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Product Overview

Hitachi Virtual Storage Platform G200, G400, G600, G800

Hitachi Virtual Storage Platform F400, F600, F800

Hitachi Data Systems

MK-94HM8013-00

Contents

Preface

This guide provides an introductory overview of the Hitachi Virtual Storage Platform G200, G400, G600, G800 and Hitachi Virtual Storage Platform F400, F600, F800 hardware and software components.

- Product version
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- Comments

Product version

This document revision applies to the following product versions:

- Hitachi Virtual Storage Platform G200, G400, G600, G800 and Hitachi Virtual Storage Platform F400, F600, F800 firmware version 83-02-0x or later
- Hitachi Infrastructure Director v1.1.1 or later
- Hitachi Command Suite v8.2.1 or later

Accessing product documentation

Product user documentation is available on Hitachi Data Systems Support Connect: https://support.hds.com/en_us/documents.html. Check this site for the most current documentation, including important updates that may have been made after the release of the product.

Getting help

Hitachi Data Systems Support Connect is the destination for technical support of products and solutions sold by Hitachi Data Systems. To contact technical support, log on to Hitachi Data Systems Support Connect for contact information: https://support.hds.com/en_us/contact-us.html.

Hitachi Data Systems Community is a global online community for HDS customers, partners, independent software vendors, employees, and prospects. It is the destination to get answers, discover insights, and make connections. **Join the conversation today!** Go to community.hds.com, register, and complete your profile.

Comments

Please send us your comments on this document to doc.comments@hds.com. Include the document title and number, including the revision level (for example, -07), and refer to specific sections and paragraphs whenever possible. All comments become the property of Hitachi Data Systems Corporation.

Thank you!

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Product summary

Hitachi Virtual Storage Platform G200, G400, G600, G800 (VSP Gx00 models) and Hitachi Virtual Storage Platform F400, F600, F800 (VSP Fx00 models) use the same common operating system, network file services, management, migration, virtualization, replication and data protection services as the Hitachi Virtual Storage Platform G1000.

VSP Gx00 models and the new all-flash VSP Fx00 models both include hardware-based compression, local, synch, and async replication and full featured management. VSP Gx00 models also include virtualization of external storage.

Hitachi Storage Virtualization Operating System

Hitachi Storage Virtualization Operating System (SVOS) is the only storage operating system that scales from midrange to enterprise. It provides the foundation for virtualization, high availability, superior storage performance, and tiering management. The enterprise-grade capabilities in Hitachi SVOS include system element management and advanced storage system features. For example, the global-active device feature available on VSP Gx00 models enables two data centers to keep their data synchronized at all times. Additional features include:

- External storage virtualization
- Thin provisioning and automated tiering
- Flash performance acceleration
- Storage service-level controls
- Data-at-rest encryption
- Performance instrumentation across multiple storage platforms

Scalability

All storage systems offer pay-as-you-grow scalability by allowing you to hot add drives as you need them.

Hitachi Accelerated Flash storage

Hitachi Accelerated Flash (HAF) storage delivers best-in-class performance and efficiency in all Hitachi VSP systems.

HAF features patented flash modules (FMDs) that are rack-optimized with a highly dense design that delivers greater than 154 TB effective capacity per 2U tray based on a typical 2:1 compression ratio. IOPS performance yields up to five times better results than that of enterprise solid-state drives (SSDs), resulting in leading performance, lowest bit cost, highest capacity, and extended endurance. HAF integrated with SVOS enables leading, real-application performance, lower effective cost, and superior consistent response times. Running on Hitachi Virtual Storage Platform G200, G400, G600, G800 and Hitachi Virtual Storage Platform F400, F600, F800 storage systems, HAF with SVOS enables transactions executed within sub-millisecond response even at petabyte scale.

- **Key Features**
  HAF delivers outstanding value compared to enterprise SSDs. When compared to small form-factor 1600 GB SSDs, the HAF drives deliver:
  - 10 times faster inline compression with no performance impact
  - Up to three times the per-device random read 8 KB I/O performance
  - Up to five times the per-device random write 8 KB I/O performance
  - Up to 70% lower effective bit price
  - 60% lower response time at peak load
  - 60 times faster formatting speed
  - Superior data integrity

- **Second-generation FMD DC2**
  Second-generation FMD DC2 drives are designed to support concurrent, large I/O enterprise workloads and enable hyperscale efficiencies. At their core is an advanced embedded multicore flash controller that increases the performance of multi-layer cell (MLC) flash to levels that exceed those achieved by more expensive single-level cell (SLC) flash SSDs. Their inline compression offload engine and enhanced flash translation layer empower the drives to deliver up to 80% data reduction (typically 2:1) at 10 times the speed of competing drives. With up to two times more raw capacity (6.4 TB) and inline, no-penalty compression, FMD DC2 enables up five times more write IOPS than SSDs.

Support for global-active device

Global-active device is supported for like-to-like configurations of VSP Gx00 models.

VMware® support

Now supports the Virtual Volumes (VVols) functions provided in VMware vSphere® 6.0, which make VSP G series storage systems more compatible with the VMware® environment.

- Storage Manager for VMware vCenter™
- vStorage API for Array Integration (VAAI)
- Unified Storage Provider for VMware (VASA)
- vStorage API for Multipathing (VAMP)

- vStorage API for Data Protection (VADP)
- Hitachi Storage Replication Adapter (SRA)

User interfaces

The following user interfaces are provided for storage management:

- **Hitachi Command Suite**
  For more complex storage environments, Hitachi Command Suite (HCS) provides an application-centric storage management solution that simplifies administration of a common pool of multi-vendor storage. The software offers comprehensive management, control, and discovery for file, object, and block storage services, reducing complexity, costs, and risk in the storage infrastructure.
- **Command control interface**
  Command control interface (CCI) enables you to perform storage system configuration and data management operations by issuing commands to enterprise storage systems. CCI provides command-line access to the same provisioning and storage management operations that are available in Hitachi Command Suite and Hitachi Device Manager - Storage Navigator as well as in-system replication, remote replication, and data protection operations. CCI commands can be used interactively or in scripts to automate and standardize storage administration functions, simplifying the job of the storage administrator and reducing administration costs.
- **Hitachi Infrastructure Director**
  Hitachi Infrastructure Director eases management of Hitachi VSP Gx00 models and VSP Fx00 models. With simplified key administrative operations, Hitachi Infrastructure Director makes storage management feasible for IT generalists and less time-consuming for experienced IT administrators. Based on open standard APIs, the interface provides easy configurations that abstracts complex management operations into fewer steps.

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Hardware overview

This chapter provides an overview for the Hitachi Virtual Storage Platform G200, G400, G600, G800 (VSP Gx00 models), and the all-flash array Hitachi Virtual Storage Platform F400, F600, F800 (VSP Fx00 models) storage systems.

VSP Gx00 models and VSP Fx00 models

The Hitachi Virtual Storage Platform G200, G400, G600, G800 (VSP Gx00 models), and the new all-flash array Hitachi Virtual Storage Platform F400, F600, F800 (VSP Fx00 models) are modular, rack-mountable storage systems that incorporate state-of-the-art virtualization, data-management, and fault-tolerant technologies.

All VSP Gx00 models and VSP Fx00 models have dual controllers that provide the interface to a data host. Each controller contains its own processor, dual in-line cache memory modules (DIMMs), cache flash memory (CFM), battery, and fans. Depending on the model, the storage systems support, 64, 128, 256, or 512 GB of high-speed memory cache and provide interfaces for Fibre Channel and iSCSI with copper or optical connectors.

Each controller also has an Ethernet connection for out-of-band management using Hitachi Device Manager - Storage Navigator. If the data path through one controller fails, all drives remain available to data hosts using a redundant data path through the other controller. The VSP Gx00 models and VSP Fx00 models allow a defective controller to be replaced. The storage systems also allow defective drives to be hot swapped without interrupting data availability. A hot spare drive can be configured to replace a failed drive automatically, securing the fault-tolerant integrity of the logical drive. Self-contained, hardware-based RAID logical drives provide maximum performance in compact external enclosures.

All models are compatible with most industry-standard, 4-post EIA 19-inch racks with square mounting holes. The storage system can be factory configured and shipped in a Hitachi 600 x 1200 mm V2 Universal Rack, or shipped without a rack for customer installation into an existing compatible rack. The Hitachi rack comes with either two or four Power Distribution Units (PDUs), depending on the PDU model selected.

Installable in the same rack, the service processor (SVP) is a 1U device that operates independently from the storage system's CPU and operating system. The SVP provides out-of-band configuration and management of the storage system and collects performance data to enable diagnostic testing and analysis. The SVP runs Windows Embedded Standard 7, which provides the same look and feel and desktop environment as Windows 7 Professional.

Enhanced VSP Gx00 models

Leveraging the new FMD DC2 drives that are the foundation of the VSP Fx00 models, the enhanced VSP Gx00 models can now deliver improved response times, effective flash capacity and return on investment.

The VSP Gx00 models combines FMD DC2 flash with inline compression and Hitachi Dynamic Tiering active flash for improved responsiveness and

efficiency, making it simple for customers to move to all-flash gradually over time.

VSP Gx00 models support HDDs, SSDs, and FMD and FMD DC2 flash-module drives.

New Hitachi VSP F series

New to the Hitachi VSP family, the Hitachi Virtual Storage Platform F400, F600, F800 all-flash arrays bring together all-flash storage and the simplicity of built-in automation software with the proven resiliency and performance of Hitachi VSP technology.

The VSP F series offers 1.4 million IOPS to meet the most demanding application requirements. The VSP F series leverages the new FMD DC2 second-generation flash-module drives which deliver twice the capacity per tray over previous generation flash-module drives, resulting in a smaller data center footprint and lower maximum performance cost. Fast inline data compression with an ASIC engine reduces space with no performance penalty.

Easy-to-use replication management is included with the VSP F series with optional synchronous and asynchronous replication available for complete data protection. The VSP F series ranges in effective storage capacity from 12.8 TB up to 448 TB and provides customers with and all-flash solution that works seamlessly with other Hitachi infrastructure products through common management software and rich automation tools.

VSP Fx00 models are all-flash arrays that support FMD DC2 flash-module drives.

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Software overview

This chapter provides an overview of the software components, features, and benefits available.

Hitachi Command Suite

Hitachi Command Suite (HCS) is an application-centric storage management solution that simplifies administration of a common pool of multivendor storage. The software offers comprehensive management, control, and discovery for file, object, and block storage services, reducing complexity, costs, and risk in the storage infrastructure.

The base HCS product consists of Hitachi Device Manager, which provides centralized management of multiple Hitachi storage systems. By providing a single console for managing complex storage environments, Device Manager software unifies and simplifies storage management. Featuring an intuitive GUI, Device Manager supports multiple management views for primary and secondary storage, including physical, logical, host, and NAS and virtual server for provisioning and storage pooling.

