SAP HANA on Hitachi Unified Compute Platform HC

Reference Architecture Guide

Feedback

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Revision history

Changes	Date
Initial release	October 9, 2023

Reference Architecture Guide

Use this reference architecture guide for fast deployment of a Hitachi Solution for the SAP HANA Platform on a hyperconverged infrastructure.

Based on a partnership of more than 20 years with SAP, Hitachi Vantara solutions and services can help you deploy your SAP HANA hyperconverged infrastructure environment quickly, according to your business needs. Hitachi, the industry leader for end-to-end SAP digital transformation, is a trusted partner to help you digitally transform, plan integrations, map your business process, manage change, and deploy SAP HANA.

The Hitachi Vantara converged and hyperconverged product family offers a complete portfolio of solutions to enable a fast deployment of data-driven infrastructure. Resilient architectures support the high availability and reliability requirements of SAP HANA. See Hitachi Solutions for the SAP HANA Platform for details about solutions that are certified for SAP HANA.

A hyperconverged infrastructure consolidates compute, storage, and virtualization in industry-standard x86 servers, enabling a building-block approach to the software-defined data center (SDDC) and a true hybrid cloud. With a hyperconverged infrastructure, all key data center functions run as software in a tightly integrated software layer.

This hyperconverged infrastructure using Hitachi Unified Compute Platform HC (UCP HC) running VMware vSAN is an integrated turnkey solution that combines compute, storage, and virtualization to deliver certainty for edge to core to cloud operations. Advanced automation and intelligence for day 0-2 operations accelerate innovation and improve productivity while lowering the total cost of ownership (TCO).

> 📄 **Note:** Testing of this configuration was 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 otherwise matches your production environment before your production implementation of this solution.

Key benefits

Solutions with SAP HANA on the hyperconverged Hitachi Unified Compute Platform HC serve mission-critical workloads. They plug into your network to provide real-time access to operational data inside SAP HANA in your software-defined data center. This certified SAP HANA hyperconverged infrastructure solution provides simplified management of your private cloud deployment and builds the bridge to a public cloud.

SAP HANA on Unified Compute Platform HC enables your businesses to innovate faster and accelerate your IT operations providing the following benefits:

- **Business and Staff Productivity**

  - Greater agility and improved performance translate to addressing more business opportunities in a timely manner with more productive employees.

  - Application development teams do not wait for compute and storage resources to code, test, and deploy business applications for new business revenue opportunities.

  - Converging three separate IT and support teams — networking, storage, and compute — into a single talent hierarchy gives more time back to transform the business around orchestration and automation, and for value-add activities that were lacking IT talent in the past.

- **Risk Mitigation**

  - A reliable, automated, and agile infrastructure foundation reduces unplanned outages.

  - SAP HANA on Unified Compute Platform HC reduces the frequency and duration of unplanned outages. This minimizes the disruption to employee productivity, business operations, and revenue losses.

- **Lower Total Cost of Ownership**

  - For SAP HANA deployment and utilization, there are significant cost-benefits:

    - Streamlined and efficient IT infrastructure lowers hardware costs and expenses to run SAP HANA workloads.

    - Deploying a hyperconverged infrastructure significantly faster than legacy systems, and reducing IT staff resources needed to install or upgrade SAP HANA.

  - Infrastructure management and automation software [Hitachi Unified Compute Platform Advisor](#) (UCP Advisor) automates day 0-2 operations, including patching and upgrades, reduces operational costs.

  - Initial deployment cost of SAP HANA on Hitachi Unified Compute Platform HC is lower than refreshing a legacy environment with separate components.

  - Using policy-based management across compute and storage eliminates many manual and repetitive tasks, delivering large recurring savings.

  - A hyperconverged infrastructure from Hitachi with Intel Optane solid state drives (SSD) provides substantial performance advantages, lowering the demand for new storage capacity.

Use this reference architecture to design your implementation of SAP HANA on Hitachi Unified Compute Platform HC with VMware vSphere 7.0 update 3.

Solution overview

This solution uses a Hitachi Unified Compute Platform HC (UCP HC) V224N node on Hitachi Advanced Server DS220 G2 using VMware vSAN.

Implement and configure VMware ESXi 7.0 update 3 following VMware and SAP best practices to guarantee best performance for SAP HANA running in a single or multiple virtual machine deployment.

Advanced Server DS220 G2 is certified with VMware vSAN as a scale-up system in various configurations running SUSE Linux Enterprise Server and Red Hat Enterprise Linux. For more details, see Certified and Supported SAP HANA Hardware ® at https://www.sap.com/dmc/exp/2014-09-02-hana-hardware/enEN/#/solutions?filters=v:deCertified.

VMware has certified vSphere 7.0 on Intel Ice Lake processors for virtualized SAP HANA deployments. See SAP Note 2937606 (SAP user credentials required).

