



Hitachi Unified Compute Platform for the SAP HANA Platform in a Scale-Up Configuration Using Hitachi Compute Blade 2500: OCFS2 Active-Standby HA Solution

Reference Architecture Guide

By David Pascuzzi

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Reference Architecture Guide

This reference architecture guide describes how to extend a Hitachi Unified Compute Platform for the SAP HANA Platform (UCP for SAP HANA) in a Scale-Up configuration Using Hitachi Compute Blade 2500 (CB 2500) for different sized solutions to provide High Availability using OCFS2 and SAP HANA Storage API with the following additional items:

- 520X B2 server blades (for CB 2500 chassis).
- SMP connection board for 520X server blades.
- LAN PCIe adapters
- Fibre Channel adapters

Unified Compute Platform for SAP HANA is a preconfigured analytical appliance, ready to plug into a network to provide real-time access to operational data for use in analytic models.

This standby node extension to the appliance supports the configurations listed in Table 1. The configuration for the standby node must match the configuration used for the SAP HANA node.

Table 1. Supported Scale-Up Configuration Sizes

Description	2-Socket	4-Socket	8-Socket
Number of CPUs	2	4	8
Number of Server Blades	1	2	4
Memory	<ul style="list-style-type: none"> ■ 128 GB ■ 256 GB ■ 384 GB ■ 512 GB ■ 768 GB ■ 1024 GB ■ 1536 GB 	<ul style="list-style-type: none"> ■ 128 GB ■ 256 GB ■ 384 GB ■ 512 GB ■ 768 GB ■ 1024 GB ■ 1536 GB ■ 2048 GB ■ 3072 GB 	<ul style="list-style-type: none"> ■ 256 GB ■ 512 GB ■ 768 GB ■ 1024 GB ■ 1536 GB ■ 2048 GB ■ 3072 GB ■ 4096 GB ■ 6144 GB

This technical paper assumes that you have familiarity with the following:

- Storage area network (SAN)-based storage systems.
- General storage concepts.
- Common IT storage practices.
- SAP HANA.
- SLES system administration.
- Hitachi UCP for SAP HANA configuration.

Solution Overview

This reference solution extends an existing appliance by adding the following:

- 520X B2 server blades for Hitachi Compute Blade 2500 chassis
- SMP connection board for 520X server blades.
- LAN PCIe adapters
- Fibre Channel adapters

Figure 1 shows the changes to the existing topology for this reference architecture.