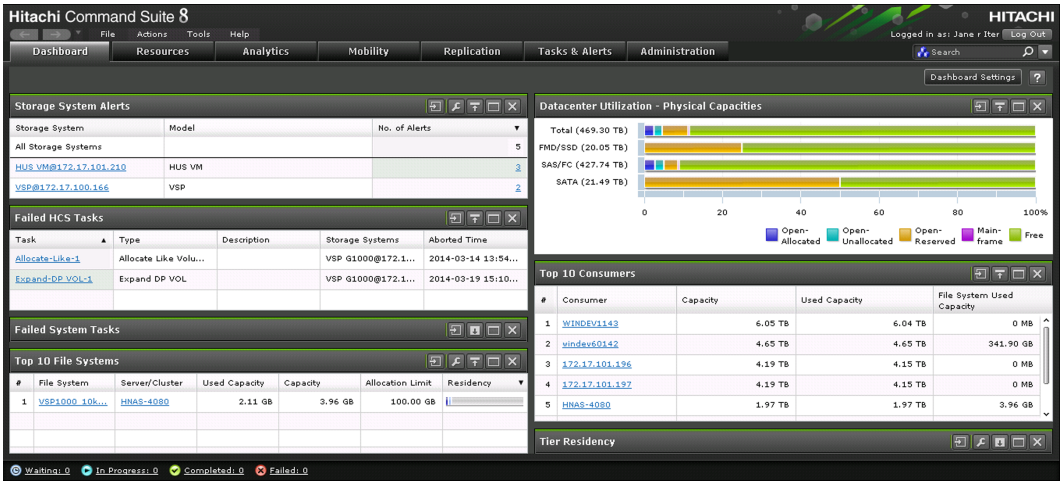
Note: Key functions of the previously separate Storage Navigator have been integrated into HCS to enable a unified interface for storage management.

HCS comprises the following optional components, each of which is licensed separately:

- **Hitachi Tiered Storage Manager:** Supports storage tiers of differing performance characteristics so that volume data storage costs and performance can be optimized.
- **Hitachi Replication Manager:** Adds remote replication capabilities and supports backup and disaster recovery.
- **Hitachi Tuning Manager:** Supports optimizing the performance of storage resources.
- **Compute Systems Manager:** Supports centralized monitoring and management of hosts, including rebooting and power management.
- **Hitachi Command Director:** Supports sophisticated business centric views of storage environments, such as adherence to service-level agreements and data usage trends to forecast future storage requirements.
- **Hitachi Dynamic Link Manager:** Supports the use of multiple paths between resources such as hosts and storage for path failover and load balancing.
- **Hitachi Global Link Manager:** Supports management of multipath management software between resources, such as hosts and storage.

At minimum, you must license Device Manager. Additional licensing can be added as needed for other storage management products. Related functionality becomes available in the HCS user interface in the form of activated menu choices, and new or updated tabs and related screens and buttons.

The following figure shows the main HCS dashboard.



Hitachi Command Suite offers the following benefits:

Central inventory management to properly manage growth

- Common administrative framework consolidates asset management across all virtualized storage resources for operational efficiency to increase storage return on investment
- Common management console to discover, configure, monitor, and report on all tiers and virtualized storage resources
- Dashboard highlights system-wide capacity usage, top consumers, and system alerts
- Logical group constructs to easily align storage resources with business applications
- Integrated management framework enables automation, mobility, service-level management, and data protection

Simplified storage provisioning for rapid deployment

The common management framework consolidates storage provisioning for both structured and unstructured data:

- Centrally configure storage pools for block, file, and object consumers
- Centrally manage data security, mobility, performance, and replication
- Simplified provisioning with contextual workflows
- Reduce operational expenses; manage more with less effort

Maximize business application performance

- Automatically align with business applications, define tiers, and set policies by application workload for maximum performance
- Automate optimal data placement to increase storage utilization by up to 50%

Automated lower cost and less management

- Automatically move inactive data to lower-cost storage

- Automatically move active data to highest-performing tier
- Define tiers and set policies to optimize cost

Meet business application service levels with Hitachi Command Director

- Define key storage performance and capacity objectives by business application
- Global storage service-level management dashboard to monitor compliance 24/7 and identify applications at risk
- Monitor application service levels and storage system health from virtually anywhere with the mobile Apple® iPad® app
- Investigate service-level violations to quickly identify and resolve potential bottlenecks

Ensure performance is running at peak efficiency with Hitachi Command Suite Analytics, featuring Hitachi Tuning Manager

Comprehensive storage system health monitoring and troubleshooting to deliver the operational efficiencies required to optimize shared Hitachi storage resources

Dynamic tiering and active flash

Hitachi Dynamic Tiering (HDT) is based on Hitachi Dynamic Provisioning. It further simplifies tiered storage management by automating fine-grained, page-based movement of data to the most appropriate storage media according to workload and usage patterns. It automates management, maximizes service levels, and minimizes storage costs.

Dynamic Tiering places the host volume's data across multiple tiers of storage. There can be up to three tiers (high-, medium-, and low-speed layers). Dynamic Tiering determines tier usage based on data access levels. It automatically allocates pages with high I/O load to the upper tier, which contains higher speed drives, and pages with low I/O load to the lower tier, which contains lower speed drives.

HDT tracks page usage within each tier over a configured time period. At the end of each time period, pages that have been accessed very frequently might be moved from a slower media to high-performance flash media.

Active flash is a feature enhancement to HDT that monitors a page's access frequency level and promotes pages that suddenly became busy in real time rather than waiting for a specific time period to elapse.

Dynamic Tiering and active flash offer the following benefits:

Reduced storage costs

- Reduces media costs and drive counts through self-optimized use of storage tiers
- Achieves space efficiency through thin provisioning

- Eliminates manual data classification
- Eliminates manual data movement between tiers
- Reduces operational overhead
- Reduces space, power, and cooling requirements

Improved performance

- Optimizes data placement automatically for performance using an I/O rate-based heat index
- Gives SSD-class performance to information stored largely on less expensive tiers by automatically moving the most accessed data to the highest (SSD) tier
- Supports the highest efficiency and throughput through granular page-based data movement
- Uses wide striping across the entire pool
- For applications that have high I/O to particular pages, active flash improves HDT performance by automatically moving the most frequently accessed data in real time.

Efficient administration

- Simplifies management of up to three storage tiers as a single volume
- Automatically moves the most active data to the highest performing tier
- Automatically adjusts to dynamic workloads and capacity requirements
- Moves pages up and down for optimal placement
- Significantly reduces administration time

Advanced SAN multipathing

Hitachi Dynamic Link Manager offers robust multipath SAN connections between servers and storage systems. It provides fault-tolerant failover, failback, load balancing, and centralized path management, for improved information access, usability, and availability. Automatic workload balancing helps to maintain outstanding system performance across all available paths. If one path fails, Dynamic Link Manager automatically switches the I/O to an alternate path, ensuring that an active route to data is always available.

Dynamic Link Manager offers the following benefits:

Business continuity

- Improves system performance by spreading I/O request workload across available paths to ensure that no single path is overworked or underutilized
- Provides a high level of data availability through automatic path failover and failback, ensuring continuous access to application data, improved application performance, and reduced risk of financial loss due to failures of critical applications
- Improves availability and data access on storage systems in SAN environments, with path failover and I/O balancing over multiple HBAs

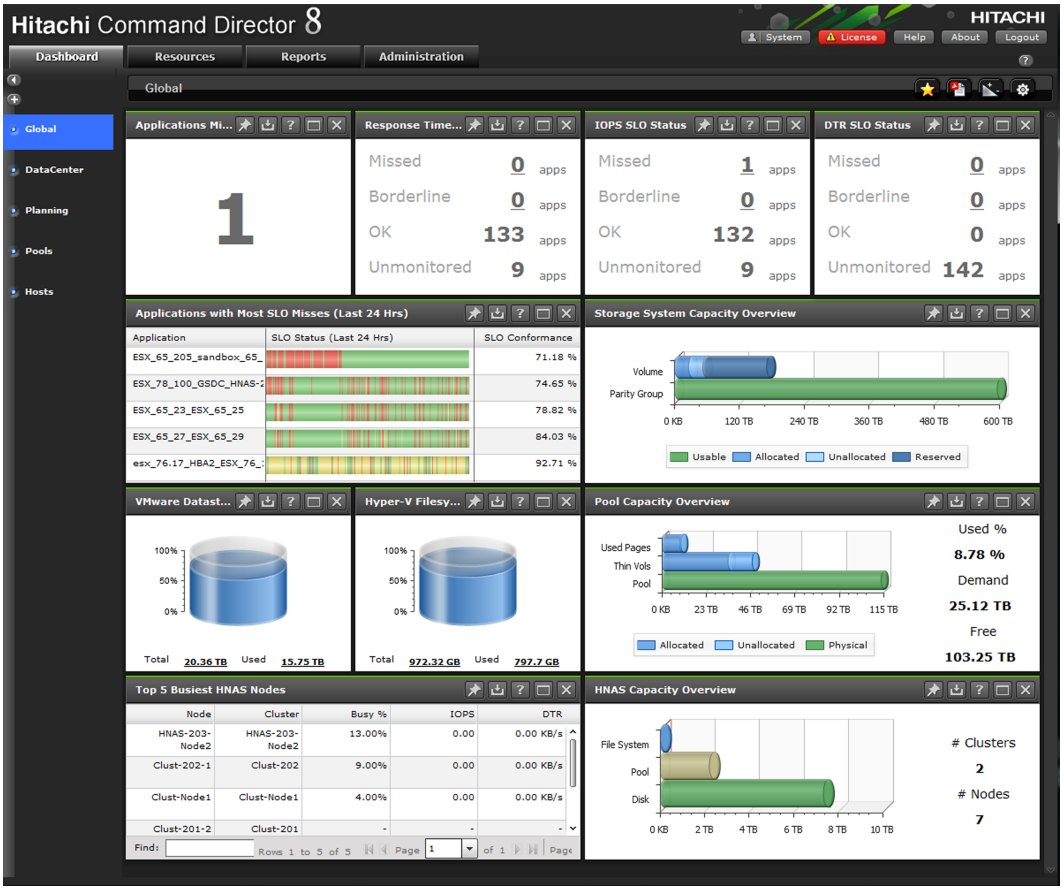
- With its health-check facility, monitors online path status at specified intervals, and places a failed path offline when an error is detected

Productivity and process

- Provides a centralized facility for managing path failover, automatic failback, and selection of I/O balancing techniques through integration with Hitachi Global Link Manager
- Eases installation and use through the auto-discovery function, which automatically detects all available paths for failover and load balancing
- Provides one path-management tool for all your operating systems
- Includes a command line interface (CLI) that allows administrators the most flexibility in managing paths across the network
- Provides manual and automatic failover and failback support

Centralized reporting

Hitachi Command Director centralizes reporting across Hitachi Command Suite. By consolidating reporting of storage configuration, capacity, performance, and tier information, Command Director provides a business-oriented view into the storage environment to easily align Hitachi storage assets with critical business applications and simplify application-to-storage reporting. It also ensures compliance with application-specific storage service levels. The following figure shows the main Command Director dashboard.