The following illustration shows full socket VMs.
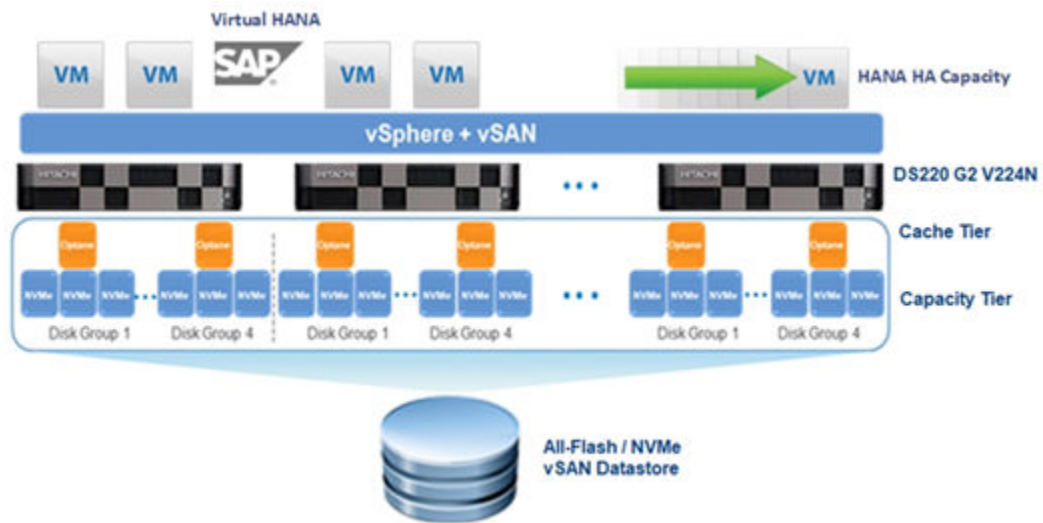
The following figure shows half socket VMs.
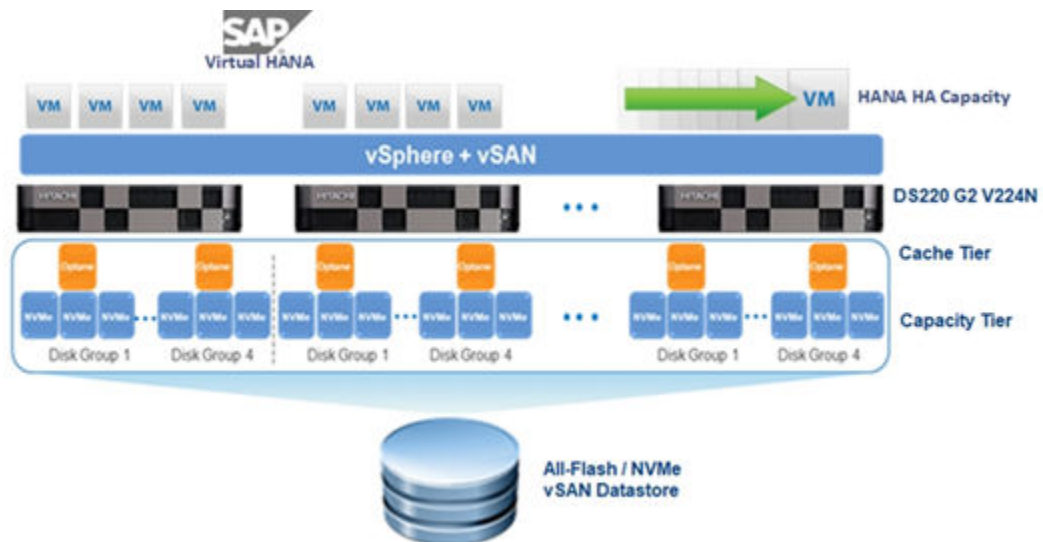
This SAP HANA hyperconverged infrastructure provides fully integrated single-system support with flexibility in choosing the size of compute, storage, and networking components in the node. This reference architecture explores the capabilities of a highly scalable architecture. This solution does not use conventional storage, but software-defined storage with Unified Compute Platform HC.

Key solution elements

These are the key hardware and software elements of this virtualized SAP HANA hyperconverged infrastructure solution from Hitachi Vantara.

Hardware elements

This reference architecture guide uses Hitachi Advanced Server DS220 G2 V224N for running VMware vSphere to host SAP HANA. The storage is backed by VMware vSAN, Intel Optane storage-class memory and NVMe technology.

