Hitachi Virtual Storage Platform 5000 Series

90-08-0*x* or later

Product Overview

This guide provides an overview of the Hitachi Virtual Storage Platform 5000 series storage systems, including general specifications, hardware components, software features, and management software.

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Contents

Preface

This guide provides an overview of the Hitachi Virtual Storage Platform 5000 series (VSP 5000 series) storage systems, including hardware components, general system specifications, software features, and management interfaces.

Product version

This document revision applies to the following product versions:

- VSP 5000 series: firmware 90-08-0*x* or later
- SVOS RF 9.8 or later
- Hitachi Ops Center: v10.8.0-00 or later

Changes in this revision

Added information about the following new features and functions:

- NVMe SCM drives
- VSP 5200 and VSP 5600 models
- Compression accelerator feature for VSP 5200 and VSP 5600 models
- Data-in-place (DIP) migration for upgrades to VSP 5600 models

Accessing product documentation

Product user documentation is available on the Hitachi Vantara Support Website: https://knowledge.hitachivantara.com/Documents. Check this site for the most current documentation, including important updates that may have been made after the release of the product.

Getting help

The Hitachi Vantara Support Website is the destination for technical support of products and solutions sold by Hitachi Vantara. To contact technical support, log on to the Hitachi Vantara Support Website for contact information: https://support.hitachivantara.com/en_us/contact-us.html.

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Thank you!

Chapter 1: Virtual Storage Platform 5000 series

Hitachi Virtual Storage Platform 5000 series (VSP 5000 series) represents the industry's highest performing and most scalable storage solution. Built on 57 years of Hitachi engineering experience and innovation in the IT sector, VSP 5000 series offers superior performance, resiliency, and agility, featuring response times as low as 39 microseconds, and all backed up with the industry's first and most comprehensive 100% data availability guarantee.

Key features

Virtual Storage Platform 5000 series storage systems reliably deliver more data faster than ever for open-systems and mainframe applications. These enterprise-level storage systems are available in configurations with up to 69 PB of raw capacity and with scalability to handle up to 33 million IOPS. The Hitachi Remote Ops monitoring system and Hitachi Ops Center Analyzer software enable superior uptime. To ensure that operations are always up and running, VSP 5000 series models can optionally be backed by a 100% data availability guarantee.

VSP 5000 series provides high performance, high availability, and reliability for enterprise-class data centers and features the industry's most comprehensive suite of local and remote data protection capabilities, including true active-active metro-clustering. When combined with server virtualization, storage virtualization supports applications at cloud scale while reducing complexity.

VSP 5000 series is the first storage in the industry to offer a mixed NVMe, SCM solid-state disk (SSD), serial-attached SCSI (SAS) SSD, and HDD environment that can not only scale up in capacity but also scale out for performance. VSP 5000 series models include the industry-leading VSP 5100 and VSP 5500 models and the newest VSP 5200 and VSP 5600 models.

New VSP 5200 and VSP 5600 models

The VSP 5200 and VSP 5600 models provide enhanced capacity efficiency with improved data reduction performance along with SCM tiering and full end-to-end NVMe.

- *Data reduction.* Hardware-assisted data reduction technology offers up to a 40% performance improvement over existing VSP 5000 series models.
- *Performance.* Improved performance of up to 33 million IOPS with latency as low as 39 µs accelerates application response and increases application consolidation, making these models the most powerful and most responsive storage arrays available.
- *Data-in-place migration.* Nondisruptive data-in-place (DIP) migration is provided when upgrading from VSP 5100 to VSP 5600 or from VSP 5500 to VSP 5600.

Key features of VSP 5000 series

Agility and scalability

VSP 5100 and VSP 5200 all-flash arrays (AFAs) are scale-up enterprise storage platforms with one pair of controller nodes supporting open and mainframe workloads. VSP 5500 and VSP 5600 AFAs start with a single node pair and can scale out to three node pairs. All of these models are also available as hybrid arrays (VSP 5100H, VSP 5200H, VSP 5500H, VSP 5600H) that support the following drive types:

- NVMe SCM
- NVMe SSD
- SAS SSD
- SAS FMD (available only when upgrading to VSP 5600)
- SAS HDD

Note: The VSP 5100 and VSP 5200 models support either SAS or NVMe configurations, while VSP 5500 and VSP 5600 support mixed SAS and NVMe backend configurations.

All-flash performance accelerated by NVMe technology

NVMe drives provide high throughput and low latency to achieve high response performance, enabling large volumes of data to be processed rapidly with response times as low as 39 microseconds. NVMe storage class memory (SCM) drives provide significantly quicker access to data, up to 10 times faster than flash drives, and are more durable than flash drives.

