

Hitachi Unified Compute Platform for the SAP HANA Platform on VMware vSphere in a Medium 1 TB Scale-Up Configuration using Hitachi Compute Blade 500 and Hitachi Unified Storage VM

Reference Architecture Guide

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By

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Hitachi Unified Compute Platform for the SAP HANA Platform on VMware vSphere in a Medium 1 TB Scale-Up Configuration using Hitachi Compute Blade 500 and Hitachi Unified Storage VM

Reference Architecture Guide

Hitachi Unified Compute Platform for the SAP HANA Platform on VMware vSphere in a scale-up medium 1 TB configuration is a pre-configured analytical virtual appliance ready to plug into a network to provide real-time access to operational data for use in analytic models.

This reference architecture guide for the medium size 1 TB configuration describes how to deploy Hitachi Unified Compute Platform for the SAP HANA Platform on VMware vSphere in a scale-up configuration using the following:

- Hitachi Compute Blade 500 (with 520X B1 server blades)
- Hitachi Unified Storage VM
- SAP HANA

This technical paper assumes familiarity with the following:

- SAN-based storage systems
 - General storage concepts
 - SAP HANA
 - VMware vSphere 5.5 update 1
 - Common IT storage practices
-

Solution Overview

The 1 TB medium size UCP for SAP HANA on VMware vSphere in a scale-up configuration reference solution is a blade server solution for SAP HANA on VMware. This reference architecture uses the following:

- **Hitachi Compute Blade 500** — An enterprise-class server platform.
 - This solution uses two 520X B1 server blades.
- **Hitachi Unified Storage VM** — Storage virtualization system designed to manage storage assets more efficiently. The persistent storage of the HANA server resides on this storage device.
- **SAP HANA** — A multi-purpose, in-memory database to analyze transactional and analytical data.
- **VMware vSphere** -- A cloud computing virtualization operating system platform

Figure 1 shows the topology of this reference architecture.

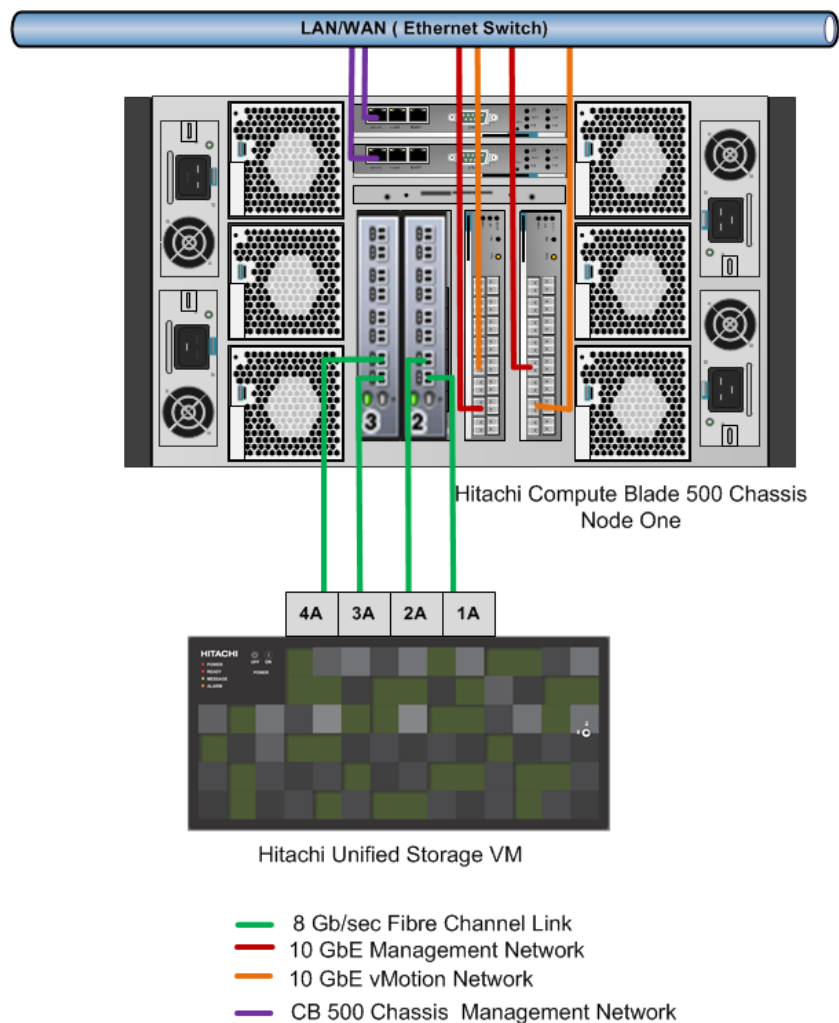


Figure 1

Key Solution Elements

These are the key hardware and software components used in this reference architecture.

Hardware Elements

Table 1 describes the hardware used to deploy the medium 1 TB UCP for SAP HANA on VMware in a scale-up configuration.