Hitachi Advanced Server DS220 G2 V224N

Hitachi Advanced Server DS220 G2 V224N is the vSAN Ready product on Hitachi Advanced Server DS220 G2. Meet the needs of your most demanding high-performance applications with Hitachi Advanced Server DS220 G2 V224N. With up to two Intel Xeon Scalable Processors and up to 4 TB memory capacity in a 2U rack-space, this server delivers unparalleled compute density and efficiency. The Advanced Server DS220 G2 V224N architecture takes full advantage of the Intel Xeon Scalable Processor family, including the highest performance options, to address the growing demands of your IT infrastructure.

Unified Compute Platform HC

Unified Compute Platform HC (UCP HC) is an integrated turnkey appliance that combines compute, storage, and virtualization to deliver certainty for edge to core to cloud operations. This market-proven Hitachi solution provides a scalable, seamless, and simplified cloud foundation for enterprise and mid-market customers. Advanced automation and intelligence for day 0-2 operations accelerate innovation and improve productivity while lowering the TCO.

Software elements

This solution uses VMware ESXi 7.0U3 as a hypervisor. SUSE Linux Enterprise Server for SAP Applications and Red Hat Enterprise Linux for SAP Solutions is supported as the guest operating system within the virtual machines for running SAP HANA.

VMware vSphere

VMware vSphere is a virtualization platform that provides a datacenter infrastructure. It helps you get the best performance, availability, and efficiency from your infrastructure and applications. Virtualize applications with confidence using consistent management.

VMware vSphere has the following components:

- **VMware vSphere ESXi**

  This hypervisor loads directly on a physical server. ESXi provides a robust, high-performance virtualization layer that abstracts server hardware resources and makes them shareable by multiple virtual machines.

- **VMware vCenter Server**

  This management software provides a centralized platform for managing your VMware vSphere environments so you can automate and deliver a virtual infrastructure with confidence:

  - VMware vSphere vMotion

  - VMware vSphere Storage vMotion

  - VMware vSphere Distributed Resource Scheduler

  - VMware vSphere High Availability

  - VMware vSphere Fault Tolerance

- **VMware vSAN Server**

  VMware vSAN is VMware's software-defined storage solution for hyperconverged infrastructure, a software-driven architecture that delivers tightly integrated computing, networking, and shared storage from x86 servers. vSAN delivers high performance and highly resilient shared storage by clustering server-attached flash devices and hard disks (HDDs).
  vSAN delivers enterprise-class storage services for virtualized production environments along with predictable scalability and All-Flash performance, all at a fraction of the price of traditional, purpose-built storage systems. Just like vSphere, vSAN provides users the flexibility and control to choose from a wide range of hardware options and easily deploy and manage it for a variety of IT workloads and use cases.

VMware vSAN

Seamlessly extending virtualization to storage with an integrated hyper-converged solution that works with your overall VMware environment, VMware vSAN reduces the risk in digital transformation by using existing tools, skillsets, and solutions.

Built by VMware, enjoy the best integration with VMware vSphere features with vSAN. Discover the flexibility to expand with other VMware SDDC and multi-cloud offerings as your needs grow. Protect current storage infrastructure investments with the only hyperconverged infrastructure solution built on policy-based management that extends per-virtual machine policies and automated provisioning to modern SAN and NAS storage systems.

With this NVMe storage design, you can host virtual SAP HANA virtual machines of 128 GB to 4 TB in production or create up to 4 virtual machines in non-production environments on the 2-socket Hitachi Advanced Server DS220 G2 V224N.

SUSE Linux Enterprise High Availability Extension

Compete more effectively though improved uptime, better efficiency, and accelerated innovation using <u>SUSE Linux Enterprise Server</u>. This is a versatile server operating system for efficiently deploying highly available enterprise-class IT services in mixed IT environments with performance and reduced risk.

SUSE Linux Enterprise Server was the first Linux operating system certified for use with SAP HANA. It remains the operating system of choice for the vast majority of SAP HANA customers.

Red Hat Enterprise Linux

Using the stability and flexibility of <u>Red Hat Enterprise Linux</u>, reallocate your resources towards meeting the next challenges instead of maintaining the status quo. Deliver meaningful business results by providing exceptional reliability on military-grade security. Use Enterprise Linux to tailor your infrastructure as markets shift and technologies evolve.

SAP HANA

SAP HANA converges database and application platform capabilities in-memory to transform transactions, analytics, text analysis, predictive and spatial processing so businesses can operate in real-time. This combines database, data processing, and application platform capabilities in a single in-memory platform. Also, the platform provides libraries for predictive, planning, text processing, spatial, and business analytics — all on the same architecture. This architecture comes from leading hardware partners of SAP, including Hitachi Vantara. For more information, see <u>https://www.sap.com/products/hana.html</u>.

By eliminating the divide between transactions and analytics, SAP HANA allows you to answer any business question anywhere in real time.

