



# SAP HANA Tailored Data Center Integration on Hitachi Virtual Storage Platform Gx00 using Hitachi Dynamic Provisioning Pools

## Reference Architecture Guide

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## Feedback

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# SAP HANA Tailored Data Center Integration on Hitachi Virtual Storage Platform Gx00 using Hitachi Dynamic Provisioning Pools

## Reference Architecture Guide

The purpose of this reference architecture guide is to help customers who prefer the Tailored Data Center Integration (TDI) approach to implement SAP HANA rather than the SAP HANA appliance model. This reference architecture provides the storage requirements for the maximum number of supported active SAP HANA nodes on a Hitachi Virtual Storage Platform (VSP) G600, VSP G400 and VSP G200 storage array using Hitachi Dynamic Provisioning (HDP) pools.

This technical paper assumes you have familiarity with the following:

- Storage area network (SAN) based storage systems
- Network attached storage (NAS) systems
- General storage concepts
- General network knowledge
- SAP HANA platform
- Common IT storage practices
- SAP HANA TDI

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**Note** — Testing of this configuration was performed in a lab environment. Many things affect production environments beyond prediction or duplication in a lab environment. Follow the recommended practice of conducting proof-of-concept testing for acceptable results in a non-production, isolated test environment that matches your production environment before your production implementation of this solution.

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## SAP HANA Tailored Data Center Integration

Unlike a SAP HANA appliance in which all hardware components are pre-configured by the hardware vendor, SAP HANA tailored data center integration deployments are customized solutions where the customer can choose any of the certified SAP HANA server vendors along with any certified SAP HANA enterprise storage to implement SAP HANA. This provides customers an opportunity to leverage their existing hardware and reduce TCO.

Using this reference architecture, SAP HANA solutions can be deployed using any certified SAP HANA server vendors and Hitachi Virtual Storage Platform Gx00. A list of SAP certified servers that are available for SAP HANA appliances can be found in the [SAP Certified and Supported SAP HANA® Hardware Directory](#). SAP only allows using homogeneous compute server hardware from a single hardware partner in a SAP HANA tailored data center integration. Also, if a certificate provided by SAP is for a specific operating system, only that operating system can be used for SAP HANA implementation. Engineering validation for this solution has been performed using Hitachi Data Systems server blades.

Every SAP certified enterprise storage platform must meet TDI storage KPI requirements set by SAP. Testing showed that the storage design of Hitachi Virtual Storage Platform G600, VSP G400 and VSP G200 for SAP HANA platform meets the TDI storage KPI requirements from SAP. It is not mandatory for customers to use the same storage design that was used for storage KPI testing, and this is demonstrated in this reference architecture guide. Refer to the [SAP HANA Tailored Data Center Integration FAQ](#) for more details about TDI.

During validation, the scalability and storage KPI testing was performed using the SAP HWCCT tool (Please refer to [SAP Note 1943937 - Hardware Configuration Check Tool - Central Note](#)):

- A maximum of eleven SAP HANA scale-up systems passed the TDI KPIs on a single Hitachi Virtual Storage Platform G600 using HWCCT revision 97
- A maximum of seven SAP HANA scale-up systems passed the TDI KPIs on a single Hitachi Virtual Storage Platform G400 using HWCCT revision 97
- A maximum of two SAP HANA scale-up systems passed the TDI KPIs on a single Hitachi Virtual Storage Platform G200 using HWCCT revision 102

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**Note** - Since the release of SAP HANA TDI in November 2013 several versions of the HWCCT have been published. To check whether or not the hardware configuration of your SAP HANA TDI infrastructure meets SAP's KPIs, it is crucial that you use the same version of the HWCCT used during the certification of the hardware (compute servers and storage system) for your tests. SAP Note 1943937 describes how to determine the right version of the HWCCT for your tests.

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## Hitachi Virtual Storage Platform Family

Hitachi Virtual Storage Platform (VSP) family delivers enterprise storage virtualization in a unified platform for midmarket to global enterprise organizations that need to manage information more efficiently. Existing storage from multiple vendors can now be centrally unified in a shared pool of data. A highly efficient architecture allows organizations to satisfy growth requirements and simplify operations to reduce the total cost of storage ownership. Including industry-leading global storage virtualization, Virtual Storage Platform family extends ease of migration, universal data replication, and active mirroring to all storage assets. Provision and manage virtual storage machines across metro distances with active-active remote data center replication support. Combined with remote data center replication, this mirroring is an ideal solution to meet zero recovery point and time objectives for critical applications. With a central point of control, VSP family unifies block and file access, enabling organizations to consolidate workloads to further simplify management and defer the cost of additional storage acquisition. Using a single interface for managing both block and file storage streamlines administration.