Table 1. Hardware Elements

<i>Hardware</i>	<i>Quantity</i>	<i>Configuration</i>	<i>Role</i>
Hitachi Compute Blade 500 chassis	1	<ul style="list-style-type: none"> ■ 4-blade chassis ■ 2 management modules ■ 6 cooling fan modules ■ 4 × Power Supply Modules (3+1 reliable model) ■ 2 × 10 Gb/sec LAN pass-through module ■ 2 × 16 Gb/sec Brocade Fibre Channel switch module 	Server blade chassis
520X B1 server blade	2	<ul style="list-style-type: none"> ■ 2 × 15 core processors ■ 0.5 TB RAM ■ On Blade 4 and 6 - 1 × 4 port 10 GbE Onboard LAN on motherboard (LOM) and 6 - 1 × 2 port 8 GB Fibre Channel Mezzanine on Mezzanine Slot 2 	SAP HANA server
SMP connector module	1	<ul style="list-style-type: none"> ■ 2-blade SMP connection board 	SMP connector
Hitachi Unified Storage VM (HUS VM)	1	<ul style="list-style-type: none"> ■ Single frame 	Block storage for SAP HANA nodes

Hitachi Compute Blade 500

[Hitachi Compute Blade 500](#) combines the high-end features with the high compute density and adaptable architecture you need to lower costs and protect investment. Safely mix a wide variety of application workloads on a highly reliable, scalable, and flexible platform. Add server management and system monitoring at no cost with Hitachi Compute Systems Manager, which can seamlessly integrate with Hitachi Command Suite in IT environments using Hitachi storage.

This configuration uses two 520X B1 server blades in the Hitachi Compute Blade 500 chassis.

Table 2 has the specifications for the 520X B1 server blades used in this solution.

Table 2. 520X B1 Server Blade Configuration

<i>Feature</i>	<i>Configuration</i>
Processors	<ul style="list-style-type: none"> ■ Intel Xeon processor E7-8880 V2 ■ 2 processors per server blade
Processor SKU	<ul style="list-style-type: none"> ■ Intel Xeon processor E7-8880 V2
Processor frequency	<ul style="list-style-type: none"> ■ 2.50 GHz
Processor cores	<ul style="list-style-type: none"> ■ 15 cores
Memory DIMM slots	<ul style="list-style-type: none"> ■ Total of 48 with 32 populated
Memory	<ul style="list-style-type: none"> ■ 512 GB RAM (32 × 16 GB DIMMs)
Network ports	<ul style="list-style-type: none"> ■ 4 × 10 Gb Ethernet LAN on motherboard (LOM) (on blades 4 and 6).
Fibre Channel Mezzanine ports	<ul style="list-style-type: none"> ■ 1 × 2 port Channel 8 GB Fibre Channel Mezzanine on Mezzanine Slot 2 (on blades 4 and 6).
Other interfaces	<ul style="list-style-type: none"> ■ 1 × USB 3.0 port ■ KVM connector (VGA, COM, USB 2.0, 2 ports)

Symmetric Multiprocessing Connector

Use Symmetric Multiprocessing (SMP) technology to combine multiple server blade resources into a single server. SMP connectors combine server blade resources, subject to product limitations.

The 520X B1 server blade uses symmetric multiprocessing in one of two ways:

- Combines the resources of two server blades with a 2-blade SMP connector
- Combines the resources of four server blades with a 4-blade SMP connector

This solution uses a 2-blade SMP connection interface to connect two server blades. This combination acts as a single HANA VM server node for the medium size configuration with the following:

- 4 CPUs
- 60 cores
- 1024 GB of RAM

Hitachi Unified Storage VM

[Hitachi Unified Storage VM](#) is an entry-level enterprise storage platform. It combines storage virtualization services with unified block, file, and object data management. This versatile, scalable platform offers a storage virtualization system to provide central storage services to existing storage assets.

Unified management delivers end-to-end central storage management of all virtualized internal and external storage on Unified Storage VM. A unique, hardware-accelerated, object-based file system supports intelligent file tiering and migration, as well as virtual NAS functionality, without compromising performance or scalability.

The benefits of Unified Storage VM are the following:

- Enables the move to a new storage platform with less effort and cost when compared to the industry average
 - Increases performance and lowers operating cost with automated data placement
 - Supports scalable management for growing and complex storage environment while using fewer resources
 - Achieves better power efficiency and with more storage capacity for more sustainable data centers
 - Lowers operational risk and data loss exposure with data resilience solutions
 - Consolidates management with end-to-end virtualization to prevent virtual server sprawl
-

The operating system LUNs, data LUNs, and log LUNs reside on this storage device.

This solution uses a single Hitachi Unified Storage VM.

Software Elements

Table 3 describes the software products used to deploy the one active node configuration.