Capacity efficiency

The advanced adaptive data reduction (ADR) technologies of VSP 5000 series provide a guaranteed effective capacity of 4:1 to improve storage utilization and reduce storage footprint. Compression and also deduplication, if desired, can be enabled for all internal and external storage media at the volume level for enhanced tunability.

Reliability and resiliency

Leveraging hot-swappable components, nondisruptive maintenance and upgrades, and outstanding data protection, VSP 5000 series offers complete system redundancy and is backed by a 100% data availability guarantee. The active-active controller architecture of VSP 5000 series protects against local faults and performance issues, and hardware redundancy eliminates all active single points of failure, no matter how unlikely, to provide the highest level of reliability and data availability.

Artificial-intelligence-based solutions

All VSP 5000 series models come with Hitachi Ops Center Analyzer, which analyzes telemetry to optimize application performance and prevent extended outages. Manual administrative tasks are streamlined and implemented with fewer errors, facilitating the addition of new applications and the expansion of existing applications. In addition, Hitachi Ops Center Analyzer works with Hitachi Ops Center Automator to maintain best practices and quality of service (QoS).

Simple, easy-to-use management

VSP 5000 series can be set up quickly and managed with ease using Hitachi Ops Center Administrator. Ops Center Administrator reduces the complexity of steps

needed to deploy, monitor, and reconfigure storage resources. In addition, REST APIs allow integration with existing toolsets and automation templates to further consolidate management tasks.

Hitachi Ops Center Suite delivers enhanced AIOps capabilities using AI/ML to provide real-time monitoring and to increase performance and tuning of your storage environment.

Protection from unauthorized access

All VSP 5000 series models are hardened to prevent any leaks of physical data as well as unauthorized system access, enabling you to protect sensitive data from unauthorized access, meet stringent data privacy requirements, and adhere to strict regulatory compliance policies. Additional measures are available to ensure quick recovery from ransomware attacks.

Specifications at a glance

The following tables list the general specifications for VSP 5000 series.

Table 1 Specifications for VSP 5100 and VSP 5200

Feature	VSP 5100	VSP 5100H	VSP 5200	VSP 5200H
Performance (IOPS)	Up to 4,200,000 IOPS		Up to 5,100,000 IOPS	
Maximum number of drives (including spares)	33 NVMe SCM 96 NVMe 192 FMD 768 SFF SSD	33 NVMe SCM 96 NVMe 192 FMD 768 SFF SSD/HDD 384 LFF HDD	33 NVMe SCM 96 NVMe 768 SFF SSD	33 NVMe SCM 96 NVMe 768 SFF SSD/HDD 384 LFF HDD
Maximum raw internal capacity	23 PB (30TB SSD)			
Maximum raw external capacity	287 PB			
Maximum cache capacity	1 TiB			
Host interfaces (ports on front-end modules)	32 x FC-NVMe (32 Gbps) 32 x FC (16 Gbps, 32 Gbps) 32 x FICON® (16 Gbps) 16 x iSCSI (10 Gbps)			

Feature	VSP 5100	VSP 5100H	VSP 5200	VSP 5200H
RAID levels	RAID 1+0 (2D+2D, 4D+4D) RAID 5 (3D+1P, 7D+1P) RAID 6 (6D+2P, 14D+2P)			

Table 2 Specifications for VSP 5500 and VSP 5600

Feature	VSP 5500	VSP 5500H	VSP 5600	VSP 5600H
Performance	Up to 21,000,000 IOPS		Up to 33,000,000	
Maximum number of drives (including spares)	99 NVMe SCM 288 NVMe 576 FMD 2,304 SFF SSD	99 NVMe SCM 288 NVMe 576 FMD 2,304 SFF SSD/HDD 1,152 LFF HDD	99 NVMe SCM 288 NVMe 576 FMD 2,304 SFF SSD	99 NVMe SCM 288 NVMe 576 FMD 2,304 SFF SSD/HDD 1,152 LFF HDD
Maximum raw internal capacity	69 PB (30TB SSD)			
Maximum raw external capacity	287 PB			
Maximum cache capacity	6 TiB (3x controller block)			
Host interfaces (ports on front-end modules)	192 x FC-NVMe (32 Gbps) 192 x FC (16 Gbps, 32 Gbps) 192 x FICON® (16 Gbps) 96 x iSCSI (10 Gbps)			
RAID levels	RAID 1+0 (2D+2D, 4D+4D) RAID 5 (3D+1P, 7D+1P) RAID 6 (6D+2P, 14D+2P)			

Application solutions

Hitachi's portfolio of storage solutions for converged, cloud, storage, server, database, and other applications enables you to solve your application infrastructure challenges and achieve the highest application service levels.