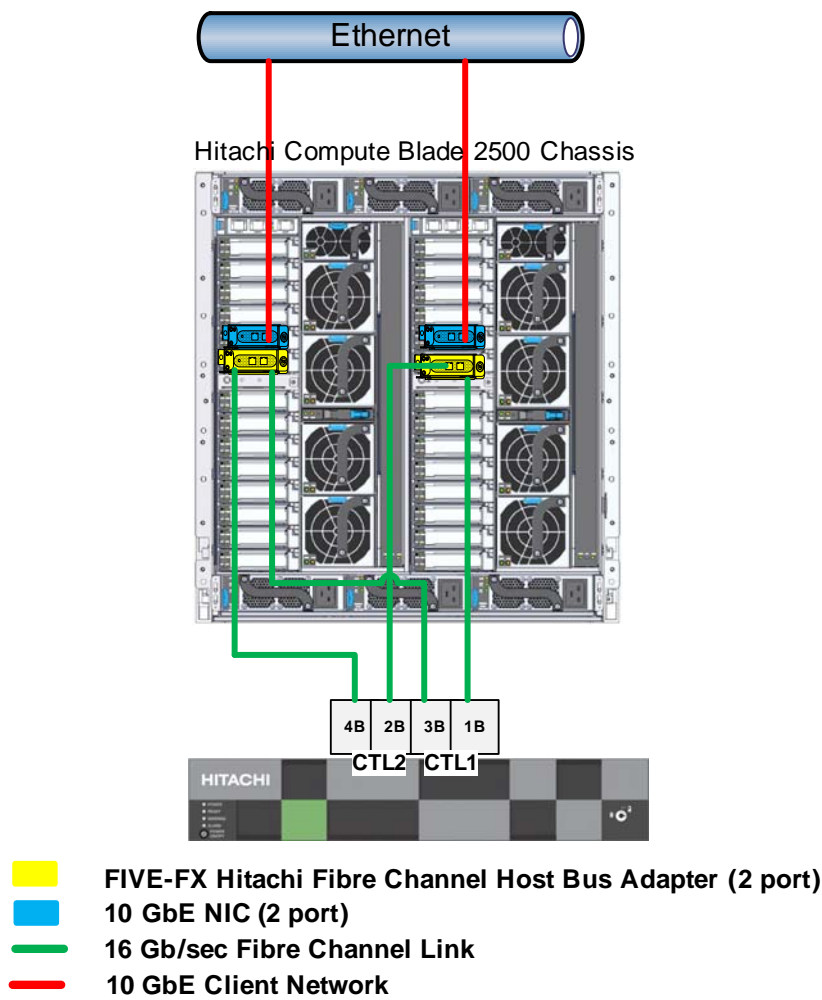


Figure 1

Key Solution Elements

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

Hardware Elements

Table 2 lists the hardware used to deploy the specific Scale-Up configuration of Unified Compute Platform for SAP HANA for the different sized solutions.

Table 2. Hardware Elements

Hardware		Quantity	Configuration (per unit)	Role
520X B2 server blade	2-Socket	1	<ul style="list-style-type: none"> ■ 2 × 18-core processors ■ RAM for all memory sizes listed in Table 1 ■ 1 × 2-port pass-through mezzanine card on mezzanine slot 2 and mezzanine slot 4 of blade 9 and blade 10 (on single blade for 2-Socket) 	SAP HANA server
	4-Socket	2		
	8-Socket	4		
SMP connection board for 520X server blade	2-Socket	0	<ul style="list-style-type: none"> ■ SMP connection board <ul style="list-style-type: none"> ■ 2-blade SMP connection board for 4-Socket ■ 4-blade SMP connection board for 8-Socket ■ SMP expansion module ■ SMP connector cover 	SMP connector
	4-Socket	1		
	8-Socket	1		

Hitachi Compute Blade 2500

[Hitachi Compute Blade 2500](#) delivers enterprise computing power and performance with unprecedented scalability and configuration flexibility. Lower your costs and protect your investment.

Flexible I/O architecture and logical partitioning allow configurations to match application needs exactly with Hitachi Compute Blade 2500. Multiple applications easily and securely co-exist in the same chassis.

Add server management and system monitoring at no cost with Hitachi Compute Systems Manager. Seamlessly integrate with Hitachi Command Suite in Hitachi storage environments.

The configuration uses one, two, or four 520X B2 server blades in the existing Hitachi Compute Blade 2500 chassis for the different sized solutions listed in Table 1.

The configuration for the 520X B2 server blades chosen for the standby node must match the configuration for the active SAP HANA node.

Table 3 lists the configurations for the 520X B2 server blades used in the various sized solutions.