VSP family systems are built on legendary Hitachi reliability, offering complete system redundancy, hot-swappable parts, outstanding data protection and non-disruptive updates to keep storage operations up and running at optimal performance. Additional data recovery and protection tools allow for application-aware recovery, simpler backup and restore, failover and consistency across copies, reducing business risk, downtime, and migration concerns. VSP family complements virtualized server environments with its ability to consolidate multiple file and block workloads in a single system. Additional integration offloads storage-intensive processing from the server hosts to increase virtual machine density, improve performance and reduce workload contention. And it extends those benefits to legacy-attached storage via external storage virtualization. Five models in the VSP family, based on Hitachi Storage Virtualization Operating System (SVOS), provide a uniquely scalable, software-defined storage foundation. Powered with Hitachi global storage virtualization, new software capabilities unlock IT agility and enable the lowest storage total cost of ownership.

## Virtual Storage Platform Models

### VSP G200

VSP G200 entry storage system includes advanced SVOS capabilities in this affordable platform. It offers a choice of internal capacity expansion of up to 12 or 24 drives, the ability to add more external storage trays, and easy setup and management for virtual applications. Advanced SVOS virtualization capabilities protect business-critical data.

### VSP G400

VSP G400 midrange platform helps reduce operational costs with an efficient unified architecture. Consolidate file, block, and object data for extensive cost savings. Simplify operations for all data types with one interface and consistent workflows. Reduce storage expense by reclaiming space and increasing utilization. Midsized organizations can choose this model to be their primary storage system.

### VSP G600

VSP G600 extends the performance and capacity scalability of VSP G400 for organizations powering additional virtualized applications. Deploy more storage solutions with this validated application integration. Manage more data types from a simple, unified interface. Deliver central, consistent storage services to all data consumers. Accelerate multiple applications with this flash optimized architecture available tiered or all flash.

### VSP G800

VSP G800 entry enterprise platform is designed to consolidate the business-critical data from multiple applications and virtual servers. Implement dual datacenter replication for high availability business continuation. Securely partition information assets for multiple tenants. Utilize crash-consistent snapshots for application-aware backup, recovery and failover. Designed for organizations seeking enterprise functionality for regional deployments.

### VSP G1000

VSP G1000 enterprise platform enables continuous operations, self-managing policy-driven management, and agile IT that today's new breed of cloud applications demand. Global storage virtualization enables an always-on infrastructure with enterprise-wide scalability. An ideal solution for applications that require zero recovery point and recovery time objectives, VSP G1000 redefines mission-critical storage virtualization and resets expectations for the data center.

Out of the five members of the VSP family (VSP G1000, VSP G800, VSP G600, VSP G400 and VSP G200), validation of this reference architecture was done with SAP HANA platform nodes on VSP G600, VSP G400 and VSP G200. These three storage platforms have the similar high availability features and run on the same family microcode as VSP G1000 (VSP G1000 was released and certified by SAP for use as enterprise storage for SAP HANA before the VSP midrange models). VSP G1000 hardware architecture is more resilient than the VSP midrange models.

Figure 1 shows VSP storage arrays in the order of increasing performance and storage capacity. Table 1 highlights the features of the VSP family storage platforms.