Table 3. Software Elements

<i>Software</i>	<i>Version</i>
SUSE Linux Enterprise Server for SAP Applications	11 SP3
SAP HANA	1.0 SPS09, Rev. 91 or later
VMware vSphere	5.5 update 1

SAP HANA

SAP HANA is a flexible, multipurpose in-memory database. It combines SAP software components optimized to specific hardware. These components come from leading hardware partners of SAP, including Hitachi. The use of the SAP HANA appliance does not depend on the data source.

The SAP HANA appliance enables the analysis of huge volumes of detailed business information in real-time from almost any data source. It captures operational data in memory as it occurs. Flexible views quickly expose analytic information. External data can be added to analytic models from across an entire organization.

This hardware and software combination integrates a number of SAP components, including the following:

- **SAP In-Memory Database**

This hybrid in-memory database combines row-based, column-based, and object-based database technology. It takes advantage of parallel processing capabilities of multi-core CPU architectures.

SAP customers can download more information on the SAP HANA Platform at the [SAP Service Marketplace](#). See the installation and upgrade guides download section for SAP In-Memory Computing (SAP In-Memory Appliance — SAP HANA). The following are available:

- [SAP HANA Master Guide](#)

This is the central starting point for the technical implementation of the SAP HANA platform. Use this for basic concepts and for planning the SAP HANA application system landscape.

- **SAP HANA Installation and Initial Configuration Guides**

Use the various installation guides to install the required SAP In-Memory Database and the other software components for the different replication technologies. Refer to the [SAP HANA Server Installation Guide](#) for an overview on how to install SAP HANA.

- [SAP HANA Technical Operations Manual](#)

Provides an end-to-end picture of the available administration tools with SAP HANA appliance and the key tasks for a system administrator to perform.

- [SAP HANA Master Update Guide](#)

This explains how to update SAP HANA and its components.

- [SAP Integration and Certification Center \(SAP ICC\)](#)

This page provides information about SAP certified HANA appliances by SAP hardware partners.

The following is a link to all SAP-related documentation: [SAP HANA Platform](#)

The following is a link to all SAP and VMware related documentation: [SAP on VMware](#)

SUSE Linux Enterprise Server (SLES) for SAP Applications

The medium size 1 TB UCP for SAP HANA VM runs on a 64-bit SUSE Linux Enterprise Server (SLES) for SAP Applications 11 SP3. The kernel version is 3.0.101-0.35 or later.

The initially delivered configuration of the guest operating system should persist. Changing the configuration settings can cause significant performance problems to occur.

Do not make any modifications to the operating system, except as noted or approved by SAP and Hitachi/HDS. Before updating operating system components, especially the Linux kernel and standard libraries like glibc, please consult the relevant information provided by SAP in the respective SAP notes. Make sure the SAP notes are SAP HANA related and not generally for SAP systems. [SAP note 1944799](#) is a good starting point for this information.

For more details, see section 2.1.4.1, "Updating and Patching the Operating System," in the [SAP HANA Technical Operations Manual](#).

VMware vSphere 5.5

[VMware vSphere 5.5](#) is a virtualization platform that provides a datacenter infrastructure. It features vSphere Distributed Resource Scheduler (DRS), high availability, and fault tolerance.

VMware vSphere 5.5 has the following components:

- **ESXi**

A hypervisor that loads directly on a physical server. It partitions one physical machine into many virtual machines that share hardware resources.

- **vCenter Server**

vCenter Server can manage the vSphere environment through a single user interface. With vCenter, there are additional features available such as vMotion, Storage vMotion, Storage Distributed Resource Scheduler, High Availability, and Fault Tolerance.

- **VMware vSphere 5.5**

Enterprise virtualization solution to create a dynamic and flexible data center with integrated management and reporting capability for a high level of server, service, and client uptime

The Unified Compute Platform for the SAP HANA platform on VMware vSphere solution combines the benefits of the Hitachi UCP SAP HANA appliance with the flexibility and manageability of the VMware vSphere solution.

VMware vSphere customers can download more information about the ESXi Platform on [VMware vSphere Documentation](#). See the vSphere installation and setup guide in the ESXi and vCenter Server Product Documentation section for ESXi documentation. In addition, you can download [Performance Best Practices for VMware vSphere 5.5](#) (PDF).

For more information on HANA on VMware best practices, review the [Best Practices and Recommendations for Scale-Up Deployments of SAP HANA on VMware vSphere](#) documentation.

For more information on vMotion best practices, review the [VMware vSphere vMotion Architecture, Performance and Best Practices in VMware vSphere 5](#) documentation.

Note — This solution assumes that a management server already exists in the customer landscape and is available for use with this solution. Make sure that the landscape has a VMware vCenter infrastructure set up and available.