As a SAP customer, you can <u>download more information</u>, including the following:

- SAP HANA Master Guide

  This is the central starting point for the technical implementation of SAP HANA. Use this guide for basic concepts and for planning.

- SAP HANA Server Installation and Update Guide

  This guide provides an overview of how to install and update a SAP HANA system with the SAP HANA lifecycle management tools.

- SAP HANA Administration Guide

  This guide explains how to configure, manage, maintain, and optimize your SAP HANA installation using SAP HANA administration tools.

<u>SAP HANA hardware directory</u> provides information about SAP HANA appliances certified by SAP hardware partners.

Solution design

The detailed hyperconverged infrastructure design for this scale-up configuration of Hitachi Solution for SAP HANA in this reference architecture guide includes the following:

- Hitachi Advanced Server DS220 G2 V224N Compute Configuration
- Network Architecture
- Storage Architecture
- VMware Cluster Configuration
- Guest Operating System Configuration
- SAP HANA Installation and Configuration

Hitachi Advanced Server DS220 G2 V224N compute configuration

The Hitachi Advanced Server DS220 G2 V224N basic building block compute configuration includes the following:

- 2 × Intel Xeon Gold or Platinum CPUs
- 16 × memory DIMMs per CPU, 32 per server, with these sizes supported:
  - 512 GB — 16 × 32 GB DDR4 R-DIMMs
  - 1024 GB — 32 × 32 GB or 16 × 64 GB DDR4 R-DIMMs
  - 2048 GB — 32 × 64 or 16 × 128 GB DDR4 R-DIMMs
  - 4096 GB — 32 × 128 GB DDR4 RDIMMs
- 6 × I/O server blades for PCIe adapters:
  - 10/25 GB dual port Intel E810
- 1 × 1 GbE native Ethernet port
- 4 × 400 GB Intel P5800X Optane drives
- 12 × 1.9 TB Intel NVME P5520 drives

The following illustration shows the available PCIe slots for Advanced Server DS220 G2 V224N.
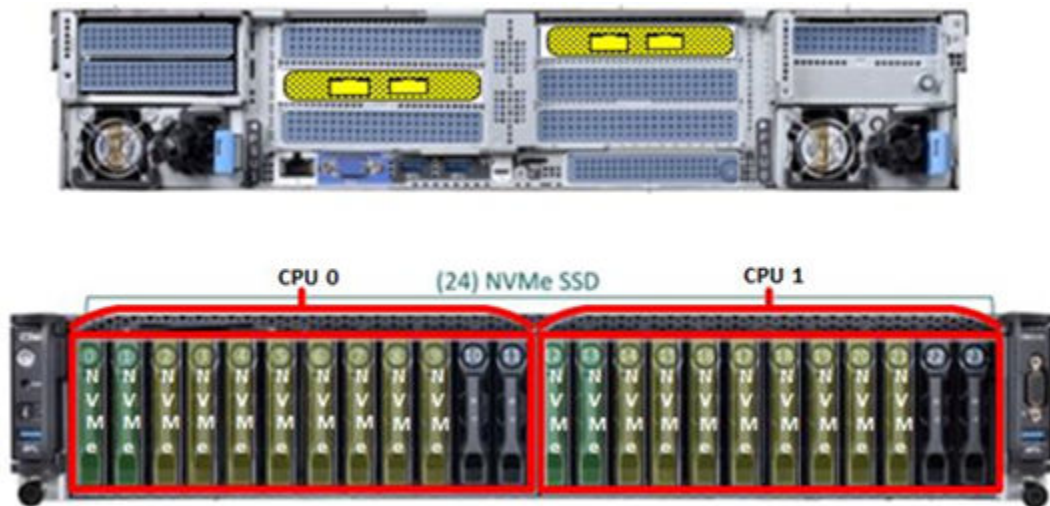
Network architecture configuration

Hitachi Advanced Server DS220 G2 V224N supports a 10/25 GbE network.

The following illustration shows where the two PCIe cards are located. This reference architecture uses Cisco switches. The 1 GbE management network uses the following:

- Cisco Nexus 92348 switches

- Cisco 93180YC-FX switches

- Nexus 9336C switches for the spine
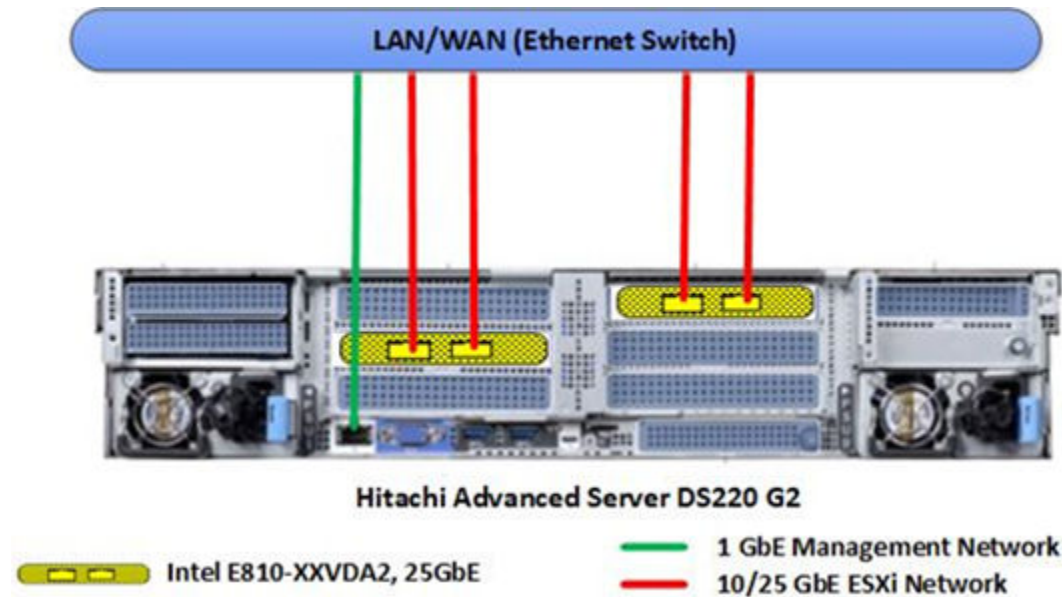
Make the following network connections for Hitachi Advanced Server DS220 G2 V224N to connect to Cisco top-of-rack switches or to any other external switches:

- Connect Port 0 of each PCIe card, noted by a red line, to one Cisco Nexus switch.

- Connect Port 1 of each PCIe card, noted by a red line, to a different Cisco Nexus switch.

- Configure the corresponding four ports at the VMware ESXi level as uplinks in the virtual standard switch (VSS). Configure all vmnics as **active**. Use these two or four ports as the management network for the ESXi node, virtual machine network, vSAN network, and vMotion network.

- At installation, the field engineer from Hitachi Vantara works with your VMware vCenter administrator to convert, merge, and migrate the VSS to your existing or new virtual distributed switch and create different port groups for these networks.

  Recommendation — To speed up the detection of corrupted connections, configure the external switch ports with a port channel set to **active/active** as well as setting the LACP timeout value to **short**. On a virtual distributed server, use **vLAGs** instead of uplinks.

If additional network connections are needed, add additional cards to the server as outlined in the following tables.

The following table lists the network setup example for two cards.

Network Card	Port	Network Description
Riser 1 first slot (right card)	0	- VMware ESXi management
	1	- VMware vMotion
Riser 2 second slot (left card)	0	- Virtual machine traffic or SAP server network
	1	- VMware vSAN traffic
Optional PCIe cards can be slotted above or below it.	0 and 1	Free for use

📄 **Note:** The VMware ESXi kernel network and virtual machine traffic can be on the same network switch or on separate network switches. It depends on the network environment.

The following table lists the example network distribution.

Property	VLAN*	Active Uplink	Standby Uplink
Administrative and VMware High Availability Network	100	Nic0-Uplink0	Nic1-Uplink0
SAP Application Server Network	101	Nic0-Uplink1	Nic1-Uplink1
vMotion Network	200	Nic1-Uplink0	Nic0-Uplink0
vSAN Network	201	Nic1-Uplink1	Nic0-Uplink1

*This is a VLAN ID example. The final VLAN numbers are determined by the network administrator.

Guidelines for deployment

In a single rack deployment, follow these deployment guidelines:

- Use up to 6 Hitachi Advanced Server DS220 G2 V224N systems when using 3-phase PDUs or up to 9 Hitachi Advanced Server DS220 G2 V224N systems when using a 1-phase PDU.

- Use two top-of-rack switches, Cisco Nexus 93180YC-FX.

- Use one 1 GbE switch for out-of-band management.

In a multi-rack deployment, follow these deployment guidelines:

- Use a maximum of four racks.

- Use up to 23 Hitachi Advanced Server DS220 G2 V224N systems when using 3-phase PDUs or up to 35 Hitachi Advanced Server DS220 G2 V224N systems when using a 1-phase PDU.

- Use two top-of-rack switches per rack, Cisco Nexus 93180YC-FX.

- Use two spine switches for inter-rack connectivity. This supports up to a maximum of four racks. To extend past four racks and to reach the cluster limit of 64, you need another pair of spine switches.

- Use one 1 GbE switch for out-of-band management per rack.

While the Hitachi Advanced Server DS220 G2 V224N cluster can have a minimum of 3 nodes up to 64 nodes, start with at least four nodes to minimize unavailability and performance impacts.