Table 3. 520X B2 Server Blade Configuration

Feature		Configuration		
		Small (2-Socket)	Large (8-Socket) Medium (4-Socket)	
Processors		2 Intel Xeon E7-8880 processors	4 Intel Xeon E7-8880 processors	8 Intel Xeon E7-8880 processors
Processor SKU		Intel Xeon E7-8880 v3		
Processor frequency		2.3 GHz		
Processor cores		18 cores		
Number of blades		1	2	4
Number of DIMMs per blade	128 GB	8 × 16 GB DIMMs	8 × 8 GB DIMMs	N/A
	256 GB	16 × 16 GB DIMMs	8 × 8 GB DIMMs	8 × 8 GB DIMMs
	384 GB	24 × 16 GB DIMMs	24 × 8 GB DIMMs	N/A
	512 GB	32 × 16 GB DIMMs	16 × 16 GB DIMMs	16 × 8 GB DIMMs
	768 GB	48 × 16 GB DIMMs	24 × 16 GB DIMMs	24 × 8 GB DIMMs
	1024 GB	32 × 32 GB DIMMs	32 × 16 GB DIMMs	16 × 16 GB DIMMs
	1536 GB	48 × 32 GB DIMMs	48 × 16 GB DIMMs	24 × 16 GB DIMMs
	2048 GB	N/A	32 × 32 GB DIMMs	32 × 16 GB DIMMs
	3072 GB	N/A	48 × 32 GB DIMMs	48 × 16 GB DIMMs
	4096 GB	N/A	N/A	32 × 32 GB DIMMs
6144 GB	N/A	N/A	48 × 32 GB DIMMs	
Network Ports		2 × 2-port 10GBASE-SR LAN PCIe adapter on two I/O board modules: <ul style="list-style-type: none"> ■ IOBD 09B ■ IOBD 10B 		
Fibre Channel Ports		2 × Hitachi 16 Gb/sec 2-port Fibre Channel adapters on two I/O board modules: <ul style="list-style-type: none"> ■ IOBD 09A ■ IOBD 10A 		

Figure 2 shows the layout of the I/O board modules from the back of the Hitachi Compute Blade 2500 chassis.

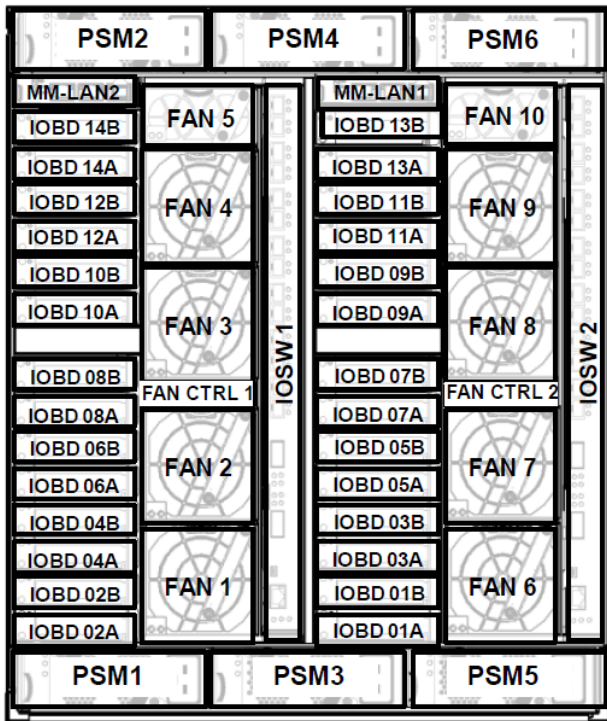


Figure 2

Symmetric Multiprocessing Connector

For multiple server blades, the solution uses symmetric multiprocessing (SMP) technology to combine multiple server blade resources into a single server.

The 520X B2 server blades use SMP in one of two ways, depending on the size of the solution:

- Combine two server blades with a 2-blade SMP connection board for 520X blade server.
- Combine four server blades with a 4-blade SMP connection board for 520X blade server.

Hitachi Virtual Storage Platform

This solution uses the existing Hitachi Virtual Storage Platform (VSP) from the base solution. The operating system LUNs, SAP HANA data, and log LUNs reside on this storage array, as well as the shared LUNs for SAP HANA configuration files, binaries and traces. This solution creates an extra LDEV on the parity group used for the operating system.

Software Elements

Table 4 describes the software products used to deploy the standby node.

Table 4. Software Elements

Software	Version
SUSE Linux Enterprise Server for SAP Applications	SLES11 SP3 or later
SAP HANA Platform	1.0 SPS 09, Rev. 97 or later

SAP HANA

The SAP HANA platform is flexible, multipurpose in-memory software. It combines SAP software components optimized to specific hardware. These components come from leading hardware partners of SAP, including Hitachi Data Systems.