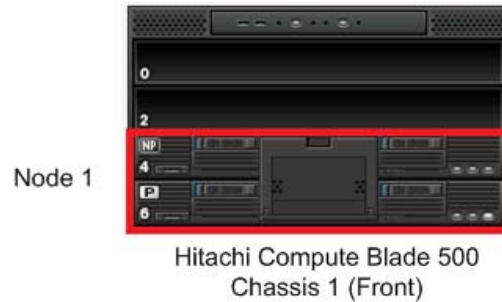
Solution Design

The detailed design for this Hitachi Unified Compute Platform for the SAP HANA Platform in a scale-up medium 1 TB configuration reference solution includes the following:

- “Hitachi Compute Blade 500 Chassis Configuration,” starting on page 10
 - “520X B1 Server Blade Architecture,” starting on page 11
 - “Fibre Channel SAN Architecture,” starting on page 11
 - “Network Architecture,” starting on page 13
 - “Storage Architecture,” starting on page 15
 - “VMware vSphere ESXi Configuration,” starting on page 17
 - “SAP HANA Configuration,” starting on page 18
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Hitachi Compute Blade 500 Chassis Configuration

Figure 2 shows the front and back view of the Hitachi Compute Blade 500 chassis.



- 10 GbE LAN Pass Through Module
- Brocade 16 Gb Fibre Channel Switch Module

Figure 2

In this solution, we use one Hitachi Compute Blade 500 chassis and it has two 520X B1 server blades.

There are four switch modules on the Hitachi Compute Blade 500 chassis, and they have the following components:

- Switch Module 0 and 1 slotted with 10 Gb/sec LAN pass through modules.
- Switch Module 2 and 3 slotted with 16 Gb/sec Brocade Fibre Channel switch modules.

520X B1 Server Blade Architecture

The SAP HANA node is a two blade server connected using the 2-blade SMP interface connector. This creates a single four-socket SMP node with 60 cores and 1 TB of memory.

Table 4 lists the server blade configuration.

Table 4. Server Blade Configuration

<i>Server Blades</i>	Total 2 server blades <ul style="list-style-type: none"> ■ Blade 4 (non-primary) ■ Blade 6 (primary)
<i>Total Number of CPU Cores</i>	60
<i>Total Memory (TB)</i>	1

Note — Due to SAP and VMware requirements for the production 1 TB virtual machine, the actual virtual machine is only allocated with 980 GB of RAM. ESXi processes use the remaining memory. For TDI, quality assurance, and development uses with SAP HANA on VMware, see “Multiple Virtual Machine Configurations” on page 19.

Fibre Channel SAN Architecture

The Fibre Channel SAN architecture consists of the following components on 520X B1 blades:

- Blade 4 has 1 × 2-port Hitachi 8 GB Fibre Channel mezzanine card on mezzanine slot 2
- Blade 6 has 1 × 2-port Hitachi 8 GB Fibre Channel mezzanine card on mezzanine slot 2

The mezzanine card installed in mezzanine slot 2 of server blade 4 and server blade 6 connects the Brocade 16 GB Fibre Channel switch modules installed in switch slot 2 and slot 3 through the backplane within the Hitachi Compute Blade 500 server chassis.

With the HANA scale-up medium-sized 1 TB configuration, there are four dedicated Fibre Channel ports on the Hitachi Unified Storage VM for Fibre Channel connection with the ESXi node. Table 5 shows the storage port mapping.

Table 5. Storage Port Mapping

<i>Switch Module, Port</i>	<i>Hitachi Unified Storage VM Ports</i>
Switch module 2, Port 16	1A
Switch module 2, Port 17	2A
Switch module 3, Port 16	3A
Switch module 3, Port 17	4A

This configuration supports high availability by providing multiple paths from the host within Hitachi Compute Blade 500 to multiple ports on Hitachi Unified Storage VM.

Figure 1 on page 2 shows the direct connect Fibre Channel architecture. Set the port properties for the point-to-point connection between Hitachi Compute Blade 500 and Hitachi Unified Storage VM as shown in Table 6.

Table 6. Port Properties

<i>Property</i>	<i>Value</i>
Port Attribute	Target
Port Security	Enabled
Port Speed	Auto (8 Gb/sec)
Fabric	ON
Connection Type	P-to-P

On Hitachi Unified Storage VM, use the default host storage group for each port listed in Table 7 and assign the World Wide Name of the Hitachi 8 GB Fibre Channel Mezzanine port as the host to the corresponding host group.

Table 7. Host Storage Group WWN Port Mapping on Hitachi Unified Storage VM

<i>Host Storage Group (Ports)</i>	<i>Chassis, Server Blade, Mezzanine Card, Mezzanine Port WWN</i>
1A-G00	Chassis 1, Server Blade 6, Mezzanine 2, Port 0 WWN
2A-G00	Chassis 1, Server Blade 4, Mezzanine 2, Port 0 WWN
3A-G00	Chassis 1, Server Blade 6, Mezzanine 2, Port 1 WWN
4A-G00	Chassis 1, Server Blade 4, Mezzanine 2, Port 1 WWN

Network Architecture

This solution uses two 10 Gb/sec LAN pass-through modules on switch slot 0 and 1 of the Hitachi Compute Blade 500 chassis. The 520X B1 server blades 4 and 6, each have one 4-port 10 GbE onboard LOM. LOM pass through connectors installed on 520X B1 server blades connect the onboard LAN to the 10 GbE LAN pass-through switch modules installed in switch slot 0 and 1.