Storage architecture

Hitachi Advanced Server DS220 G2 V224N has 24 slots for disks.

- Equip slots 0, 1, 12, and 13 with NVMe drives for the cache tier.

- Equip slots 2-11 and 14-23 with NVMe drives for the capacity tier.

The following illustration shows the distribution of drives and disk groups on a per CPU basis to balance workloads.

VMware cluster configuration

This section covers the following in the VMware configuration:

- VMware ESXi servers

- VMware vSAN cluster

- SAP requirements

- Virtual machine configurations

VMware vSphere configuration

For the SAP HANA workload in the virtual machines, SAP does not allow over-committing of CPU and memory resources. Take this into account when sizing virtual machines and determining computer hardware resources.

The following table lists the minimum and maximum sizes for virtual machines running a SAP HANA workload on a server with a 38 core CPU.

Configuration	Size
Minimum virtual machine size	1 socket, core count to match the CPU count 128 GB RAM
Maximum virtual machine size	152 vCPUs (304 vCPUs with hyperthreads) on 2-sockets and 4 TB RAM This depends on how many cores your CPU has. Estimate conservatively at 90% of total to leave processing space for VMware ESXi.
Full-socket virtual machine sizes	1 and 2 sockets
Maximum number of virtual machines supported in production	4 half socket virtual machines per 2-socket server

These are general sizing guidelines from SAP for virtualized environments with respect to storage, CPU, and memory requirements.

When creating single or multi-virtual machine environments on a VMware ESXi server, reserve memory for the ESXi server itself. Do not assign all available physical memory to the virtual machines. According to guidance from VMware, this memory overhead can be between 0.5% and a more conservative 3%. For example, on Hitachi Advanced Server DS220 G2 V224N with 4096 GB of RAM, assign up to 4080 GB to virtual machines.

Apply the VMware ESXi configuration parameters listed in the following table using the Web Client, as indicated in the VMware KB article at https://kb.vmware.com/s/article/2003582.

For This	Use This
Misc.GuestLibAllowHostInfo	1
Numa.FollowCoresPerSocket	1
Numa.PreferHT	1

Configure VMware vSphere High Availability

VMware vSAN, together with VMware vSphere High Availability, provides a solution that protects SAP virtual machines. In this case, if a host running SAP virtual machines fails, vSphere High Availability restarts those virtual machines on the remaining hosts in the cluster.

Procedure

1. Enable VMware vSphere High Availability on the **Failures and responses** tab for optimal uptime.

   - **vSphere HA** — Select enabled position.

   - **Host Failure Response** — Select **Restart VMs**.

   - **Datastore with PDL** — Select **Disabled**.

   - **Datastore with APD** — Select **Disabled**.