VMware® support

VSP 5000 series all-flash arrays are designed to complement vSphere virtualization to deliver the full benefits of software-defined data center infrastructure. Deep integration with VMware enables you to optimize performance, utilization, virtual machine (VM) provisioning, management, and data protection.

- **Hitachi Storage Provider for VMware vCenter (VASA)**

  Use Hitachi Storage Provider for VMware vCenter to enable storage-aware tagging services for VMFS and to enable VMware vSphere Virtual Volumes (vVols) for a software-defined, hardware-enabled Hitachi Storage infrastructure. Hitachi Storage Provider enables efficient provisioning and usage of storage and VMDK resources based on application-specific data services, such as snapshot, encryption, and replication.

- **Hitachi Infrastructure Management Pack for VMware vRealize Operations (vROPS)**

  Hitachi Infrastructure Management Pack for VMware vROPS integrates metrics and alerts from physical and virtual layers to help you manage the capacity and performance of Hitachi storage and converged infrastructure deployments in VMware environments. By providing dashboards, metrics, and correlated alerts, Hitachi vROPS significantly enables efficient resource utilization and proactive troubleshooting to reduce operational costs.

- **Hitachi Storage Connector for VMware vRealize Orchestrator (vRO)**

  Hitachi Storage Connector for VMware vRO enables you to automate and orchestrate workflow tasks on VSP 5000 series and other Hitachi storage, extending the capabilities of VMware vRO by providing access to over 130 foundational Hitachi storage-specific workflows.

- **Hitachi Infrastructure Content Pack for VMware vRealize Log Insight (vRLI)**

  Hitachi Infrastructure Content Pack for VMware vRLI delivers real-time log analysis and advanced troubleshooting across physical and virtual infrastructures. It simplifies searching for errors by collecting and grouping information to show important, relevant, and useful events, and it provides a comprehensive view into Hitachi storage systems, enabling you to identify potential issues and keeping track of components that show departure from normal operations.

- **Hitachi Storage Plug-in for VMware vCenter**

  Using Hitachi Storage Plug-in for VMware vCenter integrates management of VSP 5000 series and other Hitachi storage systems within the VMware vCenter console, enabling your VMware vCenter administrator to provision and manage datastores with essential configuration options from Hitachi storage systems.

- **Hitachi Storage Replication Adapter (SRA) for VMware Site Recovery Manager**

  VMware vCenter Site Recovery Manager (SRM) automates the disaster recovery and testing process using either host or storage-based replication. Hitachi Storage Replication Adapter is the software interface that integrates VSP 5000 series and other Hitachi storage systems and its replication software with VMware vCenter SRM processes. Used together, VMware vCenter SRM and Hitachi storage and software provide an automated and seamless disaster recovery solution within the VMware vCenter infrastructure.

- **Hitachi Ops Center Protector Adapter (Protector SRA) for VMware Site Recovery Manager**

  The Hitachi Ops Center Protector software provides a higher level of automation for configuration of local and remote replication relationships between primary and secondary systems. The Protector SRA is compatible with Ops Center Protector replication-managed environments that manage all the pausing, swapping, and resuming of the associated replication pairs that vCenter SRM may require. The Protector SRA is deployed independently from Hitachi Storage Replication Adapter for VMware SRM.

- **Hitachi Ops Center Protector Connector for VMware vRealize Orchestrator (vRO)**

  This connector enables admins to include Ops Center Protector storage hardware offload-based services such as VM-level backup, restore, and copy data management functionality in their vRO Workflows. Supported workflows include backup and restore of VMs, clone VMs from prior snapshots, and mount VMDKs from snapshots to any VM. These vRO operations can be performed from the vCenter UI via the packaged XML imported into vCenter.

- **VMware vSphere Storage APIs for Array Integration**

  VMware vSphere Storage APIs for Array Integration (VAAI) allow VMware vSphere environments to use advanced features and capabilities of VSP 5000 series and other Hitachi VSP storage systems from within the VMware interface. Processing is performed directly on the storage infrastructure to move the I/O load from the VMware vCenter host platform onto the storage controller. Offloading storage-related operations to the storage system speeds up the datastore and VMDK provisioning operations and frees virtualization management for more critical tasks.