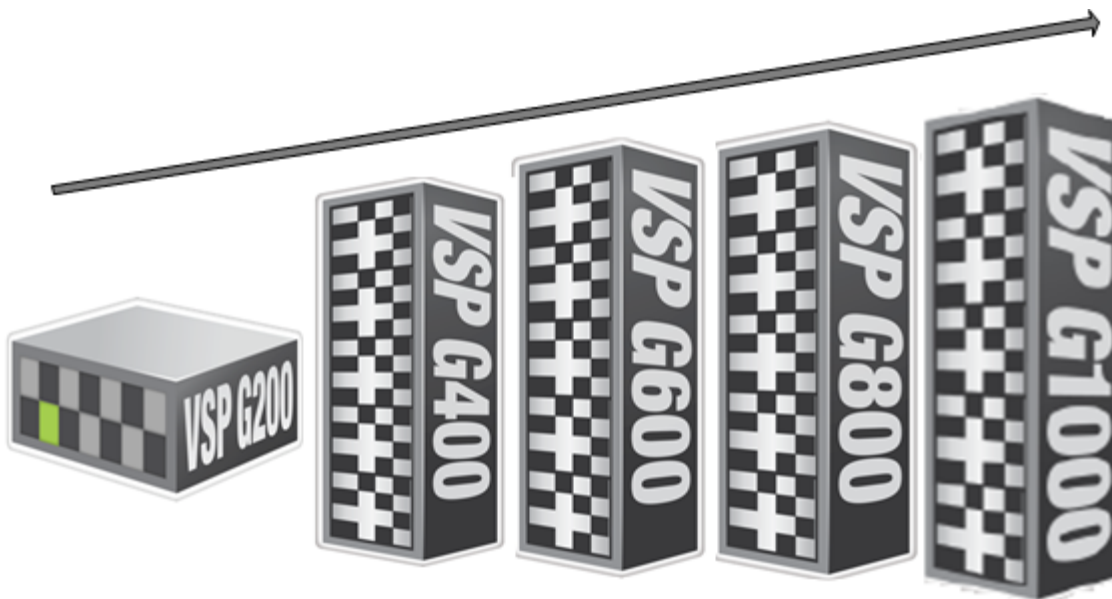


Figure 1

Table 1. Family Systems Feature Comparison

Hitachi Virtual Storage Platform	VSP G200	VSP G400	VSP G600	VSP G800	VSP G1000
Max. Raw Internal Capacity	1058 TB	1920 TB	2880 TB	5760 TB	4511 TB
Max. Raw External Capacity	8 PB	16 PB		64 PB	255 PB
Flash Module Drives	1.6 TB, 3.2 TB				
Small Form Factor (SFF) Drives	200 GB or 400 GB solid-state drive (SSD) 600 GB or 1.2 TB 10K RPM hard disk drive (HDD) 300 GB 15K RPM HDD				400 GB, 600 GB, or 800 GB SSD,  1.2 TB 10K RPM HDD;  300 GB or 600 GB 15K RPM HDD
Large Form Factor (LFF) Drives	4 TB 7200 RPM HDD				

**Table 1. Family Systems Feature Comparison (Continued)**

Hitachi Virtual Storage Platform	VSP G200	VSP G400	VSP G600	VSP G800	VSP G1000
Max. Drives	252	480	720	1440	2304 SFF 1152 LFF
Disk Expansion Trays	2U: 24 SFF (2.5"), 2U: 12 LFF (3.5") 2U: 12 flash module drive (FMD) 4U: 60 LFF (3.5") and SFF (2.5")				16U: 96 LFF (3.5") 16U: 96 FMD 16U: 192 SFF (2.5")
Block Module Height (with service processor)	3U	5U			10U
Block Controllers	2				16
Host Interfaces (with drives)	16 FC: 8 Gb/sec 8 FC: 16 Gb/sec 8 iSCSI: 10 Gb/sec	32 FC: 8 Gb/sec 16 FC: 16 Gb/sec 16 iSCSI: 10 Gb/sec		48 FC: 8 Gb/sec 24 FC: 16 Gb/sec 24 iSCSI: 10 Gb/sec	192 FC: 8 Gb/sec 96 FC: 16 Gb/sec 176 FICON: 8 Gb/sec 192 FCoE: 10 GB/sec
Max. Cache	64 GB	128 GB	256 GB	512 GB	2048 GB
Max. LUN Size	60 TB <sup>1</sup>				
Max. Number LUNs	2048	4096		16384	65280
RAID Supported	1+0, 5, 6				
Max. RAID Groups	84	240		480	575
File Module Height	3U per node				
Nodes per Cluster	1-8 Nodes				1-8 Nodes
File System Size	256 TB pool, single namespace up to maximum capacity				
Max. File Systems	128				
Max. Snapshots	1024 per file system, 1 million clones				
Cache per Node	48 GB				108 GB
Protocols	NFS/SMB/FTP/iSCSI and HTTP to the cloud				
Fibre Channel Ports	4 × 8 Gb/sec ports per node				
Ethernet Ports	4 × 10 Gb, 6 × 1 Gb per node				