   - **VM Monitoring** — Select **VM Monitoring Only**.
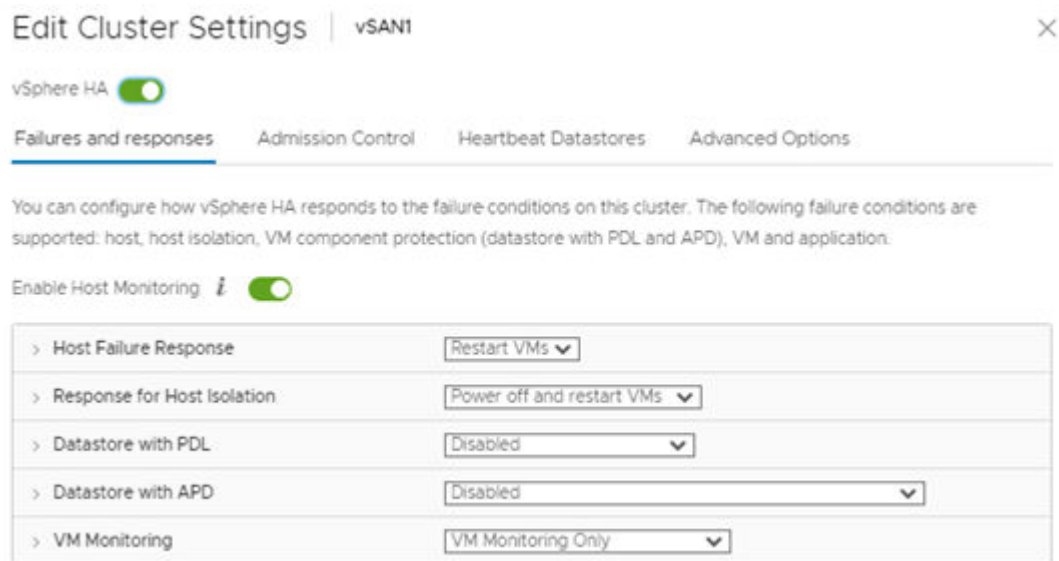
2. Under **VM Monitoring**, for **VM monitoring sensitivity**, select the **Preset** option. Move the slider to **High** for a quick recovery when detecting failures.
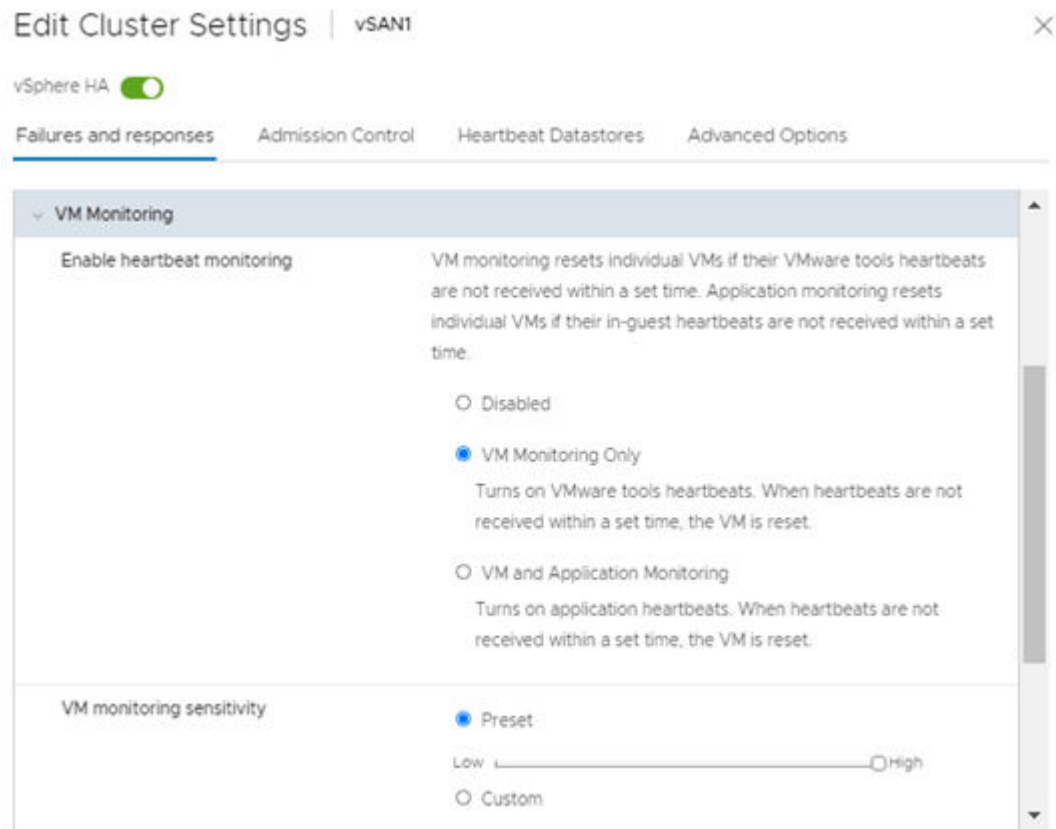
Configure the VMware vSAN cluster

Configure the VMware vSAN cluster following Hitachi and VMware best practices and procedures as follows:

- Deploy and configure VMware vCenter

- Configure VMware vSphere distributed switches and distributed port groups

- Enable VMware vSAN cluster and create disk groups

- Enable VMware vSphere High Availability on the vSAN cluster

Always follow the following minimum best practices when configuring a vSAN cluster for SAP:

- Verify that all hosts have a uniform configuration. All hosts in the same cluster must have the same model server, same model of CPU, same amount of memory, and the same amount of cache and capacity devices.

- The cache disk type should have very low latency and a very high endurance NVMe device. SAP HANA running on Hitachi Advanced Server DS220 G2 V224N is configured with Intel Optane drives delivering very low latency, high throughput, and very high endurance.

- Disk groups must be configured with the same drive model for cache and the same drive model for capacity, and the disk groups must have the same number of capacity devices. All hosts must have the same number of disk groups. The following figure shows a logical view of the vSAN datastore created with four disk groups (one cache + three capacity) for each Hitachi Advanced Server DS220 G2 V224N host with VMware vSAN.

- From a capacity perspective, it is recommended to size the vSAN cluster to always keep 25-30% slack space in the vSAN datastore to prevent the vSAN from rebalancing the storage load.