Hitachi Command Director offers the following benefits:

Manage storage assets by business application

- Gain a business intelligence view of storage resources correlated to the respective business applications and functions
- Customize dashboards of business applications and related storage resources for enterprise-wide monitoring and reporting needs

Improve utilization of storage assets

- Receive detailed reporting of allocated and utilized storage capacity without the need for host-based agents, to increase storage utilization and improve return on storage investments
- Ensure optimal file server performance by monitoring key file server performance statistics to help identify the busiest NAS nodes

Monitor business applications for adherence to storage service levels

- Proactively monitor compliance of storage service levels for mission-critical business applications
- Establish storage SLOs by application, based on detailed capacity and performance metrics

Detect problems early to avoid storage performance bottlenecks

- Monitor overall storage system health based on best practice rules to help detect problems early and reduce the likelihood of any performance issues
- Provide a consolidated service-level view of your infrastructure by aggregating key storage performance, capacity, and tier indicators from across the Hitachi Command Suite of management products
- Incorporates a REST-based API for extraction of performance and capacity data

Thin provisioning

Hitachi Dynamic Provisioning (an integral part of HCS) provides the storage system with thin provisioning services. Thin provisioning gives applications access to virtual storage capacity. Applications that access virtual, thin provisioned volumes are automatically allocated physical disk space by the storage system as they write data. Thin provisioning allows volumes to use only the amount of physical space required and no more.

All thin provisioned volumes share a common pool of physical disk capacity. Unused capacity in the pool is available to any application using thin provisioned volumes. This eliminates the waste of over-allocated and underutilized storage.

Dynamic Provisioning also simplifies storage provisioning and automates data placement on disks for optimal performance. You do not need to micromanage application storage allocations or perform complex, manual performance tuning. In addition, you can add physical storage resources to the thin provisioning pool at any time, without application downtime.

Dynamic Provisioning offers the following benefits:

Nondisruptive addition of physical disks

Actual storage capacity from the DP pool is assigned to a DP volume when the data is written. Until then, a DP volume appears as a virtual LVI/LUN volume with no actual storage capacity. Because the application sees only the virtual capacity allocated to it, additional physical disk capacity can be installed transparently when needed without interruption.

Improved performance

Dynamic Provisioning improves performance by avoiding contention and performance bottlenecks. By evenly spreading out hundreds of users' I/O patterns over all available spindles, Dynamic Provisioning optimizes aggregate throughput, generally delivering the best performance.

Reduced storage acquisition costs

Reduced acquisition costs extend to savings in space, power, and cooling requirements.

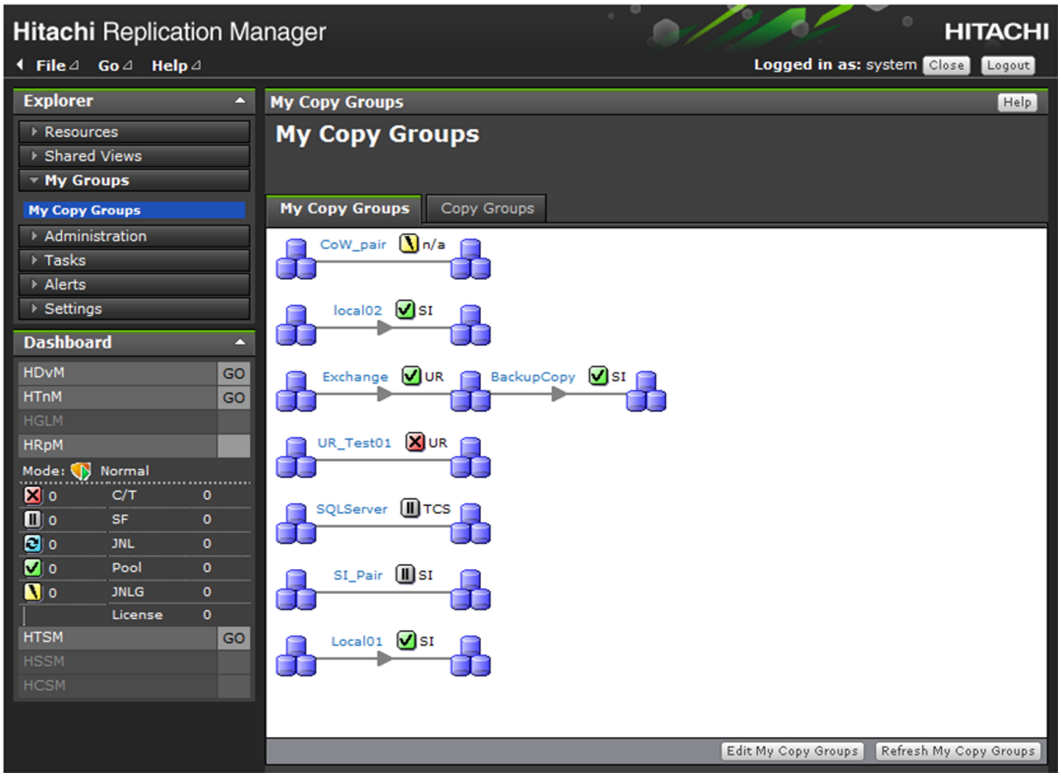
The ability to define a volume as larger than a physical disk allows you to plan for future storage needs during initial installation. You can purchase only the physical disk capacity for your current needs, adding physical storage incrementally over time.

Simplified replication planning

Because you can define the desired volume capacity without regard to the physical disk capacity, for volumes of 4 TB and smaller, you do not need to use LUSE for volume expansion. This also simplifies creating replication pairs.

Data replication

Hitachi Replication Manager provides management capabilities to configure, manage, and monitor Hitachi replication products for local and remote sites. Replication Manager supports open systems and mainframe environments and provides support for multiple data centers and multiple storage systems at each data center. It simplifies and optimizes configuration, operation, task management, automation, and monitoring of the critical applications and storage components of your replication infrastructure. The following figure shows the Replication Manager interface.



Replication Manager offers the following benefits:

Centralized management of a replication environment

Replication Manager can be used to manage storage systems and hosts at different sites. The status of copy pairs, the progress of copy operations, and performance information (such as data transfer delays between copy pairs and buffer usage when copying volumes) can be centrally managed from a single console.

Integrated database backup management

Replication Manager supports creating backups of databases. Called *application replicas*, these backups are managed as a series of secondary volumes that are rotated on a scheduled basis. Replication Manager manages the relationships between backup objects and their associated logical units within storage devices, the relationships between primary and secondary volumes, and the backup history. Replicas can be mounted and dumped to tape using scripts executed through Replication Manager.

Visual representation of replication structures

Replication Manager provides a centralized workspace where you can visually check the structure of copy pairs configured across multiple storage systems. Host and storage system relationships and copy pair definitions can be visualized using functional views. Copy pairs in complex configurations such as multitarget configurations and cascade configurations can be viewed as lists.

Monitoring and immediate notification of error information

Replication Manager provides capabilities to specify monitoring conditions for designated copy pairs and sidefiles. Alerts can be automatically generated when the conditions are satisfied. You can continue monitoring the system even when not logged in to Replication Manager because alerts can be reported in the form of email messages or SNMP traps. The status of application replicas is tracked and reflected in summary form so that you know to what extent the application databases are protected. These monitoring features allow you to work out advance strategies to handle potential problems such as the deterioration of transfer performance due to insufficient network capacity or blocked pairs caused by buffer overflows.

Modification of replication structures

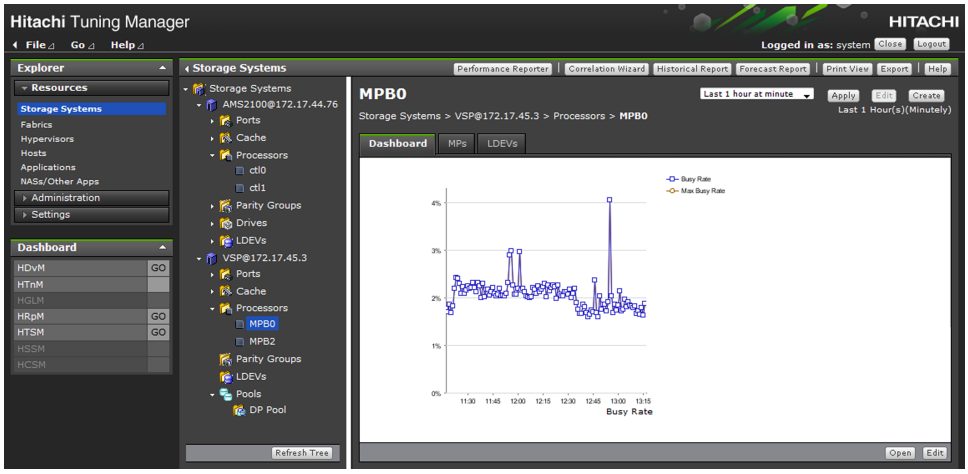
Replication Manager provides capabilities to configure additional copy pairs as business operations expand and improve performance by expanding buffer capacity for copying volumes. You can also change pair states manually after error recovery. Using the wizards provided in the GUI, you can set up pairs while visually keeping track of complex replication structures.

Monitoring and analyzing remote copy performance (write delay time)

When using Universal Replicator, you can check copy performance visually and perform root cause analysis using the Replication tab of the Hitachi Command Suite GUI.

Performance management

Hitachi Tuning Manager is a path-aware storage resource management application that maps, monitors, and analyzes storage network resources from the application to the storage device. It provides the end-to-end visibility required to isolate and diagnose performance bottlenecks with a focus on business applications, such as Oracle, Microsoft SQL Server, Microsoft Exchange, and IBM® DB2®. The following figure shows the Tuning Manager interface.



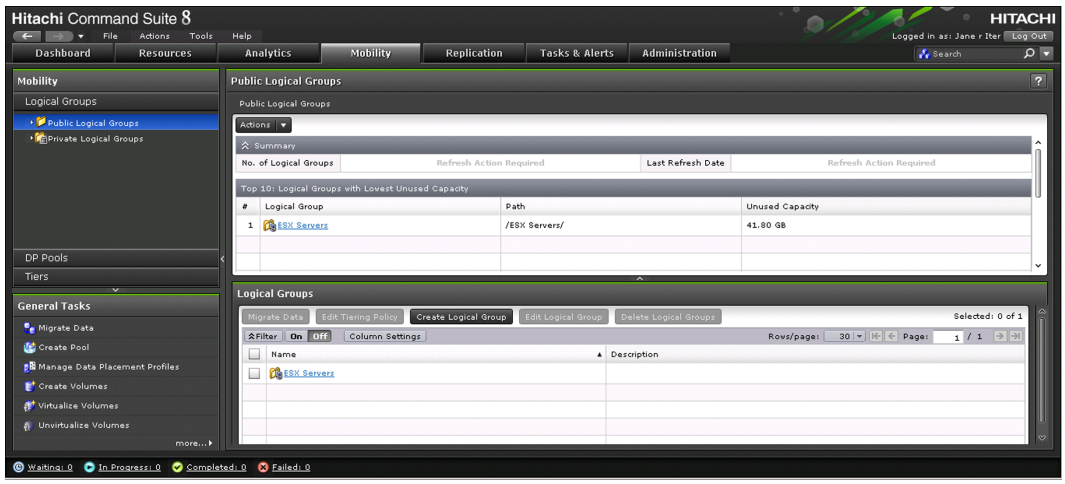
Tuning Manager offers the following benefits:

- Simplifies performance reporting and management of your storage environment
- Improves service quality with accurate performance reporting
- Increases application availability through rapid problem identification and isolation
- Reduces storage costs with proper forecasting and planning of required storage resources
- Incorporates a REST-based API for extraction of performance and capacity data

Data mobility

Hitachi Tiered Storage Manager provides the unique ability to migrate volumes between heterogeneous tiers of storage, without affecting application access to data. The software supports up to 64 simultaneous migrations, using 64 processor threads, and it offers a single interface for all data movement between storage virtualized by thestorage system.