Microsoft Windows® support

Server virtualization integration with leading virtual server platforms gives you end-to-end visibility from an individual virtual machine to the storage logical unit and protects large-scale multivendor environments. Support for Microsoft Windows® (including Microsoft Hyper-V) and Microsoft System Center includes:

- Microsoft Virtual ShadowCopy Service (VSS)
- Microsoft Windows Offloaded Data Transfer (ODX)
- Hitachi Infrastructure Adapter for Microsoft Systems Center Operations Manager
- Hitachi Storage Adapter for Microsoft Storage Management Provider
- Hitachi Storage Adapter for Microsoft Systems Center Orchestrator

Oracle® support

Hitachi Vantara has developed and supported IT solutions for many of the world's largest companies with the most demanding Oracle® database environments, solutions that maximize business value, enhance progress toward greater business outcomes, and ensure performance from Oracle® systems.

- Hitachi storage and server adapters for Oracle® databases provide integrated tools for converged infrastructure management and data protection. Hitachi Storage Adapters for Oracle Enterprise Manager, Oracle VM, Oracle Web Center, Oracle Automated Storage Reclamation Utility, and Oracle Database Cloning help you manage your database with less effort and better results. Hitachi Storage Adapter for Oracle Recovery Manager integrates multiple protection services to maximize database availability.
- Hitachi drivers for Oracle® environments enhance consolidation, performance, and efficiency.
- The Database Infrastructure Evaluation Tool (DIET), available to Oracle® database administrators at no cost, analyzes your entire Oracle® database environment, and provides best practices and expert recommendations on areas for improvement to ensure your storage, compute, and converged infrastructure operates at peak utilization.
- Hitachi Dynamic Provisioning gives your Oracle® applications the right amount and right type of storage to maximize performance and efficiency.
- Hitachi Dynamic Tiering offers finely tuned performance for Oracle®, automatically keeping the most crucial data on the fastest storage.

Chapter 2: Storage system hardware

Hitachi Virtual Storage Platform 5000 series (VSP 5000 series) storage systems are high-performance, large-capacity, enterprise RAID storage systems that accommodate scalability to meet a wide range of capacity and performance requirements. VSP 5000 series features all-flash and hybrid models that can scale up in capacity and also scale out for performance, allowing for massive consolidation of workloads and providing exceptional performance and efficiency.

Hardware overview

Combining all-flash storage accelerated by NVMe technology and a new multi-node architecture with the proven performance and resiliency of Hitachi VSP technology, VSP 5000 series offers state-of-the-art advances that provide the highest performance and reliability to meet the most demanding requirements.

VSP 5000 series storage systems are available in 2-node, 4-node, and 6-node models that support a variety of drives, including NVMe storage class memory (SCM) drives, NVMe solid-state devices (SSDs), SAS hard disk drives (HDDs), SAS SSDs, and Hitachi flash module drives (FMDs).

- **All-flash arrays**

  VSP 5000 series AFAs (VSP 5100, 5200, 5500, 5600) offer industry-leading NVMe flash performance. These storage systems provide an all-flash solution that works seamlessly with other Hitachi infrastructure products through common management software and rich automation tools.

- **Hybrid arrays**

  VSP 5000 series hybrid arrays (VSP 5100H, 5200H, 5500H, 5600H) combine high-speed Hitachi flash drives with data reduction and Hitachi Dynamic Tiering, making it simple to move to all-flash gradually over time.

Storage system architecture

The new multi-node architecture of VSP 5000 series allows scale out and linear performance expansion as storage needs increase. All VSP 5000 series models share the same hardware architecture, differing only in number of nodes, number and types of features (front-end modules, back-end modules), number and types of drives, and data reduction hardware (compression accelerator module for VSP 5200 and VSP 5600 models).

VSP 5000 series models are available in the following configurations:

- VSP 5100: 2-node AFA
- VSP 5100H: 2-node hybrid array
- VSP 5200: 2-node AFA with enhanced controllers
- VSP 5200H: 2-node hybrid array with enhanced controllers
- VSP 5500: 2-node, 4-node, or 6-node scalable AFA
- VSP 5500H: 2-node, 4-node, or 6-node scalable hybrid array
- VSP 5600: 2-node, 4-node, or 6-node scalable AFA with enhanced controllers
- VSP 5600H: 2-node, 4-node, or 6-node scalable hybrid array with enhanced controllers

Nondisruptive data-in-place (DIP) migration is supported for upgrades from VSP 5100 to VSP 5600 and from VSP 5500 to VSP 5600.

The redundancy and backup features of VSP 5000 series eliminate all active single points of failure, no matter how unlikely, enabling the storage system to provide the highest level of reliability and data availability. Each node pair features an advanced, multiple-redundancy architecture. All physical and logical elements needed to sustain processing are duplicated within each node pair (front-end modules, back-end modules, and separate, duplicate copies of cache and shared memory contents). In addition, the hosts are connected to each node pair using an alternate path scheme, and the front-end and back-end modules are also split across the nodes within each node pair to provide full backup.