The SAP HANA platform allows customers to analyze large volumes of data in real time. It is also a development platform, providing an infrastructure and tools for building high-performance applications based on SAP HANA Extended Application Services (SAP HANA XS). It is the foundation of various SAP HANA editions, like the SAP HANA Platform Edition, providing core database technology, and the SAP HANA Enterprise Edition, bundling additional components for data provisioning. The SAP HANA Platform Edition integrates a number of SAP components, including the SAP HANA database, SAP HANA studio and SAP HANA clients.

As a SAP customer, you can get more information on the SAP HANA platform at the [SAP Service Marketplace](#) and help.sap.com.

See **Installation and Upgrade Information** on [SAP HANA Platform](#) for the following guides and all other SAP-related documentation:

- **The SAP HANA Master Guide** — This guide is the entry point for planning the installation of your SAP HANA system landscape.
- **The SAP HANA Master Update Guide** — This guide describes how to update the SAP HANA platform and related components.
- **SAP HANA Server Installation and Update Guide** — This guide describes how to install and update an SAP HANA system with the SAP HANA life-cycle management tools.
 - There are various related installation guides to install the required SAP in-memory database and the other software components for the different replication technologies.
- **SAP HANA Technical Operations Manual** — This guide is the entry point for administering and operating your SAP HANA system landscape.

[SAP Integration and Certification Center \(SAP ICC\)](#) provides information about SAP-certified SAP HANA appliances by SAP hardware partners.

SUSE Linux Enterprise Server (SLES)

Hitachi Unified Compute Platform for the SAP HANA Platform in a Scale-Up configuration can run on the following Linux operating system:

- 64-bit SUSE Linux Enterprise Server (SLES) for SAP Applications 11 SP3.

Changing the configuration settings is only supported along the guidelines of SAP and the operating system distributor and may otherwise cause significant performance problems. A good starting point for information on this topic provide the following SAP Note: [1944799 - SAP HANA Guidelines for SLES Operating System Installation](#)

For more details of the operating system changes, see the section, “Updating and Patching the Operating System,” in the [SAP HANA Technical Operations Manual](#).

Solution Design

The detailed design for this extension to the Hitachi Unified Compute Platform for the SAP HANA Platform in a Scale-Up configuration reference solution includes the following:

- Hitachi Compute Blade 2500 Chassis Configuration.
- CB520X B2 Server Blade Architecture.
- Fibre Channel Architecture.
- Network Architecture.
- Storage Architecture.
- Parity Group, RAID, and LUN Configuration.
- SAP HANA Configuration.

Hitachi Compute Blade 2500 Chassis Configuration

Figure 3 shows the front and back view of the Hitachi Compute Blade 2500 chassis for different configuration sizes.

Small (2-Socket) – One Blade



Hitachi Compute Blade 2500 Chassis 1
(Front)

Medium (4-Socket) – Two Blades
(SMP)

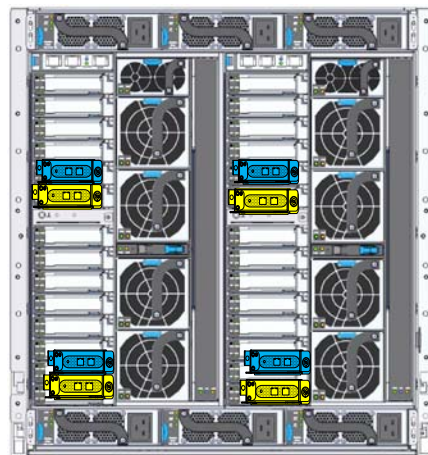


Hitachi Compute Blade 2500 Chassis 1
(Front)

Large (8-Socket) – Four Blades
(SMP)



Hitachi Compute Blade 2500 Chassis 1
(Front)



Hitachi Compute Blade 2500 Chassis 1
(Back)