**Table 1. Family Systems Feature Comparison (Continued)**

Hitachi Virtual Storage Platform	VSP G200	VSP G400	VSP G600	VSP G800	VSP G1000
Software					
Hitachi Storage Virtualization Operating System	Hitachi Infrastructure Director, Hitachi Device Manager, Hitachi Dynamic Provisioning, Hitachi Dynamic Link Manager Advanced, and Hitachi Universal Volume Manager software; cache partition manager feature; storage system-based utilities				
File Operating System	CIFS and NFS protocols, high-availability cluster, quick snapshot restore feature, file system rollback feature, virtual server, storage pool, file system audit				
Hitachi Data Mobility	Hitachi Dynamic Tiering with active flash, Hitachi Tiered Storage Manager				
Hitachi Local Replication	Hitachi ShadowImage Replication, Hitachi Replication Manager, Hitachi Application Protector				
Hitachi Remote Replication	Hitachi TrueCopy, Hitachi Universal Replicator				
Hitachi File Replication	Hitachi NAS Replication, Hitachi NAS File Clone				
Hitachi Performance Analytics <sup>2</sup>	Hitachi Command Director, Hitachi Tuning Manager				
Automation	Hitachi Automation Director, Hitachi Data Instance Director				
High Availability	global-active device <sup>3</sup> feature				
Encryption	data-at-rest encryption feature				

1. Specifications represent the maximum addressable limit in a planned future release. 2. Licensed feature available after initial release. Contact your HDS representative or HDS reseller partner for details regarding availability. 3. Hitachi global-active device feature, a separately licensed feature available in a planned future release.

Hitachi Data Systems and certified SAP HANA server vendors define the final configuration for the customer solution.

Using the family of enterprise storage products from Hitachi Data Systems, including Hitachi Virtual Storage Platform G600, VSP G400 and VSP G200, SAP HANA has the following benefits:

- Increased performance when loading data into SAP HANA
- Scalable deployments of SAP HANA
- Disaster recovery with minimal performance impact to the production instance

Table 2 shows the maximum number of nodes for these storage platforms.

**Table 2. Maximum SAP HANA Platform Nodes Supported on VSP Family**

Hitachi Virtual Storage Platform	Maximum Number of Supported Active SAP HANA Platform Nodes
VSP G600	11
VSP G400	7
VSP G200	2

## Solution Overview

This document provides an example configuration of the storage layout for SAP HANA platform nodes with variable sizes of main memory consolidated onto a Hitachi Virtual Storage Platform G600, tested within the Hitachi Data Systems lab environment.

This configuration uses the following storage components:

- **Hitachi Virtual Storage Platform G600**— Storage virtualization system designed to manage storage assets more efficiently

Figure 2 shows the server to storage configuration of this solution using VSP G600. A similar architecture can be used for VSP G400 and VSP G200. The maximum number of nodes supported with VSP G400 and VSP G200 is listed in Table 2 on page 7.