The following figure shows the Mobility tab of HCS, which is used to access Hitachi Tiered Storage Manager.



Tiered Storage Manager offers the following benefits:

- Matches application price, performance, and availability needs to storage attributes
- Controls the automated behavior of Dynamic Tiering through the use of standard and custom policies and profiles. You can also proactively create and pool different classes of storage for maximum efficiency and long-term performance
- Manages storage resources according to the needs of specific business applications, while supporting the ability to migrate data nondisruptively

Automated provisioning

Hitachi Automation Director is a software solution that provides tools to automate and simplify the end-to-end storage provisioning process for storage and data center administrators. The building blocks of the product are prepackaged automation templates known as service templates. These templates can be customized to your specific environment and processes creating services that automate complex tasks such as resource provisioning. When Automation Director is configured, it integrates with existing Hitachi Command Suite applications, including Hitachi Device Manager and Hitachi Tuning Manager, to automate common infrastructure management tasks by using your existing infrastructure services.

Some of the key features of Automation Director are:

- Automation services for intelligent provisioning of volumes from different storage classes.
- Preconfigured service templates that help you create customized automation services.
- Role-based access to defined services.

- Intelligent pool selection based on an algorithm that chooses the best pools in terms of performance and capacity.
- Common service management attributes that can be assigned and shared across all automation services.
- A REST API for application integration.
- The ability to create infrastructure groups based on customer needs and environment.

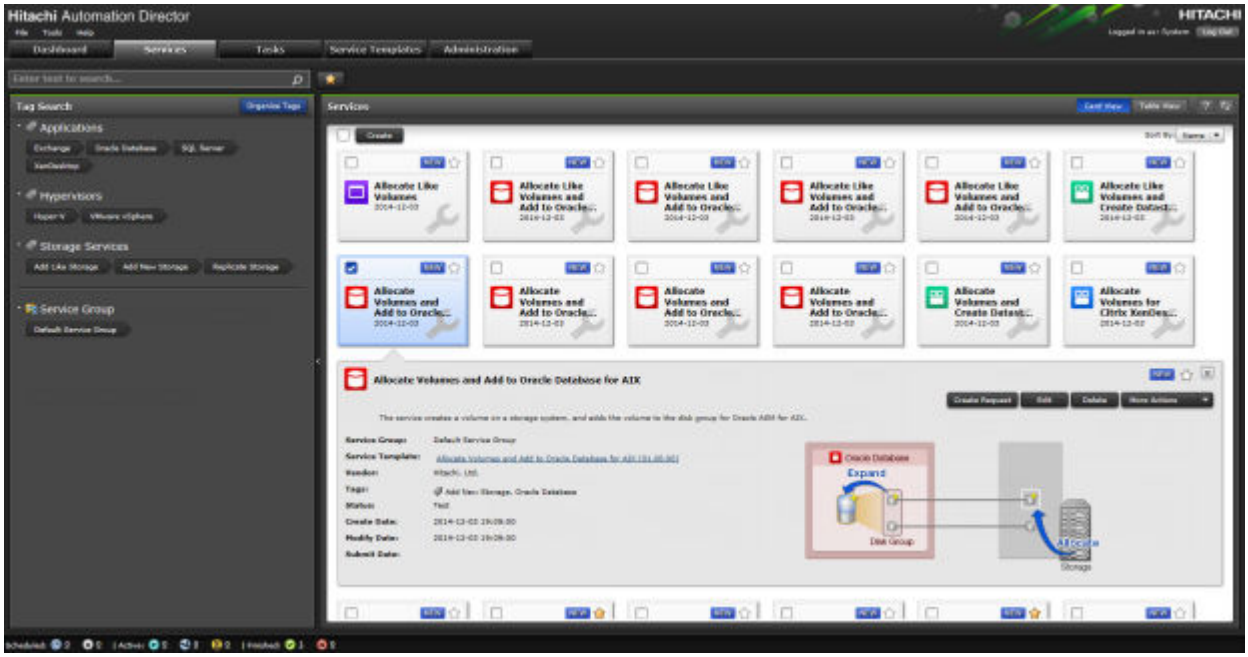


Figure 1 Select a service on the Services tab to review details and create a request for provisioning.

Hitachi Automation Director offers the following benefits:

- Provisioning is simplified through use of service templates that can automate workflow, resulting in additional OPEX savings.
- Service customization can be performed by skilled storage administrators, increasing the efficiency of resource usage and reducing human error.
- Simplified infrastructure management, including classification of storage systems and high-level grouping of resources, significantly improves storage management and provides efficient utilization of resources.
- The ability to customize pre-defined service templates, by using the Service Builder tool, to address an organization's changing needs.
- The REST API facilitates integration of Automation Director with relevant IT automation processes.

Data protection with Hitachi Data Instance Director

Hitachi Data Instance Director (HDID) provides business-defined data protection, which simplifies the creation and management of complex, business-defined policies to meet service level objectives for availability.

HDID supports the Hitachi VSP G series storage systems, offering an orchestration layer for remote replication supporting Hitachi TrueCopy® and Hitachi Universal Replicator, local and remote snapshots and clones with Hitachi Thin Image and Hitachi ShadowImage®, continuous data protection, and incremental backup.

HDID provides the following benefits:

Operational recovery

HDID offers two approaches to meeting operational recovery requirements, depending on whether the data being protected is stored on Hitachi storage.

- *Storage-based operational recovery*
  HDID configures, automates and orchestrates local application-consistent snapshot and clone copies using the local replication capabilities of Hitachi Virtual Storage Platform (VSP) family, Hitachi Unified Storage VM (HUS VM), and Hitachi NAS Platform (HNAS).
  This integration provides the ability to create fast, frequent copies of production data, with no impact on the performance of the production system. Very aggressive recovery point objectives (RPO) can be easily achieved for Microsoft® Exchange and Microsoft SQL Server® on Microsoft Windows® platforms, and for Oracle database environments on Linux. HDID is integrated with Hitachi Virtual Infrastructure Integrator to provide storage-based protection of VMware vSphere® environments. Other applications can also be integrated using the simple scripting interface.
  These snapshots and clones can be mounted and unmounted automatically as part of an HDID policy workflow. They can facilitate access to a current copy of production data for secondary purposes such as test and development, or backup to a target device such as a purpose-built backup appliance (PBBA) or tape. HDID administrators can also view and restore storage-based snapshots created in VMware environments by Hitachi Virtual Infrastructure Integrator.
- *Host-based operational recovery*
  HDID includes several storage-agnostic technologies for protection of application and file system data. Continuous data protection (CDP) and live backup support Windows environments, with application-specific support for Exchange and SQL Server. Batch mode backup is supported on Windows, Linux and IBM® AIX® systems.

Disaster recovery

HDID provides storage-based and software based choices for restoring operations at, or from, another location following a site level outage.

- *Storage-based disaster recovery*

HDID configures and automates Hitachi TrueCopy synchronous remote replication software and Hitachi Universal Replicator software on block-based systems, and file replication on HNAS, to provide a copy of data in another location. HDID can also orchestrate application-aware snapshots of these remote replicas.

- *Host-based disaster recovery*
  The backup data stored locally by HDID can be asynchronously replicated, on a scheduled basis, to another location. It does not require specific storage for either the primary or disaster recovery copy.

Long-term retention

With HDID, moving Microsoft Exchange and Windows file data to Hitachi Content Platform (HCP) for archiving enables your administrators to reduce the amount of data in their production systems and meet corporate and regulatory data retention requirements.

Leave the archived file on the source system, delete it or leave a stub file as a pointer. HDID archives files as individual objects that can be easily viewed, retrieved or audited with standard HCP tools. No special software is needed to unpack or decode the archived files

Unified management

One of the many benefits of Hitachi Data Instance Director is its single-footprint platform. It enables you to layer, combine and orchestrate backup, CDP, snapshots, replication and archive to achieve the specific service levels of data recovery and retention each application requires.

The unique graphical user interface (GUI) incorporates a powerful policy builder that resembles laying out business processes on a whiteboard. Easily create and change policies as needed, visualize data protection processes, and align them with management processes.

Additional features of HDID include:

- Block-level, incremental-forever data capture dramatically reduces the storage capacity needed for copy data, as compared to traditional full + incremental methods.
- To further reduce downtime, bare metal recovery images can be created using standard backup processes. The operating system volume and application volumes can be recovered in a single operation.
- HDID supports a range of storage repositories, including block, file, object, Microsoft Azure and tape storage.
- HDID scales seamlessly to manage hundreds of terabytes of data.

Performance analytics and reporting software

Hitachi Data Center Analytics (HDCA) is a storage performance analytics application that includes a highly scalable data repository and analytics engine for historical performance and capacity trending across the data center. HDCA provides deep and granular performance monitoring and reporting to aid users in identifying infrastructure bottlenecks and trends in order to optimize both application and storage system performance. This software enables a common, centralized storage analytics solution for Hitachi and multi-vendor storage environments, thus reducing the need for vendor-specific performance analytic tools. HDCA provides multi-vendor storage system support for Hitachi and third-party storage system environments.

High availability with global-active device

Global-active device uses volume replication to provide a high-availability environment for hosts across storage systems and sites. Global-active device provides data protection and minimizes data-access disruptions for host applications due to storage system or site failures.

