of logical storage volumes that can be migrated together between tiers.

Hitachi Tiered Storage Manager helps organizations support data retention standards and compliance issues, and it eliminates restrictive data migration windows and requirements. It enables nondisruptive, completely transparent volume movement and removes the complexity associated with managing storage tiers. Hitachi Volume Retention Manager software (VRM) enables users to protect mainframe from I/O operations performed by mainframe hosts. By default, mainframe volumes are subject to read and write operations by hosts. Because of this, data is exposed to damage or loss if a mainframe host performs erroneous write operations, and confidential or archived data could be compromised, read, or copied if read operations are allowed. Using Volume Retention Manager, you assign access attributes to logical volumes to restrict read and write operations as needed and prevent unauthorized access to data.

In-system and Remote Replication

In-system Replication with Hitachi ShadowImage® Heterogeneous Replication Software

Hitachi ShadowImage Heterogeneous Replication is functionally compatible with the industry standard IBM Peer-to-Peer Remote Copy (PPRC) host software functions. PPRC TSO, PPRCOPY ICKDSF and Hitachi Business Continuity Manager commands may be used to perform ShadowImage for z/OS operations on the Virtual Storage Platform. ShadowImage provides heterogeneous replication between any storage systems within a virtualized storage pool managed by the Hitachi Virtual Storage Platform.

ShadowImage Heterogeneous Replication copies are all RAID protected to ensure the highest data availability. These disk-based copies can provide nearly instant recovery from data corruption and can provide immediate, nondisruptive access to and sharing of information for decision support, test and development. They can also be used to enable tape backup operations to be run concurrently with production, eliminating the need for standalone backups.

The consistency group capability of ShadowImage enables a user-defined group of ShadowImage volume pairs to be split simultaneously, at a precise moment in time. A single command ensures that the data on all volumes is consistent at the precise moment of the split. This provides multivolume, point-in-time copies for applications and databases that share or span multiple volumes, shortens restart and recovery times, and dramatically reduces recovery time from data corruption.

ShadowImage can replicate large data volumes without impacting service levels, timing out or affecting performance levels and it enables normal backup operations on a copy of up-to-date production data while critical applications continue to run unaffected.

IBM Compatible FlashCopy

Hitachi Virtual Storage Platform supports FlashCopy and provides functional compatibility with IBM's

FlashCopy v2 and supports volume level as well as data-set-level copy. Storage administrators can use both the IBM DFSMSdss commands and TSO Peer-to-Peer Remote Copy (PPRC) commands to manage this capability. Hitachi's compatible IBM FlashCopy v02 solution fully supports IBM's GDPS MetroMirror (PPRC) and GDPS/HyperSwap. With this solution, operations are nondisruptive, allowing the main volume of each FlashCopy pair to remain online to all hosts for both read and write I/O operations. Once established, FlashCopy operations continue unattended to provide continuous data backup.

Remote Replication with Hitachi TrueCopy Synchronous Software

Hitachi TrueCopy Synchronous software provides a continuous, nondisruptive, host independent remote data replication solution for disaster recovery or data migration over distances within the same metropolitan area. It provides a no-data-loss, rapid-restart solution. For enterprise environments, TrueCopy Synchronous software combined with Hitachi Universal Replicator on the Virtual Storage Platform allows for advanced three data center configurations. This includes consistency across up to 12 storage systems in one site for optimal data protection.

TrueCopy Synchronous supports business continuity and disaster recovery efforts, improving business resilience. It improves service levels by reducing planned and unplanned downtime of customer facing applications. It enables frequent, nondisruptive disaster recovery testing with an online copy of current and accurate production data. TrueCopy Synchronous can be seamlessly integrated into existing z/OS environments and be controlled with familiar PPRC commands or with Hitachi Business Continuity Manager software.

Remote Replication with Hitachi Universal Replicator Software

Hitachi Universal Replicator provides asynchronous data replication across any distance for both the internal Virtual Storage Platform storage and external storage managed by the Virtual Storage Platform. Universal Replicator provides enterprise-class performance associated with storage system-based replication, while providing resilient business continuity without the need for remote host involvement or redundant servers or replication appliances.

Universal Replicator maintains the integrity of replicated copies without impacting processing, even when replication network outages occur or optimal bandwidth is not available. When compared to traditional methods of storage system-based replication, Universal Replicator leverages performance optimized, disk-based journals resulting in significantly reduced cache utilization and increased bandwidth utilization.

Universal Replicator ensures availability of up-to-date copies of data in up to three dispersed locations by leveraging the synchronous capabilities of Hitachi TrueCopy Synchronous. In the event of a disaster at the primary data center, the delta resync capability of Universal Replicator enables fast failover and restart of the application without loss of data, whether at the local or remote data center.