In addition to the high-level of redundancy that this architecture delivers, many of the individual hardware components contain redundant circuits, paths, or processors, enabling the storage system to remain operational in the unlikely event of multiple component failures. Each node in a node pair is powered by its own set of power supplies that can provide power for the entire node pair in the event of power supply failure. Because of this redundancy, a single node pair can sustain even the loss of multiple power supplies and still continue operation.

Hardware components

The VSP 5000 series models are rack-mounted, enterprise-level storage systems supporting all-open, all-mainframe, and multiplatform configurations. The main hardware components are the controller boards, cache memory, cache flash memory, front-end modules, back-end modules, drives, service processor (SVP), and power supplies and batteries.

Controller boards for VSP 5100 and VSP 5500

The controller boards for VSP 5100 and VSP 5500 contain two 10-core Intel processors on each board, providing 25% more core processors than VSP G1x00 and VSP F1500 models. The fabric-acceleration module (also called Hitachi Interconnect Edge or HIE) controls data transfer between the controllers.

Enhanced controller boards for VSP 5200 and VSP 5600

The enhanced controller boards for VSP 5200 and VSP 5600 are equipped with newer high-performance 10-core Intel processors, enabling the VSP 5200 and VSP 5600 models to deliver up to 33M IOPS.

Compression accelerator module for VSP 5200 and VSP 5600 (open-systems only)

The compression accelerator module, which includes the compression accelerator and a fan, is a new hardware component for VSP 5200 and VSP 5600. The compression accelerator performs compression for these models instead of the storage system controllers, resulting in improved performance for the controllers.

When a VSP 5100 or VSP 5500 model is upgraded to VSP 5600, the existing controllers are replaced with the enhanced controllers and the fan modules are replaced with the compression accelerator modules.

Cache memory

VSP 5000 series places all read and write data in cache. The amount of fast-write data in cache is dynamically managed by the cache control algorithms to provide the optimum amount of read and write cache, depending on the workload read and write I/O characteristics. In addition, write data is mirrored until destaged, while read data is not mirrored to use cache more efficiently. All cache memory in VSP 5000 series is nonvolatile and protected by battery backup.

Cache flash memory

The nonvolatile cache flash memory (CFM) contains the cache directory and configuration information for the storage system, and it also backs up the data in cache in the event of an input power failure. Cache flash memory is also duplexed across controllers and is protected by (redundant) battery backup.

Front-end modules

The front-end modules (FEMs) process the commands from the hosts and manage host access to cache. Each FEM feature (pair of boards) contains one type of host channel interface: Fibre Channel, iSCSI (optical), or FICON®. The channel interfaces on each board can transfer data simultaneously and independently. Fibre Channel and FICON® features, including FC-NVMe support on the 32-Gbps FC boards, are available in shortwave (multi-mode) and longwave (single-mode) versions.

The FEMs can also be called channel boards (CHBs).

Back-end modules

The back-end module (BEM) features, also installed in pairs for redundancy and performance, control the transfer of data between the data drives and cache. VSP 5000 series supports four types of BEM features: standard SAS BEMs, standard NVMe BEMs, mixed SAS/NVMe BEMs, and encrypting BEMs. The encrypting BEMs (EBEMs) provide data-at-rest encryption for open and mainframe data on NVMe or SAS drives. RAID-level intermix (all supported RAID types) is allowed within an array domain (under a BEM pair).

The BEMs can also be called disk boards (DKBs).

Drives

VSP 5000 series supports a variety of drives, featuring ultra-high-speed-response nonvolatile memory express (NVMe) solid-state devices (SSDs) and NVMe SCM drives in addition to serial-attached SCSI (SAS) hard disk drives (HDDs), SAS SSDs, and Hitachi flash module drives (FMDs). Dynamic sparing is performed automatically if needed: spare drives, which can be hot swapped without interrupting data availability, can be configured to replace failed drives automatically, securing the fault-tolerant integrity of the logical drives.

The drive chassis types for internal drives are:

- Small-form-factor (SFF) chassis for 2.5-inch (SAS) drives
- SFF chassis for 2.5-inch NVMe drives
- Large-form-factor (LFF) chassis for 3.5-inch (SAS) drives
- FMD chassis for Hitachi FMDs (also SAS)

Each drive chassis contains enclosure boards and AC-DC power supplies with built-in cooling fans that are implemented in a duplex configuration for redundancy. All drive chassis components can be replaced and added while the storage system is in operation.

VSP 5000 series also supports a diskless configuration that has external storage only and no internal drives. External storage systems benefit from the data services that VSP 5000 series delivers, including data reduction, metroclustering, and automation.

