VSP G1000, VSP G1500, and VSP F1500 overview

The following describes the hardware components of the VSP G1000, VSP G1500, and VSP F1500 storage systems.

System overview

The VSP G1000, VSP G1500, and VSP F1500 are high-capacity, high-performance, unified block and file enterprise storage systems that offer a wide range of storage and data services, software, logical partitioning, and unified data replication across heterogeneous storage systems.

Features

The VSP G1000, VSP G1500, and VSP F1500 storage systems include state-of-the-art advances in hardware technology that improve reliability, serviceability, and accessibility to drives and other components when maintenance is required.

- VSP F1500 all-flash array is configured exclusively with the latest generation of flash module drives (FMDs) to provide performance optimized for intense I/O operations. Designed for flash-first, high-performance workloads and leveraging Hitachi SVOS-based deduplication and compression, VSP F1500 offers up to five times greater ROI with unified support for SAN, NAS, and mainframe workloads.
  - Accelerated flash architecture delivers consistent, low-latency IOPS at scale.
  - Adaptive flash management distributes writes and rebalances load over time.
  - Hitachi FMDs deliver enterprise performance with superior functionality and greater cost value.
  - Hitachi FMD-HDE (high-density with encryption) drives provide high-density storage capacities with accelerated compression and hardware-embedded encryption capabilities.

- The VSP G1500 and VSP F1500 are equipped with new virtual storage directors (VSD). The VSD uses the latest generation of Intel Xenon 2.3-GHz 8-core microprocessor to efficiently manage the front-end directors, back-end directors, PCI Express interface, local memory, and communication between the service processor.

- Hitachi Accelerated Flash FMD DC2 storage offers a patented data-center-class design and rack-optimized form factor that delivers more than 8 PB per system. The FMD DC2 supports a sustained performance of 100,000 8K I/O per second, per device, with low and consistent response time.

- The latest 2.5-inch and 3.5-inch 6 Gbps SAS drives support lower power consumption and higher density per rack with up to 2,304 drives in six 19-inch standard racks. For more information about drive specifications, see Storage system specifications. For information about Hitachi racks, refer to the Hitachi Universal V2 Rack Reference Guide.

- Hitachi NAS Platform hardware-accelerated network protocols support up to 2 Gbps throughput for sequential workloads and up to 1.2 million NFS operations per second.

- Efficient caching makes up to 2 TB global cache dynamically accessible by all connected hosts and Hitachi NAS Platform nodes.
• The HNAS file module provides primary data deduplication using hardware-based SHA-256 calculation engines. This module achieves up to 90% capacity savings while maintaining high performance.

• When each controller is housed in a separate rack, the two controller racks can be placed up to 100 meters apart. In addition, the drive racks attached to a controller rack can be placed up to 100 meters from the controller rack. This enables maximum flexibility to optimize data center space usage and provides ease of access for operation and maintenance. See the detailed description of this feature and the cable diagrams in Long cable connections.

• Expandable cache memory (up to 2 TB per 2-controller system).

• Nondisruptive migration is available as a service from Hitachi Vantara representatives as well as by purchasing an optional software license for customer implementation. Best practice is to use the nondisruptive migration planning service offered by Hitachi Vantara Global Solution Services (GSS). See Nondisruptive service and upgrades.

• High temperature mode is a licensed feature that allows the storage system to operate at either standard temperature (60.8°F to 89.6°F / 16°C to 32°C) or higher temperatures (60.8°F to 104°F / 16°C to 40°C) in a data center, saving energy and cooling costs. See high temperature mode.

**High performance**

Hitachi Vantara offers the highest performance storage systems for the enterprise-class segment. The high-performance storage system enables consolidation and real-time applications, a wide range of storage and data services, software, logical partitioning, along with simplified and unified data replication across heterogeneous storage systems. Its large-scale, enterprise class virtualization layer, combined with Hitachi Dynamic Tiering and thin provisioning software, allows you to consolidate internal and external storage into one pool.

The storage system includes several features that improve system performance:

• Hitachi Accelerated Flash module drives that support ultra-high I/O rates and ultra-low latency.

• Solid-state drives with high-speed response.

• Device Manager - Storage Navigator and Hitachi Ops Center Administrator provide integrated data and storage management to ensure high-speed data transfer between the back-end directors and small form-factor (SFF) or large form-factor (LFF) drives at 6 Gbps using a SAS interface.

• Ability to scale and upgrade system performance.

• Compression functionality reduces the size of stored data by encoding without reducing the amount of data.

• Deduplication functionality deletes the duplicated data while keeping the data in a single location when the same data is written to different addresses within the same pool.

• Disk drives operating at 7,200, 10,000, or 15,000 RPM.

**Scalability**

The storage systems offer an entirely new type of scalable and adaptable integrated active-active architecture that supports integrated management. Hitachi storage systems can be configured in numerous ways to meet performance and storage requirements.