The HANA scale-up Medium 1 TB configuration has a total of eight 10 GbE LOM ports. Make the following network connections for the management and uplink network setup of the HANA node:

- Connect port 8 of the LAN pass through module on switch slot 0 and port 12 of the LAN pass through module on switch slot 1 to the external switch.
- The corresponding two ports vmnic1 and vmnic2 appear at the ESXi level and are configured as uplinks in the virtual distributed switch using active-active mode. These two ports act as the management network for the ESXi node as well as the network for the guest operating system.
- Switch slot 0 LAN pass-through module ports 10, 12, and 14, and also switch slot 1 LAN pass-through module ports 8, 10, and 14 are free for the appliance to connect to the 10 GbE external switches for use as uplink network or vMotion ports.

The compute network setup uses the ports on the 10 GbE LAN pass-through modules, as listed in Table 8.

Table 8. Network Setup Using 10 GbE LAN Pass-through Modules

<i>Server Blade</i>	<i>LAN Pass-through Switch Module</i>	<i>Switch Module Port</i>	<i>Network Description</i>
4	Switch 0	8	Client network for SAP HANA node
		10	Free for use as uplink network/vMotion
	Switch 1	8	Free for use as uplink network/vMotion
		10	Free for use as uplink network/vMotion
6	Switch 0	12	Free for use as uplink network/vMotion
		14	Free for use as uplink network/vMotion
	Switch 1	12	Client network for SAP HANA node
		14	Free for use as uplink network/vMotion

The Hitachi Compute Blade 500 chassis has two management modules for redundancy. Each module supports the following:

- An independent management LAN interface from the data network for remote and secure management of the chassis and all server blades
- A serial command line interface and a web interface
- Hot swappable replacements
- Live firmware updates without the need for shutting down the server blades

Figure 3 shows the standard network configuration used for Hitachi Compute Blade 500 chassis.