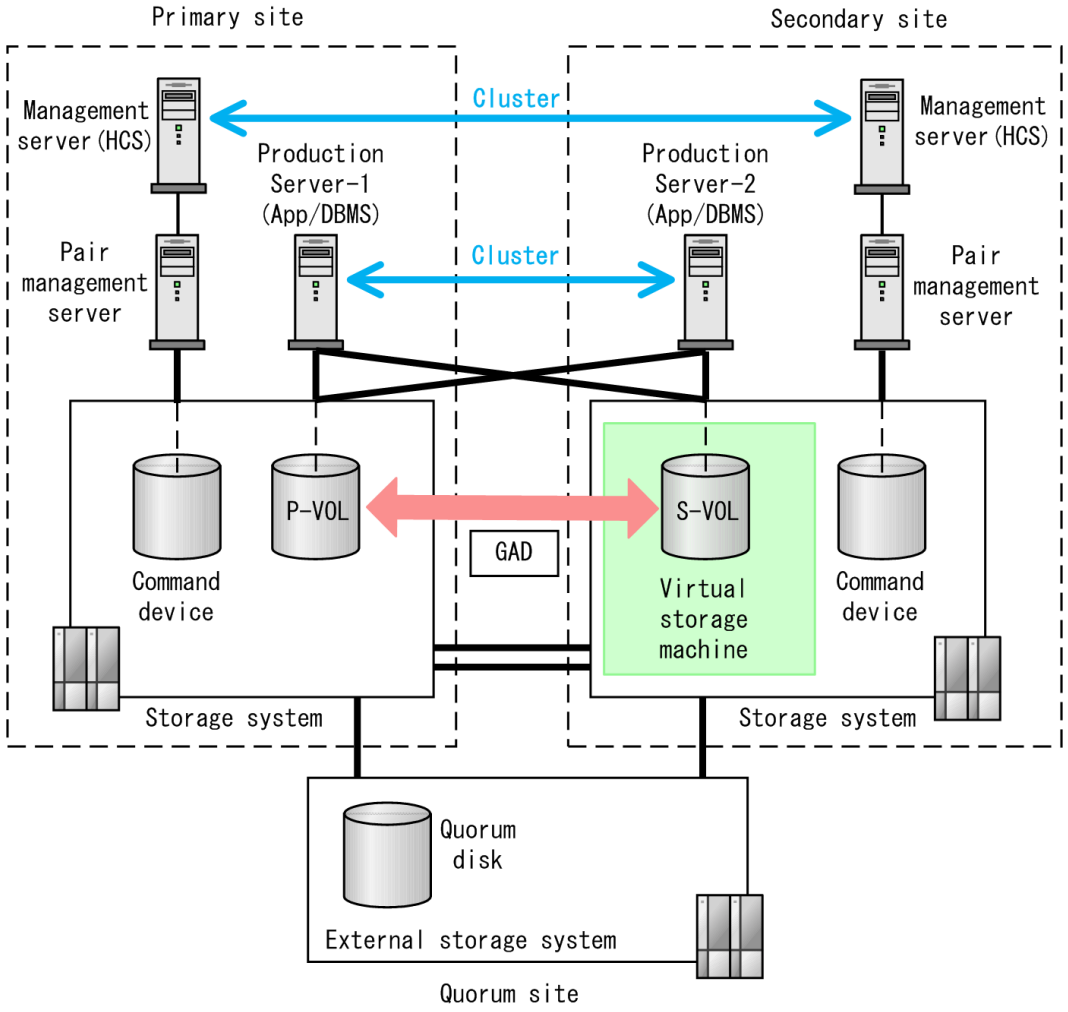
Establishing a global-active device pair has the following benefits:

- Continuous I/O:
  If a primary volume becomes unavailable, the host continues to transparently access the secondary volume.
- Clustered failover:
  You do not need to perform storage system tasks such as suspension or resynchronization of a global-active device pair due to a host failure.
- Virtual machine integration:
  If a virtual machine is creating a high load at one site, you can move the load to the other site, eliminating the need for data migration.

How global-active device works

A global-active device pair consists of a primary data volume and a synchronous, remote copy on a Hitachi Virtual Storage Platform G1000 (VSP G1000) or Hitachi VSP G200, G400, G600, or G800 storage system. A virtual storage machine is set up in a secondary VSP G series storage system using the physical information from the primary system. The global-active device primary and secondary volumes are assigned the same virtual LDEV number in the virtual storage machine. As a result, the host treats the paired volumes as a single volume on a single storage system, with both volumes receiving the same data from the host.

The following figure shows an example global-active device configuration.



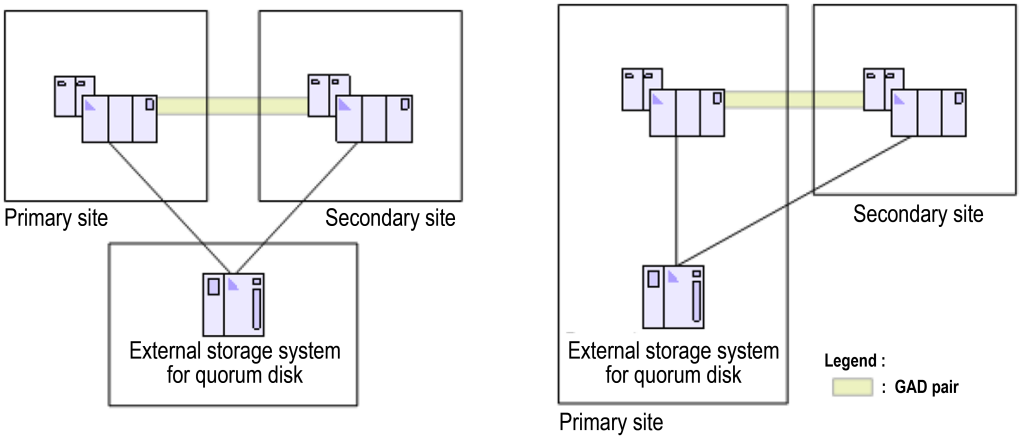
Global-active device (GAD) pair volumes are monitored by a quorum disk (preferably located at third site). The quorum disk acts as a *heartbeat* for the GAD pair; the primary and secondary storage systems access the quorum disk periodically to check on the other storage system. In the event of a communication or hardware failure, the quorum disk determines which storage system is still accessible, allowing operations to continue without interruption.

The SAN multipathing software on the host runs in an active-active configuration. If the primary volume (P-VOL) or secondary volume (S-VOL) cannot be accessed, host I/O is automatically redirected to an alternative path. Native multipath software operates at campus distances using cross-site paths (as shown in the previous diagram). At metro distances, Hitachi Dynamic Link Manager (HDLM) offers increased performance using *preferred paths* (shortest possible route).

Global-active device storage system configurations

A global-active device environment can be implemented in one site or across two or three sites.

Global-active device requires three storage systems: primary, secondary, and an external system used for the quorum disk. The configuration can be set up across three, two, or one site.



- In a three-site configuration (recommended), each storage system is located at a separate site. This configuration provides maximum protection against system or site failures.
- In a two-site configuration, both the primary storage system and the quorum storage system are located at the primary site. This configuration provides a moderate level of protection against system or site failures.
- In a one-site configuration (not shown), all storage systems are located at the same site. This configuration protects against storage system failures but not site-wide failures.

For a complete description of global-active device configurations, requirements, and setup, see:

- *Global-Active Device User Guide for Hitachi Virtual Storage Platform G Series*
- *Hitachi Command Suite User Guide*
- Hitachi Command Suite Dynamic Link Manager documentation

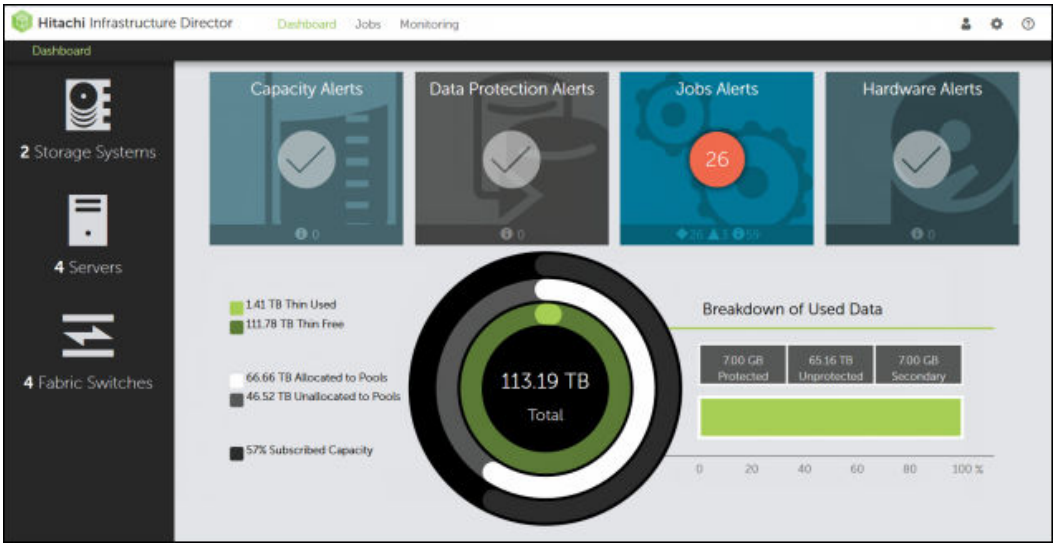
Hitachi Infrastructure Director

Hitachi Infrastructure Director (HID) enables configuration and storage element management using an intuitive graphical user interface. HID abstracts management complexities enabling users to easily configure Hitachi storage systems and provision new storage for business applications.

Overview of Infrastructure Director

Hitachi Infrastructure Director is a unified software management tool that reduces the complexity of managing storage systems by simplifying the setup, management, and maintenance of storage resources.

Infrastructure Director reduces infrastructure management complexities and enables a new simplified approach to managing storage infrastructures. It provides intuitive graphical user interfaces and recommended configuration practices to streamline system configurations and storage management operations. You can leverage Infrastructure Director to easily provision new storage capacity for business applications without requiring in-depth knowledge of the underlining infrastructure resource details. It provides centralized management while reducing the number of steps to configure, optimize, and deploy new infrastructure resources.



Some of the key Infrastructure Director capabilities include:

- Simplified user experience for managing infrastructure resources. Provides visual aids to easily view and interpret key management information, such as used and available capacity, and guide features to help quickly determine appropriate next steps for a given management task.
- Recommended system configurations to speed initial storage system setup and accelerate new infrastructure resource deployments.
- Integrated configuration workflows with Hitachi recommended practices to streamline storage provisioning and data protection tasks.
- Provides common, centralized management for supported storage systems.
- REST-based API to provide full management programmability and control in addition to unified file-based management support.
- Infrastructure Director enables automated SAN zoning during volume attach and detach. Optional auto-zoning eliminates the need for repetitive zoning tasks to be performed on the switch.

4

Software management examples

Using a series of examples, this chapter explains how you can manage your Hitachi VSP storage systems using the Hitachi Command Suite management software.

Example 1: Enabling simple and efficient storage provisioning and unified management with Command Suite

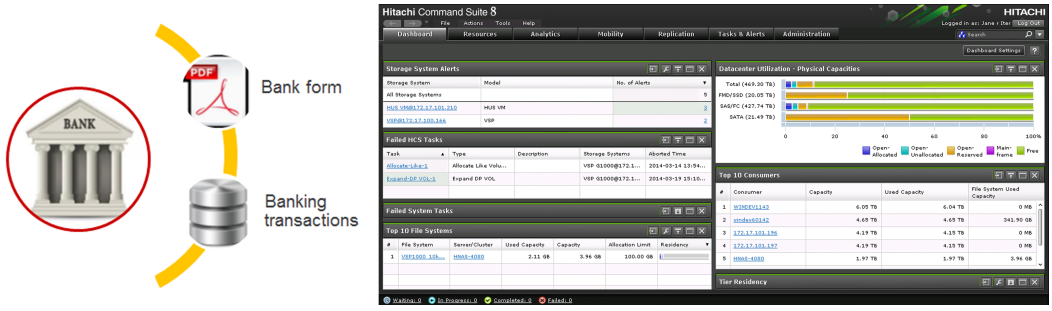
Today, financial institutions provide a wide array of services to their customers. These services must support both structured data (online and ATM transactions, such as withdrawing or depositing checks and cash) and unstructured data (such as email messages, SMS text messages, customer feedback, bank statements, and electronic forms). To meet the ever-increasing need for customer access to the services, the institutions must have a solution that meets the following needs:

- Ability to process customer transactions quickly and accurately. At the same time, provide access to online reports (such as account statements) and forms (such as for opening a new bank account or for applying for a mortgage).
- Flexibility to accommodate structured and unstructured data, and ability to access services no matter where the storage system resides.
- Centralized management of all storage repositories to reduce storage management costs and total cost of ownership.