- FIVE-FX Hitachi Fibre Channel Host Bus Adapter (2 port)
- 10 GbE NIC (2 port)

Figure 3

The solution uses the existing Hitachi Compute Blade 2500 chassis with the following components added:

- One to four 520X B2 server blades. Refer to Table 1.
- A maximum of 28 I/O board modules (IOBD) can be mounted on one Hitachi Compute Blade 2500 chassis; the solution extends the configuration by four I/O board modules.
 - Hitachi 16 Gb/sec 2-port Fibre Channel PCI-X adapters are installed on IOBD 09A and IOBD 10A.
 - 10GBase-SR 2-port network PCI-Ex adapters are installed on IOBD 09B and IOBD 10B.

520X B2 Server Blade Architecture

Each solution size has a different number of server blades, from one up to four full-width server blades. Multiple server blades use a two- or four-server blade SMP connection board to create a single four- or eight-socket SMP node with a total of 72 or 144 cores and different memory sizes.

Table 5 lists the information of server blade configuration for small, medium, and large solution sizes.

Table 5. Server Blade Configuration

	Small (2-Socket)	Medium (4-Socket)	Large (8-Socket)
Server Blades	Total of 1 server blade: <ul style="list-style-type: none"> ■ Blade 9 (primary) 	Total of 2 server blades: <ul style="list-style-type: none"> ■ Blade 9 (non-primary) ■ Blade 11 (primary) 	Total of 4 server blades (bottom-up): <ul style="list-style-type: none"> ■ Blade 9 (non-primary) ■ Blade 11 (non-primary) ■ Blade 13 (non-primary) ■ Blade 14 (primary)
Total Number of CPU Cores	36	72	144

Fibre Channel Architecture

As shown in Table 6, the solution uses two Hitachi 16 Gb/sec 2-port Fibre Channel Adapters installed on the PCIe slot of the I/O board module of blade 9. This solution uses four 16 Gb/sec Fibre Channel ports on the Virtual Storage Platform directly attached to the Hitachi Compute Blade 2500 server chassis via the Fibre Channel PCI-X adapters.

Table 6. Fibre Channel Port Mapping

Blade #	PCIe Slot #	Port #	VSP Port
Blade 9	IOBD 09A	0	1B
		1	2B
	IOBD 10A	0	3B
		1	4B

This configuration supports high availability by providing multiple paths from the host within Hitachi Compute Blade 2500 to multiple ports on Virtual Storage Platform.

Figure 4 shows the direct connect Fibre Channel architecture for this solution.