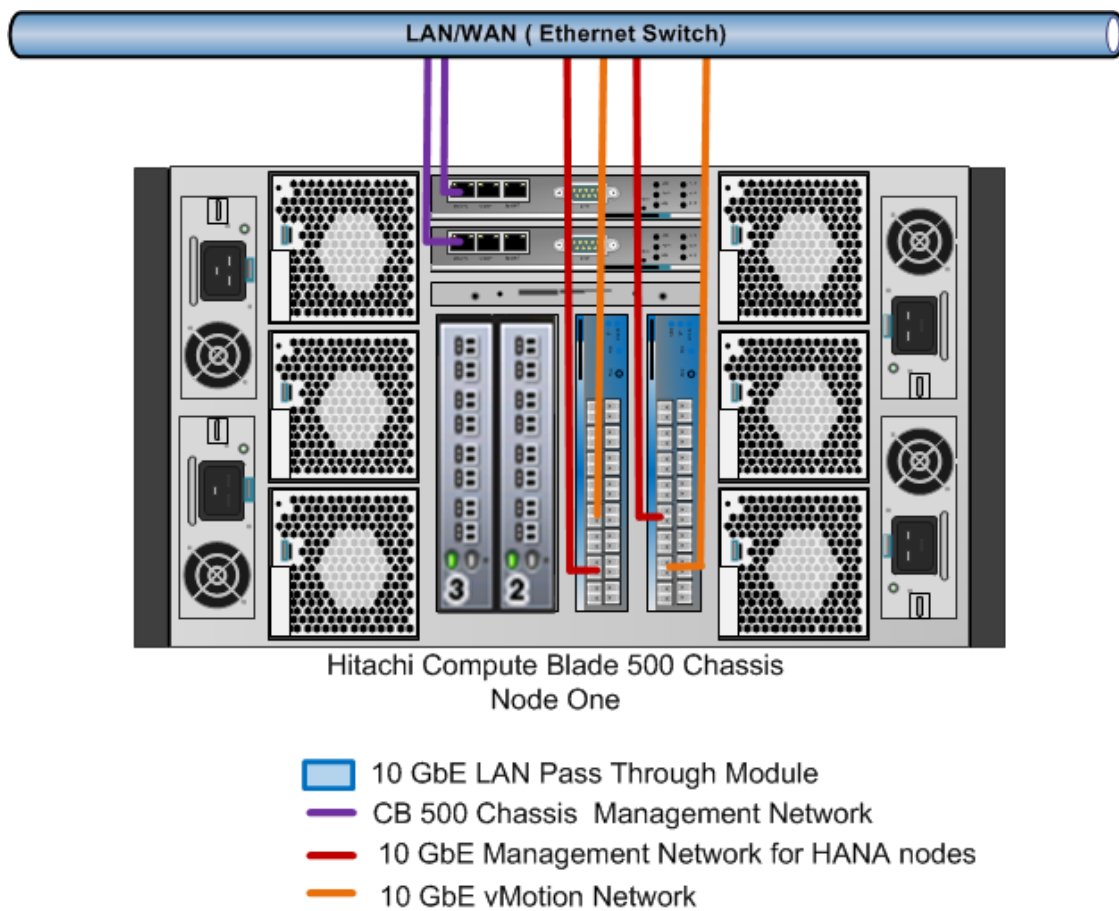


Figure 3

Storage Architecture

Many factors drive the sizing and configuring of storage for use with the medium 1 TB configuration of Hitachi Unified Compute Platform for the SAP HANA Platform on VMware vSphere in a scale-up configuration reference solution. This includes I/O and capacity requirements.

Note — The storage layout presented uses five parity groups configured as RAID-6 (6D+2P). It supports eight virtual machines running batch loads in parallel. To run seven more virtual machines at the same time for a total of 15 virtual machines of 64 GB running SAP HANA, then Hitachi Data Systems recommends that you purchase four more parity groups for data LUNs and log LUNs. If performance is not an issue or requirement, one set of parity groups has enough storage capacity to host 15 virtual machines of 64 GB running SAP HANA.

Figure 4 shows the disk configuration of the storage subsystem.

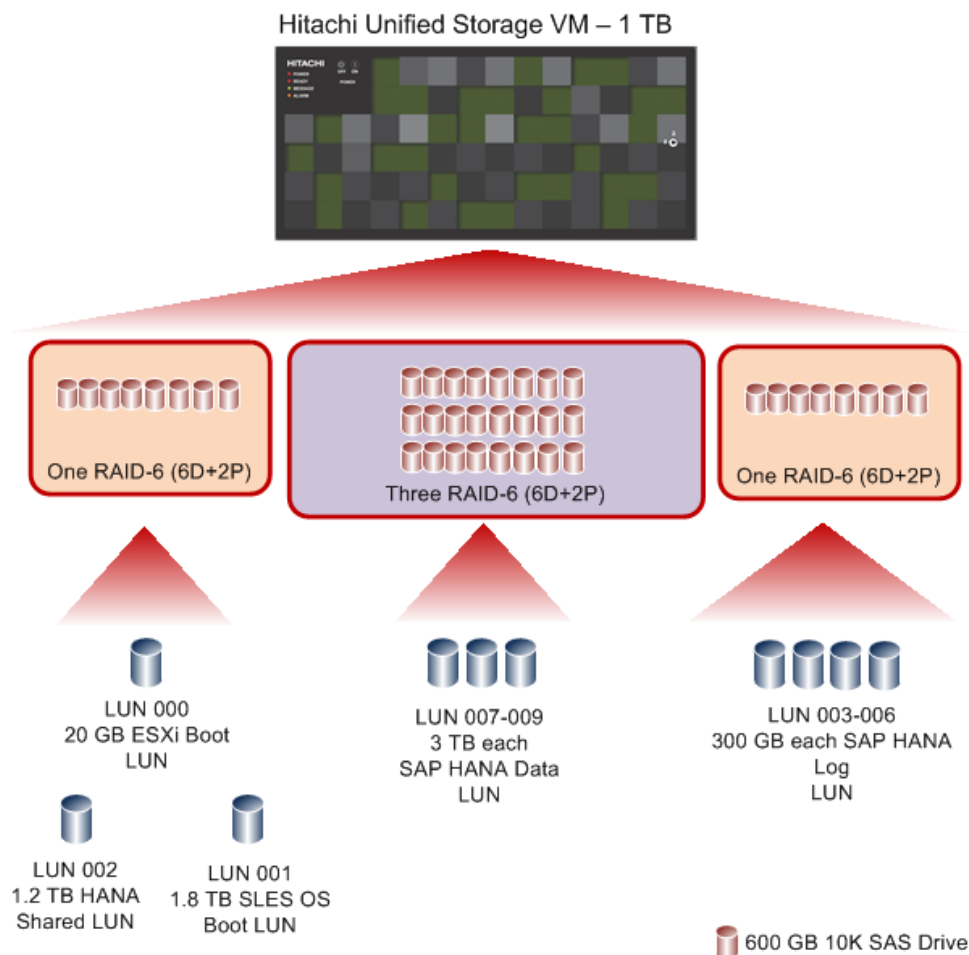


Figure 4

RAID and LUN Configuration

This reference architecture for Hitachi Unified Compute Platform for the SAP HANA Platform on VMware vSphere in a scale-up medium 1 TB configuration uses the following RAID configuration on Hitachi Unified Storage VM:

- Five RAID-6 (6D+2P) groups created using 32 × 600 GB SAS 10k RPM drives
- One 600 GB SAS 10k RPM spare drive

This reference solution contains the following:

- One 20 GB OS LUN to host the ESXi 5.5 U1 hypervisor.
- One 1.8 TB OS LUN to host the SAP HANA virtual machine server operating system and virtual machine storage
- One 1.2 TB LUN to host the SAP HANA shared volume
- Four 300 GB LUN to host the SAP HANA log volume
- Three 3 TB LUN to host the SAP HANA data volume

Table 9 has the parity groups and LDEV assignments for the medium 1 TB configuration.