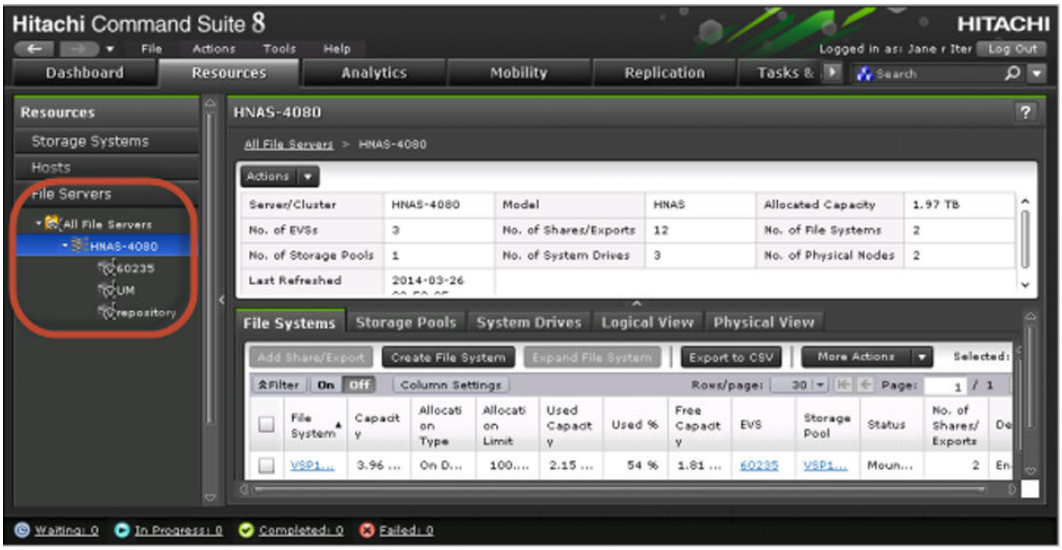
Overall, financial institutions require a platform with the breadth and flexibility to provide services wherever, whenever, and however customers need them.

Solution

Hitachi Command Suite (HCS) software consolidates block and file storage arrays to unify the management of all types of data, and provides a single, integrated view for all customers.



HCS natively discovers Hitachi storage systems, Hitachi NAS systems, and Hitachi Data Ingestor file appliance-based systems, displaying the correlation of File Module system drives with back-end physical volumes and File Module storage pools.



HCS discovers and displays related file systems, mount points, and share information for CIFS, and export information for NFS systems. It unifies block, file, and content data across all Hitachi storage and manages all virtualized heterogeneous storage assets.

HCS natively provisions storage to an HNAS cluster the same way as to a physical or hypervisor server, such as the VMware ESX server. It creates and manages file systems, CIFS shares, and NFS exports using the unified, common GUI. Reaching across file, block, content, and application environments, HCS improves business application availability and performance, and expedites access to critical data.

Example 2: Ensuring optimal storage performance and business application service levels with data analytics

Banks offer several incentives to its customers. One of them is online banking, which customers have come to prefer. They see the need and growing importance of creating an excellent experience for their online customers. They must provide quick, 24/7 access to online banking services, and must do so across the many devices and platforms used by customers. Customers expect access to these services anytime and from anywhere. If the service is not fast, not available 24/7, and not consistent, customer loyalty can be negatively affected and result in bank account closures.

ATM machines provide yet another critical service to bank customers. ATM transactions have become an essential component of the banking industry. The problem with ATM machines is when they are not functioning.

Banks strive to keep their business-critical services available for customers, but often find the following problems still exist:

- Lack of performance baselines or benchmarks to analyze response time for online banking and ATM applications
- Insufficient root cause analysis (RCA) techniques that look deep into application performance problems, and ineffective existing techniques
- Absence of real-time monitoring capability and analysis of all elements in the customer environment
- No tools to help storage administrators analyze application performance or to determine if the storage is at fault
- Lack of custom reporting capabilities to obtain detailed storage capacity and performance metrics to gain insight into key storage system performance indicators
- Uncertainty whether critical business applications are meeting required storage service levels

Solution

Use Hitachi Command Suite Analytics to monitor performance and meet storage service-level needs.

- To help banks determine how well their online banking service is performing, they must know the current level of performance and benchmark it against an industry best practice. Storage downtime affects system availability for online transactions. One of the best ways to avoid bottlenecks is through regular monitoring, system feedback, and on-demand customizable reporting based on parameters defined by users. The parameters can be based on storage or files, such as EVS, FS, and VVOL utilization, and on capacity reporting, such as on tiers, users, and groups. Instead of reacting to bottlenecks after they occur, administrators can get alerts from HCS Analytics about potential bottlenecks before they

occur. Administrators can identify problem performance trends at an earlier stage to avoid system downtime.

HCS Analytics performs end-to-end performance monitoring along the application's entire data path to quickly determine if storage is the source of application-performance degradation. With this monitoring information, storage administrators can take appropriate measures to remove upcoming bottlenecks and to improve storage (and ultimately application) performance.

- To ensure that critical business applications are meeting required storage service levels and comply with storage service-level requirements, storage administrators can use HCS Analytics to accurately monitor application storage levels and quickly resolve problems. Applications have varying service-level objectives (SLO) based on their business criticality. For important applications, such as online banking and ATM transactions, storage administrators can use HCS Analytics to provide the applications with appropriate storage resources in compliance with defined SLO requirements.

Management software

To ensure business application performance and predictive growth, Hitachi Command Suite Analytics provides all the necessary capabilities to find storage resource trouble spots, identify the actual affected storage resources, and help determine the root cause of problems. It also provides centralized service-level management of mission-critical business applications.

HCS Analytics features Tuning Manager and Command Director:

- *Hitachi Tuning Manager* provides comprehensive storage performance monitoring required to maximize both business application and Hitachi storage system performance. It provides integrated performance analytics

that can quickly identify, isolate, and find possible causes of performance bottlenecks. Within the HCS central management console, the integrated analytics capabilities provide the necessary first step to quickly address performance problems associated with Hitachi storage environments.

If additional performance details or diagnosis is required, Tuning Manager includes a web-based interface to provide deeper performance monitoring across a comprehensive range of performance and capacity metrics, with historical trending and custom reporting capabilities.

- *Hitachi Command Director* defines key storage performance and capacity objectives by business application. It features a global storage service-level management dashboard to monitor compliance 24/7 and identify applications at risk. It provides an analysis of application performance and capacity (allocation and utilization) to properly define storage service levels.

  Command Director then monitors service levels and storage system health and investigates service-level violations to quickly identify and resolve potential bottlenecks. Command Director also features a new SLO profile recommendation engine. Recommendations are generated automatically based on historical performance data. Users can easily update profile assignments for volumes at application, pool, and volume levels.

Example 3: Maximizing business application performance and availability with data mobility

Customer service is a top priority for major commercial and retail banks. They strive to maintain good relationships with, and retain current customers as well as attract new ones. They would also like to achieve faster response times for customer transactions involving personal banking or credit cards, and for potential customers inquiring about their services.

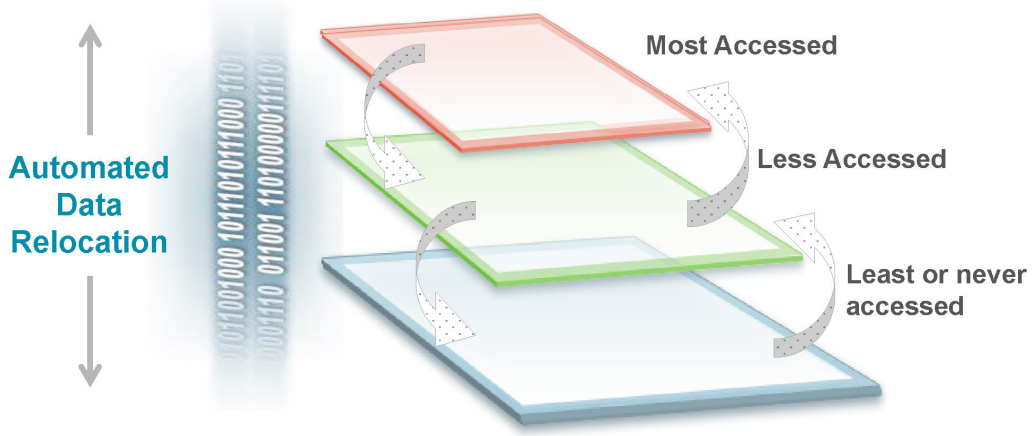
In addition to ensuring the timeliness of critical transactions, banks must provide customers with effective processing of mortgage applications from inception to closing.

Banks must optimize the cost of maintaining data gathered from numerous mortgage applications. While users can tolerate slightly slower response times that are required for transactional systems, they are quickly frustrated by consistently slow responses. In a fast-paced business, older and closed mortgage applications lose business relevance quickly, so it does not make sense to store them on fast storage. A lower tier of storage can be used to achieve effective, long-term archiving of inactive data (such as closed or inactive mortgage applications that companies maintain largely in response to legal requirements).

Solution

A Hitachi Dynamic Tiering (HDT) pool is added to a storage system to support mortgage applications. Using Hitachi Command Suite Mobility, a custom policy is applied to the volumes in the HDT pool that supports the mortgage applications.

The policy is set to ensure that infrequently or never accessed mortgage applications are placed on the lowest cost storage, reducing the total cost of ownership. Conversely, the newest and still-active mortgage applications are promoted to the fastest tier and get the fastest response time.



Management software

To optimize data access and application Quality of Service, Hitachi Command Suite Data Mobility software places data wherever and whenever it is needed. HCS Data Mobility features Dynamic Tiering, Tiered Storage Manager, and the file-tiering capabilities of the storage system.

- *Hitachi Dynamic Tiering* automates data lifecycle management at a low cost while delivering top-tier performance to the information most frequently accessed by the business. HDT manages the tiering dynamically. It monitors and manages space utilization at the page level rather than at the file or dataset level. This means that only frequently referenced parts of a file or dataset reside on the highest tier of storage, minimizing the amount of tier 0 storage required for the highly referenced data.
  HDT identifies hot spots of frequent access and moves them to the highest tier of storage to improve storage performance. It also moves less frequently referenced pages to lower tiers of storage. All of this occurs with complete transparency to the application.
- *Hitachi Tiered Storage Manager (HTSM)* proactively matches application performance and availability needs to storage attributes for optimal placement.
- *Intelligent file tiering* improves performance in file-sharing environments by automatically separating metadata from user data, placing metadata on

the fastest storage tier for improved response times, while keeping user data on less expensive storage tiers.