Scalable system performance

System performance can be optimized according to the needs of the user and can be easily upgraded (in small or large increments) as storage needs increase. The following table shows the supported configurations.
### Table 1: System performance configurations

<table>
<thead>
<tr>
<th>Number of controllers</th>
<th>Number of VSD pairs / CPU cores</th>
<th>Cache size $^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>min = 1 (16 cores)</td>
<td>min = 64 GB $^3$</td>
</tr>
<tr>
<td></td>
<td>max = 4 (64 cores)</td>
<td>max = 1 TB</td>
</tr>
<tr>
<td>2</td>
<td>min = 2 (32 cores)</td>
<td>min = 64 GB per system (32 GB per controller) $^3$</td>
</tr>
<tr>
<td></td>
<td>max = 8 (128 cores)</td>
<td>max = 2 TB</td>
</tr>
</tbody>
</table>

### Notes:

1. A VSD pair consists of two VSD blades. Each VSD contains one 8-core processor.
2. Cache memory modules can be either 16 GB or 32 GB, but only one memory module size can be used in a system.
3. HDs minimum cache per system is 64 GB whether the system contains one or two controllers.

### Scalable storage capacity

- The minimum configuration is a single rack with one controller chassis in a diskless configuration.
- A small system can be a single rack with one controller chassis and up to two drive chassis or flash drive chassis.
- A mid-sized system can be three racks with one controller chassis and a maximum of eight combined LFF or SFF drive chassis and up to two flash module drive (FMD) chassis.
- For combined block and file storage systems, the maximum configuration depends on how many HNAS servers and switches are installed. Consult your authorized representative for examples of available configurations.
- Maximum storage capacity:
  - The storage systems can be configured up to 65,280 logical volumes.
  - Configurable up to 2,304 SFF disk drives with a maximum physical disk capacity of approximately 5.3 PB (using 2.4 TB HDDs) or 34.7 PB (using 15 TB SSDs) per storage system, or up to 1,152 LFF disk drives with a maximum physical disk capacity of approximately 6.8 PB (using 6 TB HDDs) per storage system.
  - A drive intermix configuration can be configured up to 576 flash module drives with a maximum physical capacity of 8.1 PB (using 14 TB FMDs) per storage system.

### Flexible connectivity
The storage system supports connectivity to mainframe hosts through FICON® front-end directors and to open servers via Fibre Channel, iSCSI, and Fibre Channel over Ethernet (FCoE) front-end directors. The storage system can be configured with a combination of all of these front-end directors to support both mainframe hosts and open servers simultaneously.

For details about host connectivity and OS support, see https://support.hds.com/en_us/interoperability.html.

**High reliability**

The storage system includes the following features to enhance reliability:

- **Multiple RAID configurations**
  The system supports RAID 6 (6D+2P and 14D+2P), RAID 5 (3D+1P and 7D+1P), and RAID 1 (2D+2D and 4D+4D).

- **Duplicate hardware**
  Every module in the controller chassis and drive chassis is configured in redundant pairs so that if any module fails, the redundant module takes over until the failed component is replaced. The redundant hardware includes power supplies, VSD pairs, cache path controllers, front-end directors, back-end directors, and drives. If one of these hardware components fails, the storage system continues normal operation with zero data loss.

- **Protection from power failures**
  The storage systems have dual-power feeds. In the event of a partial power loss on one of the feeds, the system operates normally on the alternate feed until full power is restored. In the event of a full power loss, the cache backup modules maintain the availability of the cache contents for 32 minutes while the system copies the system configuration information and all data in the cache to a cache flash drive (SSD).

**High flexibility**

The storage systems are available in several configurations, from a small single rack, diskless system to a large six-rack system that includes two controller chassis, up to 2,304 SFF drives, up to 1,152 LFF drives, up to 384 SSDs (per controller in a standard performance back-end configuration) or 1,152 SSDs (per controller in a high-performance back-end configuration), up to 576 flash module drives, and a total of 2 TB cache. The systems can be easily reconfigured for more storage capacity.

The storage systems support block-only, file-only, and unified (block and file) configurations in open and mainframe environments. Unified systems contain Hitachi Network Attached Storage servers and switches in addition to the block controller and storage drives.

Typical system configurations

The storage systems can be configured to meet a variety of storage needs, with the following typical configurations based on customer use-cases:

- **Tiered storage**
  A storage system configured for tiered storage consists of multiple drive types, including high-performance flash module drives for fast data access, medium performance and capacity drives for most storage needs, and maximum capacity drives for data warehousing, all in one system. A tiered storage system can be configured with FMDs (flash module drives), SSDs (solid state drives), SAS drives (SFF or LFF), and high-capacity LFF drives. Software applications such as Dynamic Tiering allocate data to the appropriate drives based on frequency of access.