Table 9. Storage Configuration

<i>Parity Group</i>	<i>Parity Group RAID Level and Disks</i>	<i>LDEV ID</i>	<i>LDEV Size</i>	<i>MPU ID</i>	<i>LUN Assignment</i>	<i>Description</i>
1	RAID-6 (6D+2P) on 600 GB 10k RPM SAS drives	0:00:00	20 GB	MPU-10	000	ESXi_operating system
	RAID-6 (6D+2P) on 600 GB 10k RPM SAS drives	0:01:00	1.8TB	MPU-21	001	SLES_OS_Storage
	RAID-6 (6D+2P) on 600 GB 10k RPM SAS drives	00:01:01	1.2 TB	MPU-20	002	SAP_Shared

Table 9. Storage Configuration (Continued)

<i>Parity Group</i>	<i>Parity Group RAID Level and Disks</i>	<i>LDEV ID</i>	<i>LDEV Size</i>	<i>MPU ID</i>	<i>LUN Assignment</i>	<i>Description</i>
2	RAID-6 (6D+2P) on 600 GB 10k RPM SAS drives	00:02:00	300 GB	MPU-10	003	SAP HANA Log Volume VMFS_1
	RAID-6 (6D+2P) on 600 GB 10k RPM SAS drives	00:02:01	300 GB	MPU-11	004	SAP HANA Log Volume VMFS_2
	RAID-6 (6D+2P) on 600 GB 10k RPM SAS drives	00:02:02	300 GB	MPU-20	005	SAP HANA Log Volume VMFS_3
	RAID-6 (6D+2P) on 600 GB 10k RPM SAS drives	00:02:03	300 GB	MPU-21	006	SAP HANA Log Volume VMFS_4
3	RAID-6 (6D+2P) on 600 GB 10k RPM SAS drives	00:03:00	3 TB	MPU-10	007	SAP HANA Data Volume VMFS_1
4	RAID-6 (6D+2P) on 600 GB 10k RPM SAS drives	00:03:01	3 TB	MPU-11	008	SAP HANA Data Volume VMFS_2
5	RAID-6 (6D+2P) on 600 GB 10k RPM SAS drives	00:03:02	3 TB	MPU-20	009	SAP HANA Data Volume VMFS_3

Follow the LUN path assignment in Table 9 for the four host groups on the Hitachi Unified Storage VM in Table 7 on page 12. To support high availability, each LUN has four paths from the host within Hitachi Compute Blade 500 to four ports (1A, 2A, 3A, 4A) on Hitachi Unified Storage VM.

VMware vSphere ESXi Configuration

This section describes the VMware vSphere ESXi configuration.

SAN Operating System Boot Configuration

This two blade configuration requires SAN boot. It uses one 20 GB LUN from Hitachi Unified Storage VM as the operating system boot volume to host the hypervisor of the medium size 1 TB SAP HANA VM appliance.

The Hitachi 8 GB Fibre Channel mezzanine ports in Table 7 on page 12 have the 20 GB ESXi boot LUN configured as the primary boot device. The installation of ESXi version 5.5 update 1 is on the boot LUN.

Activate Round Robin Multipathing Policy

This reference architecture uses the round robin multipathing policy, a component of the ESXi operating system.

Using the round robin multipathing policy allows the configuration of multiple I/O paths between the server blades and Hitachi Unified Storage VM. Round robin aggregates all physical I/O paths into a single logical path and thus provides high availability and load balancing for the block devices. The LUNs are always available unless all four paths fail.

The round robin multipathing policy is used for the following I/O paths:

- ESXi operating system LUN
- SAP HANA server operating system LUN
- SAP HANA data volume LUN
- SAP HANA log volume LUN
- SAP HANA shared volume LUN

SAP HANA Configuration

This describes the configuration of SAP HANA for medium size 1 TB SAP HANA VM appliance.

SAN Operating System Boot Configuration

This virtualized SAP HANA configuration requires SAN boot. The Hitachi Unified Storage VM provisions a 1.8 TB LUN called SLES_OS_Storage. ESXi sees the LUN and creates a VMFS. From the VMFS, a 100 GB VMDK is carved out to be used as the 1 TB SAP HANA virtual operating system including the `/usr/sap/` directory for SAP application related files.