Example 4: Delivering storage infrastructure as a service through automated workflows

Financial institutions must provide services 24/7, with almost zero tolerance for outages and inaccessibility to data and information. Storage provisioning plays an integral part in data management. Organizations need to control the complexities associated with storage management and balance operational efficiency. A positive customer experience depends on how the data center is controlled and managed and on the ability to deliver applications in a consistent and timely manner. However, to achieve this objective, customers require a solution to alleviate these pain points:

- Manual storage provisioning processes, which can lead to human errors. Studies show that more than 40% of outages in a storage environment are caused by human error.
- Time-consuming operational inefficiencies
- Cost-inefficient storage provisioning, which can waste storage resources
- A requirement to know infrastructure and environmental details, which allows for no abstraction
- A requirement to manually analyze performance and capacity without any built-in intelligence or automation

Solution

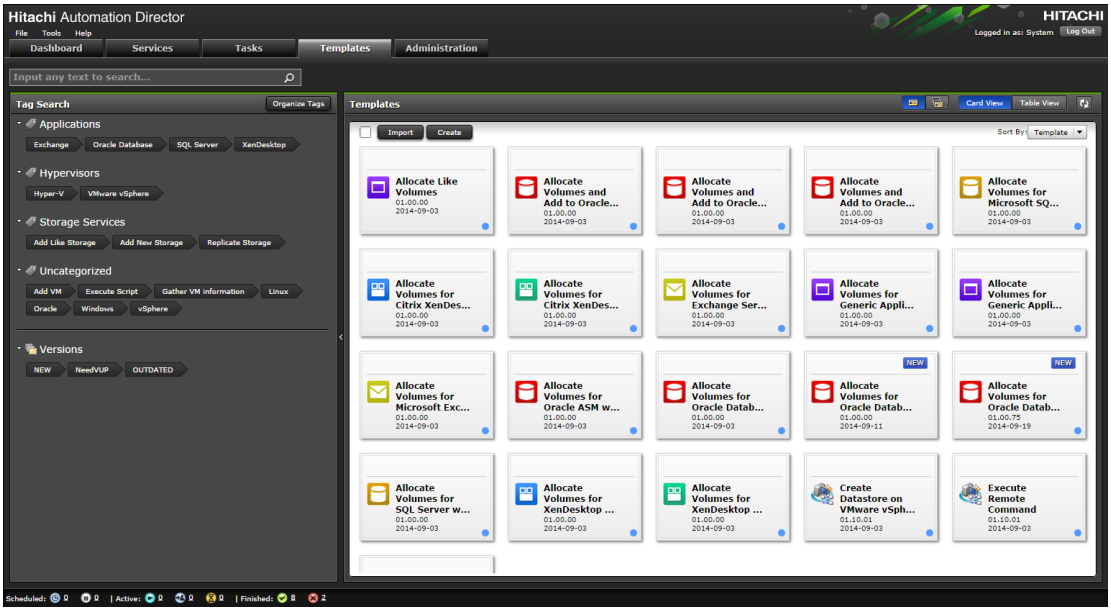
Hitachi Automation Director automates manual storage provisioning processes and provides application-based provisioning services that require minimal user input and that intelligently leverage infrastructure resources. Hitachi Automation Director provides the following solutions to alleviate the pain points that customers experience in the current environment:

- Implements intelligent automation workflows to streamline the storage provisioning process.
- Provides a catalog of predefined service templates and plugin components that incorporate Hitachi best practices in storage provisioning and that minimize human error.
- Provides customizable storage service templates requiring minimal input that administrative users can use to increase operational efficiency.
- Optimizes storage configurations for common business applications such as Oracle, Microsoft Exchange, Microsoft SQL Server® and hypervisors such as Microsoft Hyper-V and VMware.
- Analyzes current storage pool capacity utilization and performance to automatically determine the optimized location for new storage capacity requests and to make storage provisioning more cost-efficient.

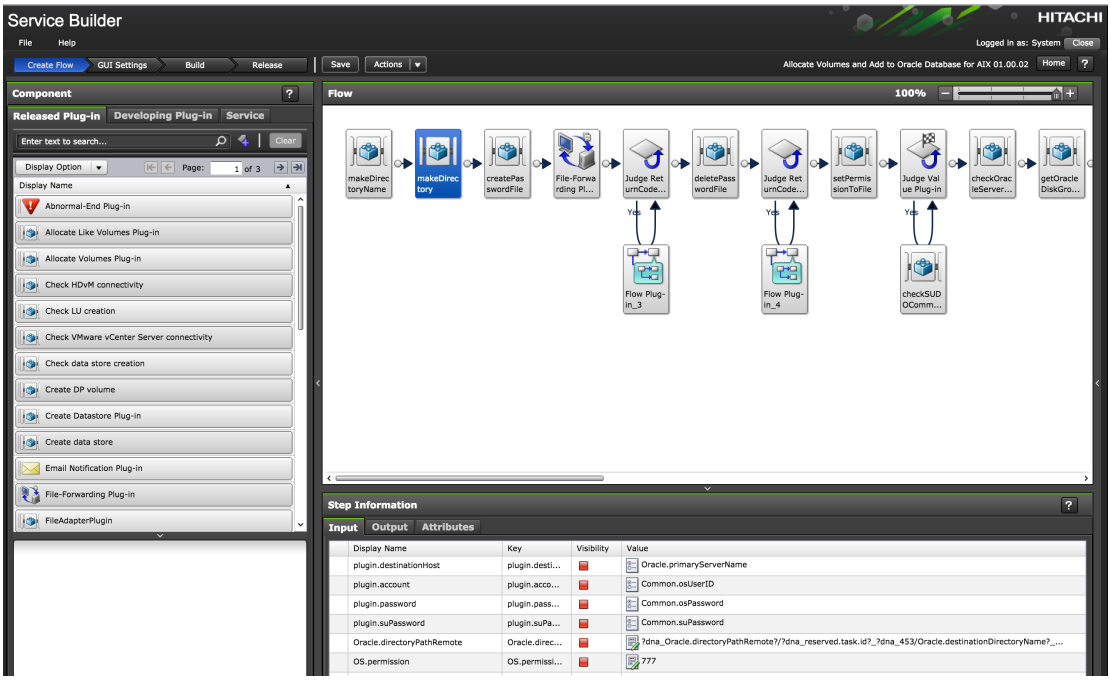
Management software

Hitachi Automation Director offers a web-based portal and includes a catalog of predefined workflows that are based on best practices for various applications. These workflows take into account infrastructure requirements for specific applications, including the appropriate storage tier. Capturing the provisioning process with predefined requirements in the workflow, a storage administrator can repeatedly provision infrastructure with simple requests.

After information for provisioning is submitted, the Automation Director intelligent engine matches the request with the appropriate infrastructure based on performance and capacity analysis. Hitachi Automation Director expedites the provisioning process and enables smarter data center management. It provides a REST-based API to integrate provisioning workflows into existing IT management operation applications.



Hitachi Automation Director includes a comprehensive tool, Service Builder, to create and modify existing workflows and plug-in components that automate the storage management tasks for a given operating environment.



Hitachi Automation Director supports all native block storage systems and 3rd-party storage systems through virtualization technology.

Example 5: Data protection for business-critical Oracle databases

Data protection and recovery operations are cited by most customers as one of their top three IT-related challenges. Meanwhile, traditional solutions cannot keep up with rampant data growth, increasing complexity, and distribution of infrastructure. Tighter data availability service-level requirements (backup window, recovery point objective, and recovery time objective) create an impossible situation for line of business owners.

The simple truth is that backup is broken in certain highly important areas, including critical 24x7 applications with large databases.

The business demands that critical data is protected with little or no data loss and with minimal or no performance or availability impact while the data protection occurs.

Solution

Hitachi Thin Image (HTI) provides fast copies of the production data and Hitachi Universal Replicator (HUR) ensures that there is an asynchronous copy of the data on another storage system in a distant location. Hitachi Data Instance Director (HDID) orchestrates the HTI and HUR data protection

activities through a business-objective-driven, whiteboard-like graphical interface, and ensures application consistency for both local and remote snapshots.

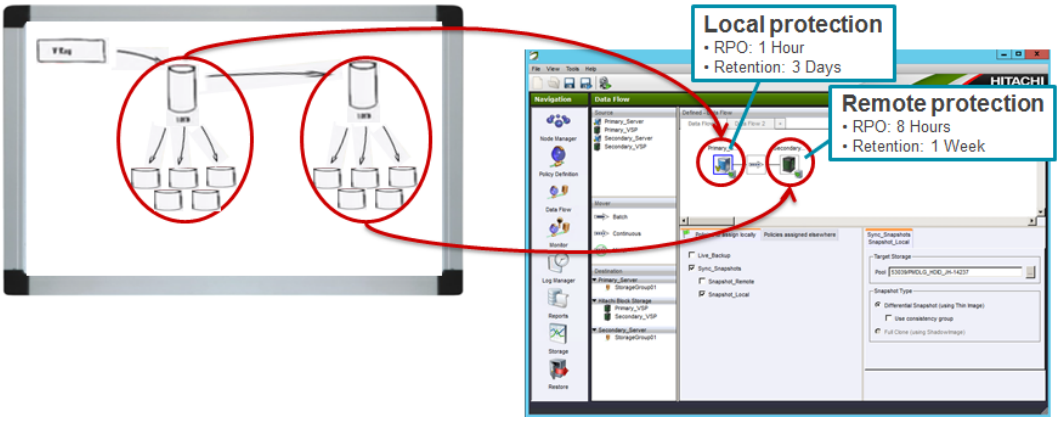
The HDID policy is defined in terms of recovery point objectives (RPO) and retention so that new application-aware snapshots are taken to meet each RPO and deleted after the retention period.

Management software

Hitachi Data Instance Director (HDID) combines modern data protection with business-defined copy data management, simplifying the creation and management of complex data protection and retention workflows.

For simplified management, HDID provides a powerful, easy to use workflow-based policy engine, so that you can define a data protection workflow within 10 minutes:

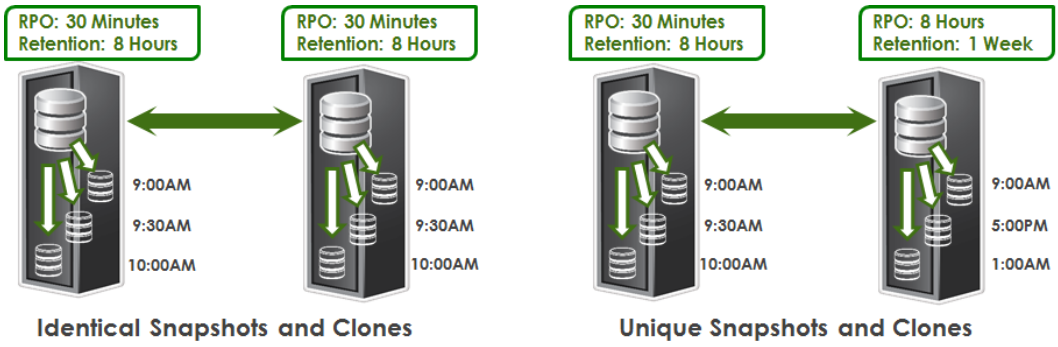
- *Service Level Agreement (SLA)-driven Policy* enables administrators to define the data classification (such as SQL Server or Oracle), data protection operations, and required SLAs (RPO, data retention).
- *Whiteboard-style Data Flow* enables the administrator to define the copy destinations and assign policies to them using drag-and-drop operations**.** The topological view helps the administrator to visualize the data protection processes and align them with the management requirements.