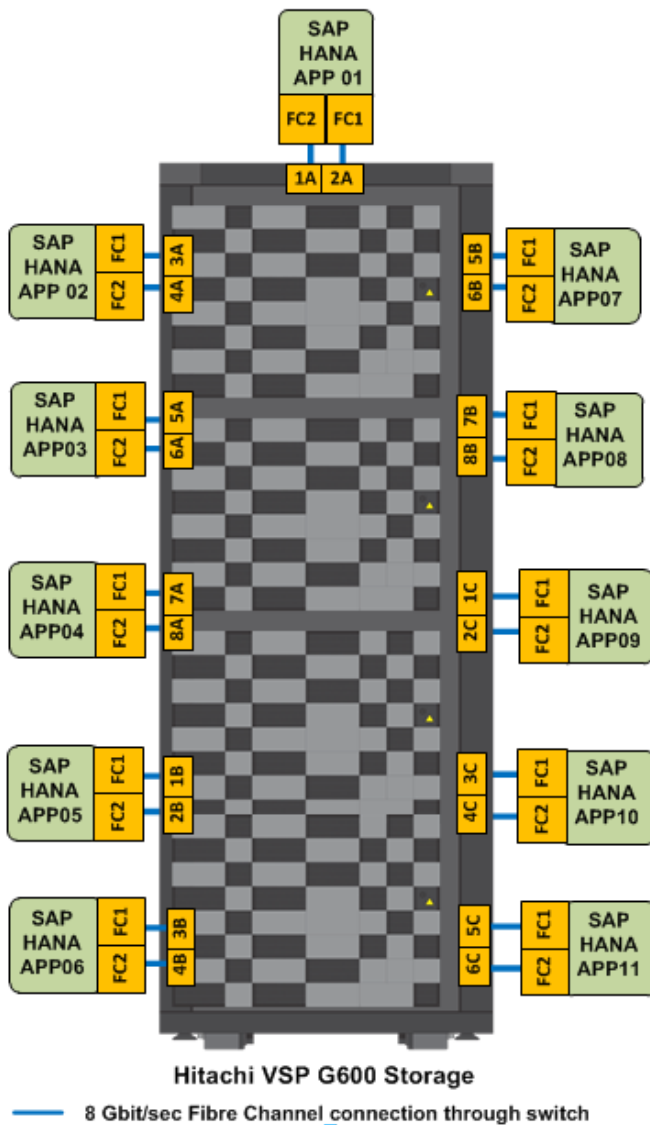


Figure 2

## Key Solution Elements

These are the key hardware and software elements used for the scalability testing.

### Hardware Elements

Table 3 describes the hardware used to test the maximum scalability of 11 active nodes on a VSP G600.

**Table 3. Hardware Elements**

Hardware	Quantity	Configuration	Role
Hitachi Virtual Storage Platform G600	1	<ul style="list-style-type: none"> <li>▪ Single frame</li> <li>▪ 8 Gb/sec Channel Blades</li> </ul>	Block storage for SAP HANA platform nodes and Hitachi NAS Platform
Quanta Cloud Technology QuantaPlex T41S-2U server (optional)	1	<ul style="list-style-type: none"> <li>▪ T41S 2U 2.5" Bay Chassis</li> <li>▪ T41S Server Node</li> <li>▪ 3 × Server Filler</li> <li>▪ 2 × Intel Xeon E5-2620 v3 (6C 2.4GHz 85W)</li> <li>▪ 1 × Heatsink CPU0 and CPU1</li> <li>▪ 2 × 16 GB DDR4 2,133MHz Memory Module</li> <li>▪ 2 × HDD SATA 500 GB, 7200rpm, 2.5 inch (6 Gb)</li> <li>▪ 1 × Dual port 10 GigE Intel 82599ES SFP+ OCP Mezzanine Card</li> <li>▪ 1 × Dual port 1 GigE Base-T Intel i350 Mezzanine Card</li> <li>▪ 1 × Emulex Dual Port 8 Gb/sec FC HBA</li> </ul>	Management server runs the following: <ul style="list-style-type: none"> <li>▪ NTP</li> <li>▪ Hitachi Command Suite</li> <li>▪ Hi-Track Remote Monitoring system</li> <li>▪ SAP HANA Studio</li> </ul>
SAP HANA Server	11	<ul style="list-style-type: none"> <li>▪ Rack servers/blade chassis certified for SAP HANA with 256 GB (SAP HANA Platform 1.0 SPS09, Rev. 97 or later ) nodes. A list of certified configurations can be found <a href="#">here</a></li> </ul>	SAP HANA servers with 256 GB of main memory
Brocade ICX 6430-48 port switch(optional)	1	<ul style="list-style-type: none"> <li>▪ 1 GbE</li> <li>▪ 48 ports</li> </ul>	1 GbE Management Network
Brocade VDX 6740-48 port switch(optional)		<ul style="list-style-type: none"> <li>▪ 10 GbE</li> <li>▪ 48 ports</li> </ul>	10 GbE external connectivity

## SAP HANA Server

Only certified SAP HANA servers are allowed in the SAP HANA TDI environment following the exact same bill of materials as the certified SAP HANA appliance server but without the storage or local disks. A list of all certified servers and enterprise storage solutions can be found in the [SAP HANA Hardware Directory](#). For more information on SAP HANA TDI consult the [SAP HANA TDI FAQ](#) document on SCN.