The Virtual Storage Platform with Hitachi Universal Replicator supports IBM GDPS, including HyperSwap. As a result, if GDPS is being used, Universal Replicator can be integrated into this environment, thus providing a much more cost-effective and complete recovery solution than the IBM alternative, z/OS Global Mirror. With Universal Replicator and TrueCopy Synchronous support of a three data center replication solution, the Virtual Storage Platform supports delta resync, which is similar to but more efficient than z/OS Metro/Global Mirror Incremental Resync.

The Hitachi Virtual Storage Platform supports IBM z/OS Basic HyperSwap, which is enabled by IBM Tivoli Productivity Center for Replication for System z Basic Edition (TPC-R). TPC-R enables the administrator to develop a z/OS Basic HyperSwap configuration using Hitachi Virtual Storage Platform. Using the Hitachi Virtual Storage Platform, the customer can create a z/OS Basic HyperSwap configuration, for a two data center configuration with TrueCopy Synchronous or a three data center configuration with TrueCopy Synchronous, Hitachi Universal Replicator and Business Continuity Manager. Initially, Hitachi Virtual Storage Platform will support a maximum of three storage systems at each site.

The Virtual Storage Platform with Hitachi Universal Replicator will support a four data center configuration and allow you to have two long asynchronous data paths and two synchronous paths. This solution offers you the ability to create multiple copies of data in many locations and reduce the impact of data migration.

Hitachi Compatible Replication Software for IBM XRC

Hitachi Compatible Replication software for IBM XRC is a cross-license technology between Hitachi Data Systems and IBM that provides support for z/OS Global Mirror. This Hitachi software is fully compatible with IBM XRC and lets administrators create and share server-based remote copies between Hitachi Virtual Storage Platform, the Hitachi Universal Storage Platform family and IBM enterprise storage controllers, such as the DS8000® system. Hitachi Data Systems is the only third party storage vendor capable of fully supporting IBM XRC command sets.

Hitachi Business Continuity Manager Software

Hitachi Business Continuity Manager software for IBM z/OS enables centralized, enterprise-wide replication management for IBM z/OS mainframe environments. Through a single, consistent interface Based on the Time Sharing Option/Interactive System Productivity Facility (TSO/ISPF) it uses full screen panels to automate Hitachi Universal Replicator, Hitachi TrueCopy Synchronous remote replication (including multisite topologies) and in-system Hitachi ShadowImage Heterogeneous Replication software operations.

This software feature automates complex disaster recovery and planned outage functions, resulting in reduced recovery times. It also enables advanced, three data center disaster recovery configurations and extended consistency group capabilities. Business Continuity Manager provides built-in capabilities for monitoring and managing critical performance metrics and thresholds for proactive problem avoidance. It also delivers auto discovery of enterprise-wide storage configuration and replication objects, eliminating tedious, error prone data entry that can cause outages.

Hitachi Business Continuity Manager integrates with the Hitachi replication management framework, Hitachi Replication Manager software, for replication monitoring and continuous operations in mainframe (and open system) environments.

Availability and Reliability

In order to meet the needs of the most demanding enterprise organizations and their mainframe-based applications, Hitachi Data Systems places maximum emphasis on availability and reliability of the Virtual Storage Platform.

Hitachi has a history of providing hardware and microcode that are designed to provide the high

availability storage systems. Beginning with the Hitachi Freedom 7700 in the 1990s, Hitachi storage systems have included redundant, hot-swappable components that include automatic failover in the case of a component failure as well as microcode that can be upgraded with no disruption to production. Hitachi enterprise storage controllers have all included dual data paths and dual control paths connecting every component. This means that even when a single component failure has occurred, the storage system can continue operations.

The data cache in the Virtual Storage Platform is mirrored for all data writes. It is backed up to a flash drive to ensure that nothing is lost if there is ever a problem. In earlier systems, a battery was used that would provide the necessary power to maintain the cache image during a limited duration power outage. With cache backed up to a flash drive, the data in cache is protected and available when the system resumes operations, even during an extended power outage.

All of the disk drives are active-active with dual ports. This improves performance during normal operations and ensures available access to the disk drive in the event of a port being unavailable.

Hitachi Data Systems includes the Hi-Track® Remote Monitoring system in all Virtual Storage Platforms. This function notifies the Hitachi Data Systems support center immediately in the event of any incident that may affect availability. This can result in a Hitachi service technician arriving onsite to resolve any problem caused by the incident before the administrator is aware that the incident occurred.

In addition to the redundant hardware and microcode designed for high availability, the Virtual Storage Platform also provides software features to ensure that the data is available in the event of an outage or a disaster. It offers mainframe-specific replication with its support for IBM GDPS HyperSwap, which is implemented on the Virtual Storage Platform using Hitachi TrueCopy Synchronous and Hitachi Universal Replicator software.