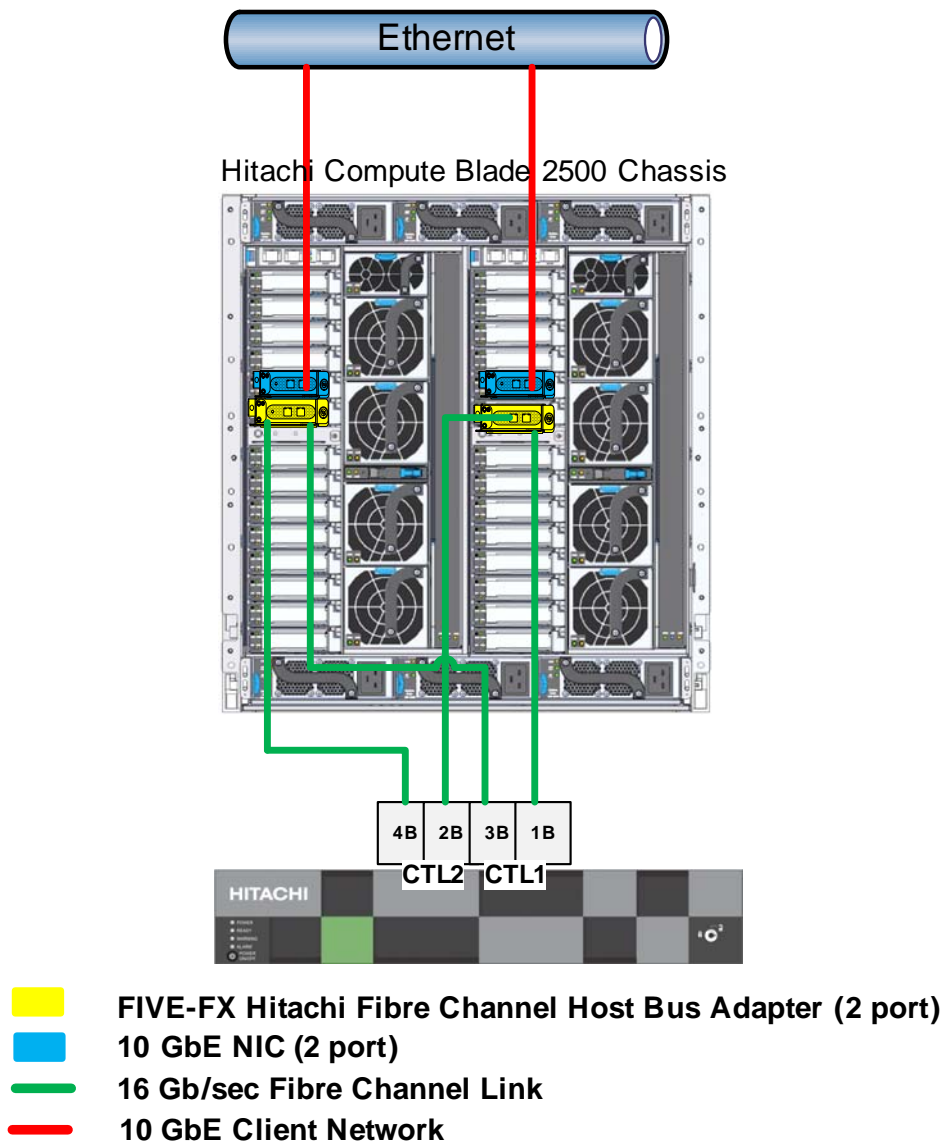


Figure 4

Set the port properties for the point-to-point connection between Hitachi Compute Blade 2500 and Virtual Storage Platform, as shown in Table 7.

Table 7. Port Properties

Property	Value
Port Security	Disabled
Port Speed	Auto (16 Gb/sec)
Fabric	ON
Connection Type	P-to-P

Network Architecture

There are two 10GBASE-SR 2-port LAN adapters installed on the PCIe slots of the I/O board module of blade 1 of the Hitachi Compute Blade 2500 chassis. The solution uses two 10 GbE ports on the 10GBASE-SR 2-port LAN adapters for connectivity with the 10 GbE external switches.

Make the following network connections for the client network setup of the SAP HANA node as an uplink network setup:

- Connect the following to the external switches:
 - Port 0 of the I/O board module on PCIe slot IOBD 09B.
 - Port 0 of the I/O board module on PCIe slot IOBD 10B.
- Bond the corresponding two ports eth9901 and eth9902 as bond0 at the operating system level using the active-active network bond mode with options "mode= 802.3ad miimon=100 xmit_hash_policy=layer3+4 updelay=5000 lacp_rate=fast", which acts as the client network for the SAP HANA node.
- Configure the external switch ports with a short LACP timeout value to speed up detecting corrupted connections.

The compute network setup uses the ports on the 10GBASE-SR 2-port LAN adapters, as listed in Table 8.

Table 8. Network Setup Using 10GBASE-SR 2-Port LAN Adapter

Server Blade	PCIe Slot #	Switch Module Port	Network Description
Blade 9	IOBD 09B	0	Client network for SAP HANA node
		1	Free for use as uplink network
	IOBD 10B	0	Client network for SAP HANA node
		1	Free for use as uplink network

Figure 4 shows the standard network configuration used for Hitachi Compute Blade 2500 chassis for this solution.