- **Maximum performance**
  A storage system configured with only flash module drives delivers maximum performance. This two-controller system can contain 12 FMD chassis with a total of 576 FMDs. This system is designed for an online retail site where customers expect fast access to multiple images, or a hospital medical imaging system...
where physicians need immediate access to 3D CAT or MRI images.

- Maximum storage capacity

A storage system containing 12 LFF chassis with a total of 1152 LFF drives provides the maximum storage capacity. This system configuration with less priority for high-speed access is ideally suited for use as a data warehouse for medical or insurance records.

### Software applications

The storage systems provide the foundation for matching application requirements to different classes of storage and delivering critical services, including:

- Business continuity services
- Content management services (search, indexing)
- Thin provisioning
- Dynamic Tiering
- High availability
- Security services
- I/O load balancing
- Data classification
- File management services

#### Nondisruptive service and upgrades

The storage systems are designed specifically to avoid any interruptions during normal operations while servicing or upgrading the system components.

- Main components can be “hot-swapped” (added, removed, or replaced without disruption) during normal operation. These include every module in the controller chassis and the drive chassis, such as power supplies, virtual storage directors, front-end directors, and back-end directors, cache and cache backup modules, SVPs, and drives.
- A service processor (SVP) mounted in the controller chassis monitors the operating condition of the storage system. Connecting the SVP with a service center allows authorized service personnel to manage the system remotely.
- An online, nondisruptive upgrade of the Storage Virtualization Operating Systems (SVOS) can run during normal operation without shutting down or restarting the storage system.
- Optional Migration Enablement Service (includes pilot migration) is available to jump-start self-service migration. For complex, large-scale, heterogeneous, and remote replication data center environments, nondisruptive migration service from Hitachi Global Solution Services (GSS) is required. Contact your HDS authorized sales or service representative for more information.

#### High temperature mode

High temperature mode is a feature that allows the storage system to operate at standard temperature (60.8°F to 89.6°F / 16°C to 32°C) or higher temperatures (60.8°F to 104°F / 16°C to 40°C), saving energy and cooling costs. Temperature sensors at the air inlets in the primary microprocessor blades measure the ambient air temperature.

High temperature mode window

High temperature mode is set through the Edit High Temperature Mode window in the Device Manager - Storage.
Navigator GUI. The window also displays alerts when the ambient air temperature exceeds the preset limits.

- In standard temperature mode, a temperature alert (SIM) appears when the temperature in the storage system exceeds 89.6°F / 32°C.
- In high temperature mode, the temperature alert (SIM) appears when the temperature in the storage system exceeds 104°F / 40°C.

System life

The lifetime of the system is five years when operating in the standard temperature mode. This lifetime is reduced when operating the system in high temperature mode, even if you change the system to standard temperature mode later.

Cache flash memory battery life

When high temperature mode is enabled, the cache flash memory battery life is reduced to two-thirds of the battery life when high temperature mode is enabled.

Example 1: A new cache flash memory battery has three years of usable life when operated in a standard temperature environment. If you enable high temperature mode when the battery is new, the battery life will be reduced to two years.

Example 2: The storage system is used for two years at normal temperature mode. The cache battery has one year of usable life remaining at that time. If you enable high temperature mode, the life of the battery is reduced to eight months.

Cache flash memory battery date

When high temperature mode is enabled, the battery replacement notice displays one year earlier than when high temperature mode is disabled.

After high temperature mode is enabled, the date of the battery replacement notice cannot be changed back to normal, even if high temperature mode is disabled. When high temperature mode is enabled, a confirmation message appears. Caution! Important information about using high temperature mode.

See the System Administrator Guide for additional information.

- Notify Technical SupportBefore enabling high temperature mode, contact Hitachi Vantara Support at https://support.hds.com/en_us/contact-us.html for updates or additional information besides the following notes.

- Guidelines for operating with flash module drives in high temperature mode
  - Do not enable high temperature mode if the system contains flash module drives (FMDs) from an earlier generation (prior to Hitachi Accelerated Flash FMD DC2 drives). The early generation FMDs cannot operate in high temperature mode. Only enable high temperature mode with Hitachi Accelerated Flash FMD DC2 drives.
  - Do not enable high temperature mode if the system contains a combination of early and current generation FMDs.

- Operating altitude Because thinner air does not provide sufficient cooling, do not enable high temperature mode if the system is located above 4920 ft / 1,500 m above sea level. A storage system can operate up to 9842 ft / 3,000 m above sea level in standard temperature mode.

- System noise When the storage system is used in a high temperature environment near 104°F / 40°C, the fans operate at high speed, increasing system noise. See Environmental specifications for detailed information.

Temperature measurement
Ambient air temperature is measured by a sensor in the cooling air inlet on each module in the primary VSD pair on each controller.

**Economical and quiet**