With unique 3D scaling, the Virtual Storage Platform system configuration can scale up and out in performance and capacity and deep with external storage to meet business requirements. It can be upgraded or downgraded, from the smallest single rack system with no disk drives to the largest with six racks, or any configuration in between, without impacting production. You can attach and manage external storage from Hitachi Data Systems and many other vendors. This means you can re-use and extend the life of existing storage assets while taking advantage of Virtual Storage Platform features and functionality. Storage requirements change dynamically and you have to adjust your environment to meet your needs whether you are in a growth cycle or need to consolidate to meet budget constraints. With its 3D scaling, the Virtual Storage Platform can adjust to meet your unique needs.

Migration

Hitachi Data Systems Global Solution Services (GSS) provides a unique FICON Data Migration service to migrate mainframe data to the Hitachi Virtual Storage Platform. With this offering, z/OS data can be copied from legacy Hitachi storage systems and other storage vendors, e.g., IBM and EMC, to the Virtual Storage Platform without using host software. In addition, no conversion of data is necessary. GSS connects the legacy system to the Virtual Storage Platform using FICON connections and then moves the data with a proprietary tool while the mainframe applications are still running. The service is intended purely as a means of migration, and no other vendor offers this unique capability.

GSS experts start by taking an inventory of volumes on your existing equipment and mapping them to the new volumes on your new devices. They finish by implementing the transfer of your data to your new Hitachi storage environment. The strength of these services lies in the combination of the GSS team's data migration planning and execution skills, the remote copy hardware capability and outstanding reliability of Hitachi storage, as well as the custom tools developed for GSS.

GSS ensures your operational environment will experience only minimal downtime during the transfer, and the FICON connections ensure a timely synchronization of data. During the migration process, your host systems continue to access the original storage without interruption or significant host performance impact. Following the data migration, GSS performs the additional steps required to allow the host LPARs to access the new system(s).

SSD, SAS and SATA

The Virtual Storage Platform supports a variety of disk architectures:

- Solid State Disk (SSD) — high speed, flash memory drives
- Serial Attached SCSI (SAS) — drives that deliver performance equivalent or to better than Fibre Channel drives
- SATA — drives that provide an inexpensive, high capacity solution where performance is less critical

SSD

SSDs use high speed flash memory to store and retrieve data. They have no mechanical components, which means they have improved reliability. These devices deliver fast storage for the heavy I/O requirements of high performance enterprise storage applications. They are also very energy efficient, reducing operational expenses, such as online transaction processing, seismic data rendering, currency trading and providing many other real-life customer use cases.

Flash-based SSDs enable organizations to store working data on these high speed devices and move less frequently accessed data to a less expensive lower tier of storage. The combination of SSD, SAS and SATA drives along with the Hitachi Tiered Storage Manager means that highly referenced data can be placed on the fastest drives while less frequently referenced data can be easily moved to slower, less expensive drives reducing the time it takes storage administrators to manage data placement and, as a result, lowering OPEX.

SAS

SAS disk drives represent a combination of mature technologies (ATA, SCSI and Fibre Channel). This technology leverages the SCSI protocol but avoids some of the problems with parallel SCSI and Fibre Channel drives. SAS is a point-to-point architecture, so it avoids the problem of loop arbitration wait time when connecting to the controller and, in fact, enables some concurrence. In addition, it is always full duplex, which allows it to transmit and receive data at the same time.

SATA

SATA drives are inexpensive high capacity drives that offer a less expensive design option for lower tiers that are less performance critical. With Hitachi proprietary enhancements and proper RAID configuration their reliability can be brought in line with Fibre Channel drives. Hitachi ensures

reliability with SATA drives through several technology enhancements, such as read-after-write, automatic head parking and alignment, and increased sparing.

SATA drives are best suited for sequential read/write intensive applications where the performance you get from them will be closely related to the amount of cache in the data path.

Encryption

The Virtual Storage Platform is encryption capable. Every back end director (BED) has the capability to do encryption using Advanced Encryption Standard (AES) 256-bit encryption. However, it must be enabled with a software license key. With encryption implemented within the BEDs, it is media agnostic: it can encrypt data destined for SSD, SAS or SATA drives.

This feature protects the data from being read from the disk even after the disk is removed from the system for maintenance activities or due to theft. As a result of the encryption functionality being implemented in the system hardware, rather than microcode or software, there is no impact on performance or throughput. In addition, there is no impact on the organization's server as no additional software is required.

The implementation of the encryption feature within the BED means that it requires neither changes to the hosts or network infrastructure at the business site nor additional rack space or software management tools.