## Quanta Cloud Technology QuantaPlex T41S-2U Chassis with a Single Node (Optional)

This solution uses one node of a four node Quanta Cloud Technology QuantaPlex T41S-2U chassis for the management server. The management server acts as a central device for managing the SAP HANA platform. Manage the following from the management server:

- Hitachi Compute Blade chassis
  - Hitachi Data Systems server blades
- Brocade ICX 6430 - 48 port switch
- Brocade VDX 6740 - 48 port switch
- SAP HANA nodes
- Hitachi Virtual Storage Platform G600
- NTP configuration
- Hi-Track Remote Monitoring system from Hitachi Data Systems
- Hitachi Command Suite and management of the server blades
- SAP HANA Studio

## Software Elements

Table 4 describes the software products used to deploy the configuration for the testing.

**Table 4. Software Elements**

Software	Version
SUSE Linux Enterprise Server for SAP Applications	11 SP3
SAP HANA platform	1.0 SPS10, Rev. 102 or later
Hitachi Storage Navigator Modular 2	Microcode dependent
Hitachi Command Suite	8.1.2 or later
Hitachi Virtual Storage Platform G400/G600 Microcode	83-03-01-40/00
Microsoft® Windows Server® 2012 R2	Standard Edition <ul style="list-style-type: none"> <li>■ For QuantaPlex 2U4N server</li> </ul>

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**Note** - Scalability testing was carried out using SUSE Linux Enterprise Server for SAP Applications 11 SP3, but the solution will also support Red Hat Enterprise Linux version 6.6.

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## Solution Design

This is the detailed solution example design for the SAP HANA tailored data center integration with Hitachi Virtual Storage Platform G600 with four active nodes. It includes components in the following sections.

### Fibre Channel Architecture

The SAP HANA platform nodes are directly attached to the designated Hitachi Virtual Storage Platform target port.

Table 5 shows the storage port mapping.

**Table 5. Storage Port Mapping**

SAP HANA Platform Node	Fibre Channel Port	Hitachi Virtual Storage Platform G400 Ports
Node001	Port 0	1A
Node001	Port 1	2A
Node002	Port 0	3A
Node002	Port 1	4A
Node003	Port 0	5A
Node003	Port 1	6A
Node004	Port 0	7A
Node004	Port 1	8A

When using a direct connection between the SAP HANA servers and Hitachi Virtual Storage Platform G600, please use the correct port properties as listed in the build guides for the respective processor generation.

### Storage Architecture

Each SAP HANA node needs the following storage layout:

- OS volume
- SAP HANA Shared volume for the SAP HANA binaries and other configuration files.
- Log volume
- Data volume

This SAP HANA TDI setup utilizes an HDP pool design for the storage layout that ensures maximum utilization and optimization at a lower cost.

The layout uses two HDP pools with the specific type of parity groups listed in Table 6.

**Table 6. HDP Pools**

HDP Pool Name	Purpose	Parity Group RAID Level and disks
OS_SH_Data_Pool	OS, SAP HANA Shared and Data	RAID-6 (14D+2P) on 600 GB 10k SAS
Log_Pool	Log	RAID-6 (6D+2P) on 600 GB 10k SAS

Table 7 shows the minimum number of number of parity groups needed per HDP pool for the various combinations of nodes on a Hitachi Virtual Storage Platform G600.

**Table 7. Minimum Parity Groups Needed per HDP Pool on VSP G600**

Nodes	OS_SH_Data_Pool	Log_Pool
1	1	1
2	1	1
3	1	1
4	2	2
5	2	2
6	2	2
7	3	3
8	3	3
9	3	3
10	3	4
11	3	4

The information below shows a sample layout of the HDP pool configuration on the Virtual Storage Platform G600 used in SAP HANA tailored data center integration solution, with four active SAP HANA systems.

- System 1: 512 GB
- System 2: 1 TB
- System 3: 2 TB
- System 4: 4 TB

Provision the HDP Pools with the appropriate number of parity groups as listed below:

- Create a dynamic provisioning pool named **OS\_SH\_Data\_Pool**. This will be used to provision the operating system volume, SAP HANA shared volume, and Data volume for the four SAP HANA systems on Virtual Storage Platform G600.
- Similarly, create another dynamic provisioning pool named **Log\_Pool**. This will be used to provision the Log volume for the four SAP HANA systems on Virtual Storage Platform G600.
- Provision the parity groups for the HDP Pools as shown in Table 8 and assign all the LDEVs created to the appropriate pools.