Storage Architecture

Hitachi Virtual Storage Platform is used for this SAP HANA solution. Sizing and configuring of storage including storage drive box trays (DBS), spare drives, the operating system volume (OS), SAP HANA shared volume (/hana/shared), SAP HANA log volume (/hana/log), and SAP HANA data volume (/hana/data), varies for different sizes by taking into account requirements such as I/O and capacity.

For this solution, the only change to the existing storage is the addition of one 100 GB LUN on the operating system (OS) RAID. For shared, data, and log storage this solution uses the existing storage.

Parity Group, RAID, and LUN Configuration

This reference architecture uses various configurations of parity group, RAID level, and LUNs on Hitachi Virtual Storage Platform for different sized solutions.

Table 9 shows the parity groups and LDEV assignment that are applied to all sized memories listed in Table 1. This LDEV is added to the existing OS parity group.

Table 9. Parity Group and LDEV

Parity Group	RAID Level and Disks	LDEV ID	LDEV Size	HOST ID	MPU ID	Description	Size Applied
1	RAID-6 (6D+2P) on 600 GB 10k RPM SAS drives	0:01:05	100 GB	000	MPU10	Operating system boot volume	All

Besides using the new OS LDEVs, this solution uses the existing shared, data, and log volumes. When the stand by node becomes active, SAP HANA Storage API will mount the storage to it.

SAP HANA Configuration

This section explains the SAP HANA configuration.

Operating System Boot Configuration

The SAP HANA Scale-Up configuration requires a boot volume. It uses one 100 GB LUN on Hitachi Virtual Storage Platform for the operating system volume for the SAP HANA appliance.

The four ports of Hitachi 16 Gb Fibre Channel 2-port adapters have the 100 GB operating system LUN configured as the primary boot device. The operating system LUN holds partitions for SUSE Linux Enterprise Server for SAP Applications version 11 SP3 on the OS LUN `/usr/sap/` and the Linux swap space.

Activate Device-Mapper Multipath

This reference architecture uses Device-mapper Multipath, a component of the native Linux operating system.

Using Device-mapper Multipath allows the configuration of multiple I/O paths between the server blades, and Hitachi Virtual Storage Platform. Multipathing aggregates all physical I/O paths into a single logical path. The LUNs are always available, unless all four paths fail.

Device-mapper Multipath is used for the following I/O paths:

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

OCFS2

This reference architecture uses Oracle Clustered File System (OCFS2) and, optionally, Clustered Logical Volume Manager (cLVM). These are components of the Linux operating system. OCFS2 is a shared clustered file system, and multiple LUN configurations will need to use cLVM to make the logical volume. OCFS2 allows multiple nodes to access the same storage without using NFS. In most cases this solution uses one LUN for /hana/shared.

SAP HANA Data Volume Configuration

This solution uses the data volume from the HANA Node. The standby node will need the data volume's LUNS added to its ports.

SAP HANA Log Volumes Configuration

This solution uses the log volume from the HANA Node. The standby node will need the log volume's LUNS added to its ports

SAP HANA Shared Volume

This solution uses the shared volume from the HANA Node. The standby node will need the shared volume's LUNs added to its ports. This volume will be modified to support the OCFS2 file system.

SAP HANA Appliance Software Installation

This solution uses the SAP HANA software components that were installed in the shared directory during the HANA server node installation. The only component that will be installed on the standby node is the SAP Host agent.

This solution uses the SAP landscape management tools on the HANA server node to install the standby node. The standby node will access the SAP HANA database and SAP HANA client software from the shared volume.

 **Hitachi Data Systems**



Corporate Headquarters
2845 Lafayette Street
Santa Clara, CA 96050-2639 USA
www.HDS.com community.HDS.com

Regional Contact Information
Americas: +1 408 970 1000 or info@hds.com
Europe, Middle East and Africa: +44 (0) 1753 618000 or info.emea@hds.com
Asia Pacific: +852 3189 7900 or hds.marketing.apac@hds.com

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