This encryption feature addresses the demanding requirements of enterprise organizations seeking to protect their data. It also provides a documented configuration verifying that the storage administrators have done their due diligence in implementing a secure environment.

Storage Management Software

The Hitachi Basic Operating System and the Basic Operating System V software packages for the Virtual Storage Platform are deeply integrated tools that both simplify storage management and provide full control of the thin provisioning and virtualization capabilities of the Hitachi Virtual Storage Platform.

These software packages provide enterprises a simpler way to manage their storage, either for a single Hitachi system or for larger installations composed of multiple heterogeneous storage systems. They enable hands-on management, delivering more efficient utilization and control of your storage assets. They also include interfaces for automating your storage management processes.

The Basic Operating System features one set of common management tools that cover the full range of Hitachi storage systems. Basic Operating System V is an add-on upgrade to the Basic Operating System that provides the unique ability to virtualize externally attached storage systems to the Hitachi Virtual Storage Platform, creating a single heterogeneous pool of tiered storage. This enables simplified storage management, increases utilization and efficiency, improves service levels, simplifies data migration and helps meet compliance demands.

The Hitachi Basic Operating System software was created to deliver the return on investment, security and quality of service for storage that companies require. And the Basic Operating System V software enables the unique embedded virtualization capabilities of the Virtual Storage Platform family; it allows organizations to take advantage of Hitachi storage management, thin provisioning and data

mobility capabilities, within a single system or across an entire heterogeneous storage pool.

Hitachi Device Manager software, which is the primary interface for the Basic Operating System, provides an easy-to-use and intuitive graphical user interface and a command line interface to centrally manage the Hitachi Virtual Storage Platform. The Device Manager graphical user interface provides multiple views for managing the various capabilities of the Basic Operating System functions. These views include user, logical, physical and host management, which enable provisioning and storage pooling for primary and secondary storage. It also offers multiple levels of security for disks, ports and administrators. Its reporting capabilities enable capacity analysis based on server or application, or physical storage class usage.

While mainframes provide excellent storage management tools, which are fully supported with the Hitachi Virtual Storage Platform, Hitachi Device Manager provides an added integrated view and management capability encompassing both open systems and mainframe storage. Device Manager provides advanced Hitachi provisioning capabilities for mainframe allocated storage. Some of the capabilities supported by Hitachi Device Manager include:

- LUN Manager lets you define, configure, add, delete, revise and reassign LDEVs to specific front end ports. The LUN Manager can assign a single LDEV to multiple front end ports, providing the necessary infrastructure to support multiple mainframe channel connections to each LDEV.
- Logical Unit Size Expansion (LUSE) allows LDEV expansion by creating virtual expandable LDEVs out of groups of physical ones.
- Customized Volume Size lets you create custom-sized logical volumes. It enables better utilization of the storage system's physical capacity and boosts remote copy performance by eliminating the need to copy large volumes of partially used information.
- Volume Security Port Option helps ensure security in SAN environments by denying access to unauthorized users at the port level.
- Performance Monitor provides an intuitive, graphical interface to assist you with performance management information in capacity and configuration planning, workload balancing, and analyzing and optimizing storage system performance.

Summary

The new Hitachi Virtual Storage Platform builds on years of experience in development and support of storage systems for mainframe environments. It introduces new features and packaging designed to improve performance and lower the total cost of ownership.

With its 3D scaling, this storage platform can scale up to meet increasing demands by tightly coupling additional resources, which can act as one system, delivering maximum performance and capacity. It can be managed as one common pool of resources. It scales out to meet the demands of multiple applications and LPARs by dynamically combining multiple units into a single logical system with shared resources. At the same time it ensures quality of service through partitioning of cache and port address space. It can scale deep to extend value by dynamically virtualizing new and existing multivendor storage systems and extending its advanced functions to this external storage, facilitating the reuse of existing or legacy assets.

The Virtual Storage Platform creates a more agile storage infrastructure, which can increase the productivity of data center operators, reduce storage cost and increase the return on storage assets. Its unique virtualization scaling capabilities expand its management efficiencies to other multivendor storage and enable the creation of more efficient and agile data centers.

This storage system's highly efficient data center design delivers the best performance and capacity combined with lowest power consumption and lower cooling requirements. It has up to 40 percent better density (TB/sq ft.) while consuming 40 percent less power (power/TB) than its predecessor. Its global cache is shared across all virtual storage directors for maximum performance.

The Virtual Storage Platform is the right storage solution for mainframe environments, providing 3D scaling, resilient architecture, nondisruptive service and upgrades. With these attributes plus global cache and physical disk capacity of approximately 2.5PB per storage system, and the migration services offered by Hitachi Data Systems Global Systems Services, it delivers a breakthrough in storage economics for increased data center efficiency.

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