**Table 8. HDP Pool Provisioning**

HDP Pool	Parity Group ID	Parity Group RAID Level and disks	LDEV ID	LDEV Name	LDEV Size	MPU Assignment
OS_SH_Data_Pool	1	RAID-6 (14D+2P) on 600 GB 10k SAS	00:00:01	OS_SH_DA_Pool_1	1800 GB	MPU-10
			00:00:02	OS_SH_DA_Pool_2	1800 GB	MPU-11
			00:00:03	OS_SH_DA_Pool_3	1800 GB	MPU-20
			00:00:04	OS_SH_DA_Pool_4	1800 GB	MPU-21
OS_SH_Data_Pool	2	RAID-6 (14D+2P) on 600 GB 10k SAS	00:00:05	OS_SH_DA_Pool_5	1800 GB	MPU-10
			00:00:06	OS_SH_DA_Pool_6	1800 GB	MPU-11
			00:00:07	OS_SH_DA_Pool_7	1800 GB	MPU-20
			00:00:08	OS_SH_DA_Pool_8	1800 GB	MPU-21
Log_Pool	3	RAID-6 (6D+2P) on 600 GB 10k SAS	00:01:01	Log_Pool_1	750 GB	MPU-10
			00:01:02	Log_Pool_2	750 GB	MPU-11
			00:01:03	Log_Pool_3	750 GB	MPU-20
			00:01:04	Log_Pool_4	750 GB	MPU-21
Log_Pool	4	RAID-6 (6D+2P) on 600 GB 10k SAS	00:01:05	Log_Pool_5	750 GB	MPU-10
			00:01:06	Log_Pool_6	750 GB	MPU-11
			00:01:07	Log_Pool_7	750 GB	MPU-20
			00:01:08	Log_Pool_8	750 GB	MPU-21

- Provision the virtual volumes for each of the nodes as listed below:
  - Create the VVOLs for the OS, SAP HANA shared, Data, and Log as shown in Table 9.



Table 9. VVOLs for the SAP HANA Nodes

HDP Pool	VVOL ID	VVOL Name	VVOL Size	MPU Assignment
OS_SH_Data_Pool	00:02:00	HANA_OS_N1	100 GB	MPU-10
	00:03:00	HANA_OS_N2	100 GB	MPU-11
	00:04:00	HANA_OS_N3	100 GB	MPU-20
	00:05:00	HANA_OS_N4	100 GB	MPU-21
	00:02:01	HANA_SH_N1	512 GB	MPU-10
	00:03:01	HANA_SH_N2	1024 GB	MPU-11
	00:04:01	HANA_SH_N3	1024 GB	MPU-20
	00:05:01	HANA_SH_N4	1024 GB	MPU-21
Log_Pool	00:02:02	HANA_LOG_N1_1	75 GB	MPU-10
	00:02:03	HANA_LOG_N1_2	75 GB	MPU-11
	00:02:04	HANA_LOG_N1_3	75GB	MPU-20
	00:02:05	HANA_LOG_N1_4	75 GB	MPU-21
	00:03:02	HANA_LOG_N2_1	150 GB	MPU-10
	00:03:03	HANA_LOG_N2_2	150 GB	MPU-11
	00:03:04	HANA_LOG_N2_3	150 GB	MPU-20
	00:03:05	HANA_LOG_N2_4	150 GB	MPU-21
	00:04:02	HANA_LOG_N3_1	150 GB	MPU-10
	00:04:03	HANA_LOG_N3_2	150 GB	MPU-11
	00:04:04	HANA_LOG_N3_3	150 GB	MPU-20
	00:04:05	HANA_LOG_N3_4	150 GB	MPU-21
	00:05:02	HANA_LOG_N4_1	150 GB	MPU-10
	00:05:03	HANA_LOG_N4_2	150 GB	MPU-11
	00:05:04	HANA_LOG_N4_3	150 GB	MPU-20
	00:05:05	HANA_LOG_N4_4	150 GB	MPU-21