Service processor (SVP)

VSP 5000 series includes a service processor (SVP) and, optionally, a second back-up SVP. The SVP, which is integrated into the storage system, is used by authorized Hitachi Vantara personnel to maintain, service, and upgrade the storage system. The SVP collects performance data for hardware components to enable diagnostic testing and analysis and is connected with a service center for remote monitoring and maintenance of the storage system.

Power supplies and batteries

Each controller node is powered by redundant power supplies, with each power supply able to provide power for the entire node, if necessary. The AC power supplied to each node is converted by the AC-DC power supplies to supply DC power to other storage system components. The backup batteries for user data are installed on cache backup modules (BKMF: backup module with fan) attached to the controller boards. If input power is interrupted for more than 20 milliseconds, the controllers use power from the batteries to back up the data in cache as well as the storage system configuration data onto the cache flash memory.

Chapter 3: Software components and features

Virtual Storage Platform 5000 series is powered by Hitachi's Storage Virtualization Operating System RF (SVOS RF) and supported by Hitachi storage management software, enabling you to effectively manage, centralize, and control your software-defined infrastructure while at the same time reducing complexity, costs, and risk.

Storage Virtualization Operating System RF

SVOS RF delivers best-in-class business continuity and data availability and simplifies storage management. Flash performance is optimized with a patented flash-aware I/O stack to further accelerate data access. Adaptive inline data reduction increases storage efficiency while enabling a balance of data efficiency and application performance. Industry-leading storage virtualization allows SVOS RF to use third-party all-flash and hybrid arrays as storage capacity, consolidating resources and extending the life of storage investments.

SVOS RF works with the virtualization capabilities of the Hitachi VSP storage systems to provide the foundation for global storage virtualization. SVOS RF delivers software-defined storage by abstracting and managing heterogeneous storage to provide a unified virtual storage layer, resource pooling, and automation. SVOS RF also offers self-optimization, automation, centralized management, and increased operational efficiency for improved performance and storage utilization. Optimized for flash storage, SVOS RF provides adaptive inline data reduction to keep response times low as data levels grow, and selectable services enable data-reduction technologies to be activated based on workload benefit.

SVOS RF integrates with Hitachi’s Base and Advanced software packages to deliver superior availability and operational efficiency. You gain active-active clustering, data-at-rest encryption, insights via machine learning, and policy-defined data protection with local and remote replication.

Base software package

The Base software package, which comes standard on all VSP 5000 series, delivers software to simplify management and protection of your data and includes best-class analytics software to improve uptime and ROI of IT operations.

The Base software package includes:

- SVOS RF core functionality, including Universal Volume Manager for storage virtualization
- Hitachi Ops Center Administrator for simple, GUI system management
- Hitachi Dynamic Link Manager for path failover, path failback, and automatic load balancing
- Local replication for cloning and snapshots
- Hitachi Ops Center Protector for copy management and data protection
- Hitachi Ops Center Analyzer for data-center-wide, AI-powered insights
- Data Mobility for tiering between storage arrays and media types

Advanced software package

When business continuity is critical, or when you need to automate and accelerate delivery of IT resources, you can upgrade to the Advanced software package. Remote replication and metroclustering software enables delivery of continuous, scalable data access. Intelligent automation software simplifies and enhances provisioning of resources to reduce operational overhead and avoid misconfigurations.

The Advanced software package includes:

- All Base package products and features
- Remote replication (TrueCopy and Universal Replicator) for disaster recovery
- Global-active device (GAD) for business continuity and metro clustering
- Hitachi Ops Center Automator for data-center-wide workflow automation and orchestration

In-System Replication software

Hitachi's In-System Replication software for VSP 5000 series ensures rapid restart-and-recovery times by combining local mirroring of full volumes with fast, space-efficient snapshots.

- High-speed, nondisruptive in-system mirroring technology of Hitachi ShadowImage® rapidly creates multiple copies of mission-critical information within the storage system in mainframe and open-systems environments. ShadowImage keeps data RAID-protected and fully recoverable, without affecting service or performance levels. Replicated data volumes can then be split from the host applications and used for system backups, application testing, and data mining applications, while business continues to run at full capacity.
- The high-speed, nondisruptive snapshot technology of Hitachi Thin Image snapshot software rapidly creates copies of mission-critical information within the storage system or virtualized storage pool without impacting host service or performance levels. Because snapshots store only the changed data, the storage capacity required for each snapshot copy is substantially less than the capacity of the source volume. As a result, Thin Image can provide significant savings over full-volume cloning methods. Thin Image snapshot copies are fully read/write compatible with other hosts and can be used for system backups, application testing, and data mining applications.