You can use different methods to back up data across multiple sites, as described in the following table and figure.

Method	Description
Identical snapshots and clones	Provide identical RPO and data retention regardless of location. Keeping identical backups provides identical recovery options and

Method	Description
	procedures during a site failover, which simplifies the entire restore process.
Unique snapshots and clones	Provide flexible RPO and data retention based on differing business requirements between normal operation and a site failover. Keeping independent backups enables shorter RPOs and lower retention to be set on the local site for quick recovery, while protecting data longer on the remote site.



5

Documentation

The following tables list the manuals available for Hitachi Virtual Storage Platform G200, G400, G600, G800, Hitachi Virtual Storage Platform F400, F600, F800, Hitachi Infrastructure Director, and optional Hitachi Command Suite components (separate license required).

Table 1 Manuals for VSP Gx00 models and VSP Fx00 models

Subject of guide	Documents
General reference	*Product Overview for Hitachi Virtual Storage Platform Gx00 and Fx00 Models*, MK-92HM8013 (this guide) *Hitachi Virtual Storage Platform Gx00 and Fx00 Release Notes DKCMAIN 83-02-01, SVP 83-02-01*, RN-830201-M011 *Hitachi Command Control Interface Release Notes*, RN-90RD7194 *Hitachi Infrastructure Director Release Notes*, RN-94HID002 *Hitachi Device Manager Release Notes*, RN-00HS266 *Hitachi Tiered Storage Manager Release Notes*, RN-00HS279 *Hitachi Data Instance Director Release Notes*, RN-93HDID000
Hardware reference	*Hitachi Virtual Storage Platform G200 Hardware Reference Guide*, MK-94HM8020 *Hitachi Virtual Storage Platform G400, G600 Hardware Reference Guide*, MK-94HM8022 *Hitachi Virtual Storage Platform G800 Hardware Reference Guide*, MK-94HM8026 *Hitachi Virtual Storage Platform F400, F600 Hardware Reference Guide*, MK-94HM8045 *Hitachi Virtual Storage Platform F800 Hardware Reference Guide*, MK-94HM8046
Management software setup	*System Administrator Guide for Hitachi Virtual Storage Platform Gx00 and Fx00 Models*, MK-92HM8016 *Hitachi Command Suite Installation and Configuration Guide*, MK-90HC173 *Hitachi Command Suite System Requirements*, MK-92HC209 *Command Control Interface Installation and Configuration Guide*, MK-90RD7008 *Hitachi Command Suite Administrator Guide*, MK-90HC175

Subject of guide	Documents
	Hitachi Command Suite Mainframe Agent Installation and Configuration Guide, MK-96HC130 *Hitachi Infrastructure Director Getting Started Guide*, MK-94HID001
External storage	*Hitachi Universal Volume Manager User Guide*, MK-92HM8024
Host configuration	*Open-Systems Host Attachment Guide*, MK-90RD7037 *Provisioning Guide for Hitachi Virtual Storage Platform Gx00 and Fx00 Models* , MK-92HM8014
Provisioning and mobility	*Provisioning Guide for Hitachi Virtual Storage Platform Gx00 and Fx00 Models*, MK-92HM8014 *Hitachi Command Suite User Guide*, MK-90HC172 *Hitachi Infrastructure Director User Guide*, MK-94HID004
Data protection	*Hitachi Thin Image User Guide*, MK-92RD8011 *Hitachi ShadowImage® User Guide*, MK-92HM8021 *Hitachi TrueCopy® User Guide*, MK-92HM8019 *Hitachi Universal Replicator User Guide*, MK-92HM8023 *Global-Active Device User Guide for Hitachi Virtual Storage Platform G Series*, MK-92RD8072 *Hitachi Data Instance Director User Guide*, MK-93HDID001 *Hitachi Data Instance Director Quick Start Guide*, MK-93HDID002 *Hitachi Command Suite Replication Manager User Guide*, MK-99HC166
Analytics	*Performance Guide for Hitachi Virtual Storage Platform Gx00 and Fx00 Models*, MK-92HM8012
Security	*Hitachi Command Suite User Guide*, MK-90HC172 *Encryption License Key User Guide*, MK-92HM8029 *Hitachi Volume Shredder User Guide*, MK-92RD8025
System maintenance	*Hitachi SNMP Agent User Guide*, MK-92HM8015 *Hitachi Command Suite Audit Log Reference Guide*, MK-92HC213 *Hitachi Audit Log User Guide*, MK-94HM8028
Troubleshooting	*Hitachi Command Suite Messages*, MK-90HC178 *Hitachi Device Manager - Storage Navigator Messages*, MK-94HM8017 *Hitachi SNMP Agent User Guide*, MK-92HM8015
Command line interface	*Command Control Interface User and Reference Guide*, MK-90RD7010 *Command Control Interface Command Reference*, MK-90RD7009

Table 2 Command Suite optional component manuals

Subject of guide	Documents
Software installation	*Hitachi Command Suite Tuning Manager Installation Guide*, MK-96HC141 *Hitachi Command Suite Command Director Installation and Configuration Guide*, MK-90HCMD002 *Hitachi Command Suite Compute Systems Manager Installation and Configuration Guide*, MK-91HC195 *Hitachi Command Suite Mainframe Agent Installation and Configuration Guide*, MK-96HC130 *Hitachi Command Suite Automation Director Installation and Configuration Guide*, MK-92HC204 *Hitachi Command Suite System Requirements*, MK-92HC209 *Hitachi Replication Manager Release Notes*, RN-00HS280 *Hitachi Tuning Manager Release Notes*, RN-00HS262 *Hitachi Compute Systems Manager Release Notes*, RN-91HC198 *Hitachi Command Director Release Notes*, RN-90HCMD003
Management software setup	*Hitachi Command Suite Replication Manager Configuration Guide*, MK-90HC175 *Hitachi Command Suite Command Director Installation and Configuration Guide*, MK-90HCMD002 *Hitachi Command Suite Compute Systems Manager Installation and Configuration Guide*, MK-91HC195 *Hitachi Command Suite Tuning Manager Agent Administration Guide*, MK-92HC013
SAN multipathing	*Hitachi Command Suite Compute Systems Manager User Guide*, MK-91HC194 *Hitachi Command Suite Dynamic Link Manager (for AIX®) User Guide*, MK-92DLM111 *Hitachi Command Suite Dynamic Link Manager (for Linux®) User Guide*, MK-92DLM113 *Hitachi Command Suite Dynamic Link Manager (for Solaris) User Guide*, MK-92DLM114 *Hitachi Command Suite Dynamic Link Manager (for Windows®) User Guide*, MK-92DLM129 *Hitachi Command Suite Dynamic Link Manager (for VMware®) User Guide*, MK-92DLM130 *Hitachi Command Suite Global Link Manager Installation and Configuration Guide*, MK-95HC107 *Hitachi Command Suite Global Link Manager Messages*, MK-95HC108
Data protection	*Hitachi Command Suite Replication Manager User Guide*, MK-99HC166
Analytics	*Hitachi Command Suite Tuning Manager Server Administration Guide*, MK-92HC021

Subject of guide	Documents
	Hitachi Command Suite Tuning Manager Agent Administration Guide, MK-92HC013 *Hitachi Command Suite Tuning Manager User Guide*, MK-92HC022 *Hitachi Command Suite Tuning Manager Hardware Reports Reference*, MK-95HC111 *Hitachi Command Suite Tuning Manager Operating System Reports Reference*, MK-95HC112 *Hitachi Command Suite Tuning Manager Application Reports Reference*, MK-95HC113 *Hitachi Command Suite Tuning Manager CLI Reference Guide*, MK-95HC119 *Hitachi Command Suite Tuning Manager Getting Started Guide*, MK-95HC120 *Hitachi Command Suite Command Director User Guide*, MK-90HCMD001
Automation	*Hitachi Command Suite Guide Automation Director User Guide*, MK-92HC205 *Hitachi Command Suite Automation Director Service Builder User Guide*, MK-92HC222
Troubleshooting	*Hitachi Command Suite Tuning Manager Messages*, MK-95HC114 *Hitachi Command Suite Compute Systems Manager Messages*, MK-91HC197 *Hitachi Command Suite Tiered Storage Manager for Mainframe Messages*, MK-92HC210 *Hitachi Command Suite Automation Director Messages*, MK-92HC221
Command line interface	*Hitachi Command Control Interface Installation and Configuration Guide*, MK-90RD7008 *Hitachi Command Suite CLI Reference Guide*, MK-90HC176 *Hitachi Command Suite Tiered Storage Manager CLI Reference Guide*, MK-90HC177 *Hitachi Command Suite Tuning Manager CLI Reference Guide*, MK-95HC119 *Hitachi Command Suite Compute Systems Manager CLI Reference Guide*, MK-91HC196 *Hitachi Command Suite Command Director CLI Reference Guide*, MK-90HCMD004
API	*Hitachi Command Suite Tuning Manager API Reference Guide*, MK-92HC218 *Hitachi Command Suite Command Director API Reference Guide*, MK-90HCMD005 *Hitachi Command Suite Automation Director API Reference Guide*, MK-92HC217

Table 3 Hitachi NAS Platform manuals

Subject of guide	Documents
System installation and configuration	*Hitachi NAS Platform and Hitachi Unified Storage File Module System Installation Guide*, MK-92HNAS015 *Hitachi NAS Platform Network Administration Guide*, MK-92HNAS008
System management	*Hitachi NAS Platform Storage Systems User Administration*, MK-92HNAS013 *Hitachi NAS Platform System Access Guide*, MK-92HNAS014 *Hitachi NAS Platform Server and Cluster Administration Guide*, MK-92HNAS010 *Hitachi NAS Platform Storage Subsystem Administration Guide*, MK-92HNAS012
Data management	*Hitachi NAS Platform Data Migrator Administration Guide*, MK-92HNAS005 *Hitachi NAS Platform File Services Administration Guide*, MK-92HNAS006
Data protection	*Hitachi NAS Platform Replication and Disaster Recovery Administration Guide*, MK-92HNAS009 *Hitachi NAS Platform Backup Administration Guide*, MK-92HNAS007 *Hitachi NAS Platform Snapshot Administration Guide*, MK-92HNAS011 *Hitachi NAS Platform Antivirus Administration Guide*, MK-92HNAS004
System maintenance and repair	*Hitachi NAS Platform 3080 and 3090 G2 Hardware Reference*, MK-92HNAS017 *Hitachi NAS Platform and Hitachi Unified Storage Series 4000 Hardware Reference*, MK-92HNAS030

Hitachi Data Systems

Corporate Headquarters
2845 Lafayette Street
Santa Clara, California 95050-2639
U.S.A.
www.hds.com

Regional Contact Information

Americas
+1 408 970 1000
info@hds.com

Europe, Middle East, and Africa
+44 (0) 1753 618000
info.emea@hds.com

Asia Pacific
+852 3189 7900
hds.marketing.apac@hds.com

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