SAP HANA Volume Configuration

This SAP HANA virtual machine configuration uses the following LUNs from Hitachi Unified Storage VM:

- Three 1 TB SAP HANA data LUNs: three 1 TB VMDKs for SAP HANA data.
 - Four 150 GB SAP HANA log LUNs: four 150 GB VMDKs for SAP HANA log.
 - One 1 TB SAP HANA shared LUN: creates one 1 TB VMDK for SAP HANA shared.
-

The logical volume manager (LVM) configures the SAP HANA persistent storage volumes from virtual machines.

- With three VMDKs for the SAP HANA data, LVM creates a single 3-way striped volume on which the XFS file system is created to store the SAP HANA data volume.
- With four VMDKs for the SAP HANA log, LVM creates a single 4-way striped volume on which the XFS file system is created to store the SAP HANA log volume.

For SAP HANA shared, SLES OS creates an XFS file system to store SAP HANA binaries, configuration, and trace files.

SAP HANA Software Installation

After configuring the file system for the SAP HANA data volume and log volume, the latest version of SAP HANA 1.0 SPS09 is installed on the SAP HANA virtual machine server.

The following SAP HANA software components are installed on the HANA VM server node:

- SAP HANA Database
- SAP HANA Client
- SAP Host Agent
- LM Structure

Multiple Virtual Machine Configurations

For non-production environments used for development and quality assurance, these are the size configurations of multiple virtual machines for a 1 TB solution using SAP HANA in a VMware environment.

Note — Multiple virtual machines are only applicable for non-production environments. The production environment only allows one SAP HANA virtual machine.

SAP and VMware require the production 1 TB virtual machine only use 980 GB of RAM. ESXi processes use the remaining memory. To allocate memory evenly to all virtual machines and keep within the limitation of 980 GB of RAM for the production virtual machine, use the following sizes

to be able to have the maximum number of virtual machines for SAP HANA:

- 1024 GB virtual machine uses 980 GB RAM
- 768 GB virtual machine uses 735 GB RAM
- 512 GB virtual machine uses 490 GB RAM
- 256 GB virtual machine uses 245 GB RAM
- 192 GB virtual machine uses 183 GB RAM
- 128 GB virtual machine uses 122 GB RAM
- 64 GB virtual machine uses 64 GB RAM

To create more than eight virtual machines, Hitachi Data Systems recommends using four more parity groups configured as RAID 6 (6D+2P) to host data LUNs and log LUNs. If performance is not an issue or requirement, one parity group set has enough storage capacity to host up to 15 virtual machines running as 64 GB SAP HANA databases. For more information, see SAP Note [2024433](#).

Table 10 is a sample table of virtual machines for SAP HANA that fit within the 980 GB limitation. You can have up to 15 virtual machines of 64 GB in your environment, even though this is not shown in the table.

Table 10. Virtual Machine Allocation

<i>Number of VMs</i>	<i>Virtual Machine Size</i>							
	<i>1st</i>	<i>2nd</i>	<i>3rd</i>	<i>4th</i>	<i>5th</i>	<i>6th</i>	<i>...</i>	<i>15th</i>
2	490 GB	490 GB						
3	490 GB	245 GB	245 GB					
4	490 GB	245 GB	122 GB	122 GB				
5	490 GB	245 GB	64 GB	64 GB	64 GB			
6	490 GB	122 GB	122 GB	122 GB	122 GB			
7	490 GB	122 GB	122 GB	64 GB	64 GB	64 GB		
15 (Max)	64 GB	64 GB	64 GB	64 GB	64 GB	64 GB	...	64 GB

Appendix A

This section explains the storage connection when using the Brocade 5460 8 Gb/sec Fibre Channel switch modules.

Figure 5 displays the physical cabling.

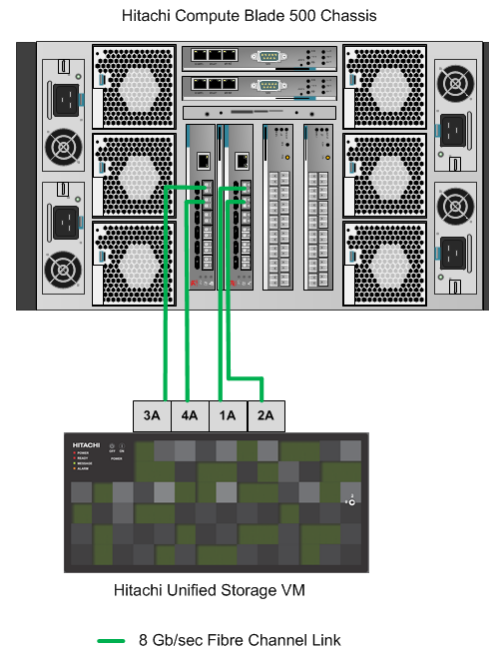


Figure 5

Table 11 provides the storage port mapping for the switch modules.

Table 11. Storage Port Mapping

<i>Switch Module, Port</i>	<i>Hitachi Unified Storage VM Ports</i>
Switch module 2, Port 0	1A
Switch module 2, Port 1	2A
Switch module 3, Port 0	3A
Switch module 3, Port 1	4A

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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