Application-consistent ShadowImage clones and Thin Image snapshots can be orchestrated using Hitachi Ops Center Protector (Protector) software. Protector supports Microsoft® Exchange and SQL Server® as well as Oracle databases on Linux operating systems. These clones and snapshots can be easily created as part of a complete data protection workflow. Protector can also trigger a ShadowImage clone or Thin Image snapshot on the remote side of a distance replication pair.

Hitachi Vantara Global Services Solutions provides Implementation Services for in-system replication software. These services improve testing and application deployment operations with high-speed, problem-free data duplication. Hitachi Vantara consultants tailor the configuration and integration of the in-system replication software to meet your backup and recovery application requirements.

Remote Replication software

Hitachi's Remote Replication software for VSP 5000 series combines Hitachi TrueCopy® and Universal Replicator solutions to enable remote data protection at up to four data centers. Providing continuous, nondisruptive, host-independent data replication, Hitachi Remote Replication software ensures the highest levels of data integrity for local or metropolitan areas. Copies generated by Hitachi Remote Replication software products can be used for the rapid recovery or restart of production systems on primary or secondary (disaster recovery) systems following an outage. They can also be used for nondisruptive test and development, data warehousing, data mining, data backup, and data migration applications.

SVOS RF business continuity solutions are designed for maximum flexibility, enabling organizations to build a recovery strategy that spans multiple data centers and delivers to their specific SLAs.

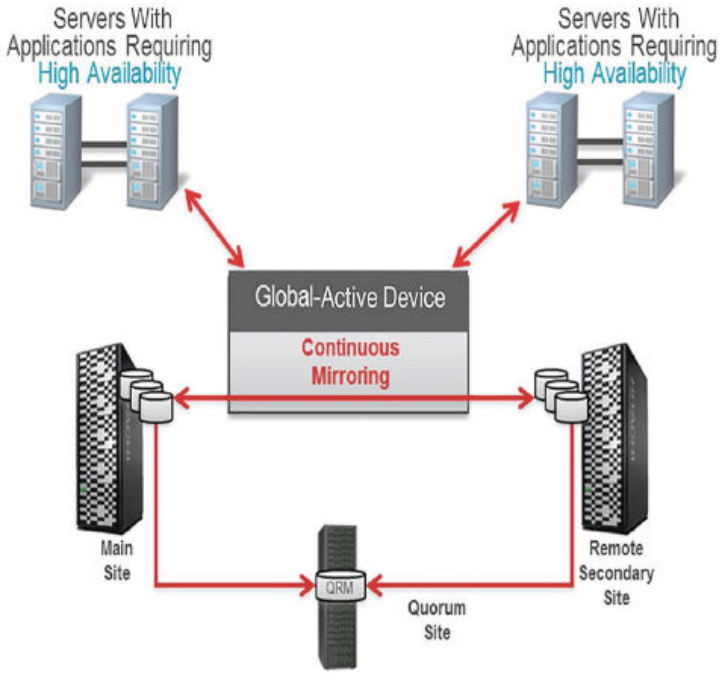
- Hitachi TrueCopy® enables synchronous remote replication of mission-critical data from a primary data center to a secondary data center. TrueCopy delivers immediate zero-RPO and automated failover capabilities and is compatible with open-systems and mainframe environments.
- Universal Replicator features journal disk caching for achieving tight RPO time capabilities, even in the event of a network outage. Universal Replicator provides asynchronous remote copy, over any distance and is compatible with open-systems and mainframe environments. Deployed implementations can be configured with or without delta resync, which ensures replication consistency for the highest level of remote copy data integrity at any distance.

TrueCopy and Universal Replicator can also be automated as part of an end-to-end, unified data protection, retention, and recovery management solution within Hitachi Ops Center Protector (Protector) software. Protector can also automatically trigger Thin Image snapshots and ShadowImage clones from the remote copy of the data.

From remote copy planning to advanced implementation services, Hitachi Vantara Global Services Solutions can support the successful and timely deployment of the most resilient data protection infrastructures. Services to support TrueCopy and Universal Replicator software and other business continuity and disaster recovery solutions from Hitachi Vantara are available.

High availability with global-active device

Global-active device (GAD) simplifies and automates high availability to ensure continuous operations for mission-critical data and applications. GAD provides full metroclustering between data centers that can be up to 500 km apart. Supporting read/write copies of the same data in two places at the same time, GAD's active-active design implements cross-mirrored storage volumes between matched VSP storage systems to protect data and minimize data-access disruptions for host applications due to site or storage system failures. GAD ensures that up-to-date data is always available and enables production workloads on both systems, while maintaining full data consistency and protection.