**Table 9. VVOLs for the SAP HANA Nodes (Continued)**

HDP Pool	VVOL ID	VVOL Name	VVOL Size	MPU Assignment
OS_SH_Data_Pool	00:02:06	HANA_DATA_N1_1	155 GB	MPU-10
	00:02:07	HANA_DATA_N1_2	155 GB	MPU-11
	00:02:08	HANA_DATA_N1_3	155 GB	MPU-20
	00:02:09	HANA_DATA_N1_4	155 GB	MPU-21
	00:03:06	HANA_DATA_N2_1	310 GB	MPU-10
	00:03:07	HANA_DATA_N2_2	310 GB	MPU-11
	00:03:08	HANA_DATA_N2_3	310 GB	MPU-20
	00:03:09	HANA_DATA_N2_4	310 GB	MPU-21
	00:04:06	HANA_DATA_N3_1	620 GB	MPU-10
	00:04:07	HANA_DATA_N3_2	620 GB	MPU-11
	00:04:08	HANA_DATA_N3_3	620 GB	MPU-20
	00:04:09	HANA_DATA_N3_4	620 GB	MPU-21
	00:05:06	HANA_DATA_N4_1	1240 GB	MPU-10
	00:05:07	HANA_DATA_N4_2	1240 GB	MPU-11
	00:05:08	HANA_DATA_N4_3	1240 GB	MPU-20
	00:05:09	HANA_DATA_N4_4	1240 GB	MPU-21

- While mapping the LUN path assignment for each node, add the VVOLs in the following order:
  - Map the OS volume for the specific SAP HANA platform node
  - Map the SAP HANA shared for the specific SAP HANA platform node
  - Map the log volume and data volume for the specific SAP HANA platform node

Table 10 shows an example configuration of the LUN path assignment for Node001. The LUN assignment should be similar for all of the other nodes.

**Table 10. Example LUN Path Assignment for Node001 for 512 GB SAP HANA Node Configuration**

LUN ID	LDEV ID	LDEV Name
0000	00:02:00	HANA_OS_N1
0001	00:02:01	HANA_SH_N1
0002	00:02:02	HANA_LOG_N1_1
0003	00:02:03	HANA_LOG_N1_2
0004	00:02:04	HANA_LOG_N1_3
0005	00:02:05	HANA_LOG_N1_4
0006	00:02:06	HANA_DATA_N1_1
0007	00:02:07	HANA_DATA_N1_2
0008	00:02:08	HANA_DATA_N1_3
0009	00:02:09	HANA_DATA_N1_4

Likewise Table 11 shows the minimum number of parity groups needed in the HDP Pool for the various combinations of nodes on Hitachi Virtual Storage Platform G400 and Hitachi Virtual Storage Platform G200.

**Table 11. Minimum Parity Groups Needed per HDP Pool on VSP G400**

Nodes	OS_SH_Data_Pool	Log_Pool
1	1	1
2	1	1
3	1	1
4	2	2
5	2	2
6	2	2
7	3	3

**Table 12. Minimum Parity Groups Needed per HDP Pool on VSP G200**

Nodes	OS_SH_Data_Pool	Log_Pool
1	1	1
2	2	1

## Best Practices of Storage Setup for SAP HANA TDI

- Create an HDP Pool with a minimum of two parity groups whenever possible
- A parity group should be dedicated to one Pool only, and should not be used for other purposes if one of its LDEVs is a Pool Volume
- HDP pools should be configured as RAID-6
- Distribute the parity groups across at least two DBS trays
- Create four VVOLs for Log volumes per SAP HANA system and distribute them across the various MPUs
- Create four VVOLs for data volumes per SAP HANA system and distribute them across the various MPUs
- Use full allocation to provision DPVOLs whenever possible

## Engineering Validation

### Test Methodology

- HWCCT revision 97 was used for the scalability testing on VSP G400 and VSP G600 because the same version was originally used for the enterprise storage certification
- HWCCT revision 102 was used for the scalability testing on VSP G200
- The initial testing started with one node on each of the storage systems. The storage was then provisioned to evaluate the requirements to fit that node
- Additional nodes were added if the KPIs passed, or an additional parity group per HDP pool was added if it failed
- The cache write pending and MPU utilization were also considered, and the cutoff was set at a maximum of 60% usage for both per storage best practices

## For More Information

Hitachi Data Systems Global Services offers experienced storage consultants, proven methodologies and a comprehensive services portfolio to assist you in implementing Hitachi products and solutions in your environment. For more information, see the Hitachi Data Systems [Global Services](#) website.

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