Global-active device volume pairs have 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 GAD pairs 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.
- **High performance:** Multipath software allows application access to mirrored data from the shortest path for highest performance.
- **Workload mobility:** The concurrent data mirroring capability of global-active device makes data immediately available to servers at a second site (over metro distances).
- **Nondisruptive data migration:** Data volumes can be migrated between storage systems without disruption to normal operations.

Data Mobility software

By simplifying tiered storage management, Hitachi's Data Mobility software delivers the highest storage performance for the most frequently accessed data while at the same time lowering costs by automatically optimizing data placement.

Hitachi Data Mobility software automatically and transparently moves data across tiers of storage, maximizing business application service levels while minimizing costs. Support for a broad range of storage media, configurations, and virtualized third-party arrays facilitates seamless data migration from older to newer Hitachi storage.

- Dynamic Tiering automates data placement and access in a tiered storage environment, dynamically moving the most active data to the highest-performing storage tiers while moving less frequently accessed data to lower tiers. An additional active-flash mode moves suddenly active data to higher-performing tiers in real time. In seconds to subseconds, active flash responds to workload demands based on current I/O activity and proactively preserves flash endurance by monitoring and demoting pages that exceed thresholds for heavy write I/O.
- Nondisruptive data migration is accomplished using the global storage virtualization technology of the Hitachi VSP storage systems. Resources on the migration source storage system are virtualized on the target storage system. From the perspective of the host, I/O requests continue to be serviced by the source storage system during the migration process.

Data-at-rest encryption

The Encryption License Key feature of VSP 5000 series protects your sensitive data against breaches associated with storage media (for example, loss or theft). Encryption License Key includes a controller-based encryption implementation as well as integrated key management functionality that can leverage third-party key management solutions via the OASIS Key Management Interoperability Protocol (KMIP).

The data at-rest encryption (DARE) functionality is implemented using cryptographic chips included as part of the encryption hardware. The encryption hardware encrypts and decrypts data as it is being written to and read from the physical drives. The key management functionality controls the full key life cycle, including the generation, distribution, storage, backup/recovery, rekeying, and destruction of keys. In addition, the design of this key management functionality includes protections against key corruption (for example, integrity checks on keys) as well as key backups (both primary and secondary).

The Encryption License Key feature provides the following benefits:

- Hardware-based Advanced Encryption Standard (AES) encryption, using 256-bit keys in the XTS mode of operation, is provided for open and mainframe systems.
- Encryption can be applied to some or all supported internal drives.
- Each encrypted internal drive is protected with a unique data encryption key.
- Encryption has negligible effects on I/O throughput and latency.
- Encryption requires little to no disruption of existing applications and infrastructure.
- Cryptographic erasure (media sanitization) of data is performed when an internal encrypted drive is removed from the storage system.

CLI and API integration

Advanced management tools, including CLIs and REST APIs, are available for more advanced management of your VSP 5000 series storage environment.

The Command Control Interface (CCI) software provides powerful command-line control for VSP 5000 series. CCI enables you to configure your storage system and perform data management operations by issuing commands directly to the storage system. CCI commands can be used interactively or in scripts to automate and standardize storage administration functions, thereby simplifying storage administration tasks and reducing administration costs. CCI also provides enhanced control and functionality for SVOS RF in-system and remote replication operations, including ShadowImage, Thin Image, TrueCopy, Universal Replicator, and global-active device. For remote replication operations, CCI interfaces with the system software and high-availability (HA) software on the hosts as well as the software on the storage systems to provide failover operation commands that support mutual hot standby in conjunction with industry-standard failover products.

REST-based APIs for VSP 5000 series extend operations, enabling integration with existing toolsets and automation templates to further simplify and consolidate management tasks. For details about API integration solutions for VSP 5000 series, contact your Hitachi Vantara representative.

Storage management software

The Hitachi approach to software-defined solutions enables you to manage your IT infrastructure to align storage resources to rapidly changing business demands, achieve superior returns on infrastructure investments, and minimize operational costs. Hitachi Ops Center, Hitachi's suite of management software for VSP 5000 series, delivers high storage availability, mobility, and optimization for key business applications and automates storage management operations with integrated best practices to accelerate new resource deployments. Hitachi storage management software enables you to manage more storage capacity with less effort and ensure that service levels for business-critical applications are met while increasing utilization and performance of virtualized storage assets.

The storage management software for VSP 5000 series includes the following products:

- Ops Center Administrator
- Ops Center Analyzer
- Ops Center Automator
- Ops Center Protector

For details about Hitachi Ops Center, visit the Ops Center website, or contact your Hitachi Vantara representative.

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