- While a vSAN cluster can be configured with three hosts, it is recommended that a production environment have at least four hosts, because it provides more flexibility for maintenance and remediation operations. The maximum number of hosts that can be configured in the same cluster is 64.
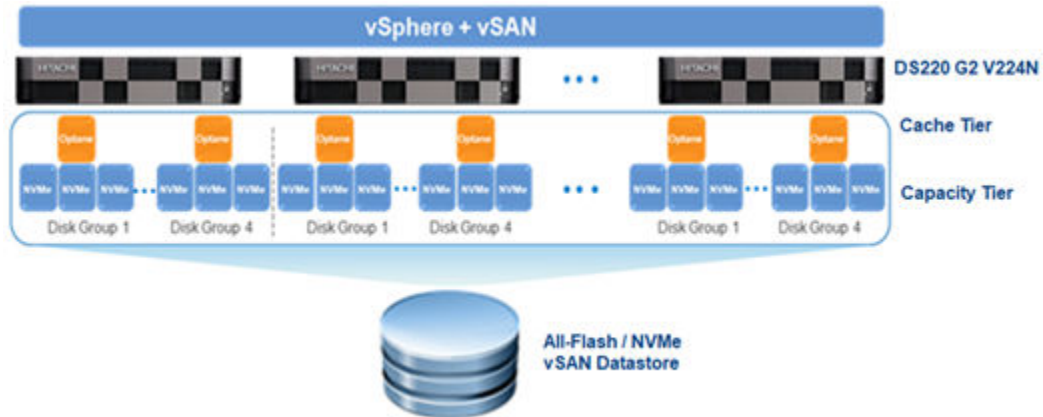
VMware vSAN storage policy

Create a VMware vSAN storage policy and apply it at the SAP virtual machine level for SAP HANA running on Hitachi Advanced Server DS220 G2 V224N. Using the striping feature from vSAN, set the disk stripes per object equal to the total number of capacity devices (12) of the system for maximum performance. Also, use thick provisioning.

From a failure tolerance perspective, while having four nodes in the cluster supports RAID 5, the recommendation for SAP HANA virtual machines or VMDKs is to use RAID 1 (mirroring). This provides the best performance compared to RAID 5 or RAID 6 (erasure coding).

When virtual machines are configured with RAID 1, they require twice the virtual disk size. When configured with RAID 5, they require 1.33 times the virtual disk size.

The following table lists VMware vSAN storage policy settings for a configuration with 12 capacity disks.

For This	For This
Failures to tolerate method (FTM)	RAID 1 (Mirroring)
Number of failures to tolerate (FTT)	1
Number of disk stripes per object	12
Flash read cache reservation (%)	0 %
Object space reservation (%)	100 % (Thick provisioning)
Disable object checksum	No

The following screen shows the rules defined in the VMware vSAN storage policy.
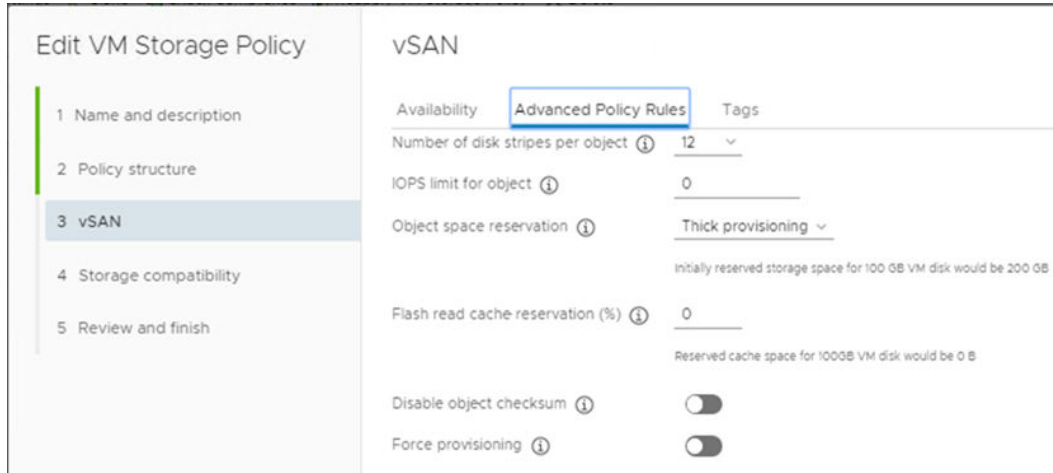
Verify that the vSAN storage policy has been applied to all virtual disks (VMDKs):

- SAP HANA server operating system disk

- SAP HANA shared disk

- SAP HANA log disks

- SAP HANA data disks

In addition, modify alarms for Datastore usage on disk and Datastore cluster is out of space. Set the warning to 70% and set the critical warning to 75% to provide enough time to allocate more storage. (The default warning is 75% and critical warning is 85%).

SAP HANA on VMware vSAN health check Vib and installation script

VMware has created a custom script that detects whether or not the deployed virtual machine is using VMware vSAN and applies extra information in the VMX. When running sapsysinfo, the script checks for the correct model name, V224N, and vSAN-related information.

If the script retrieves the expected model (V224N) and vSAN information, it will validate this solution as an SAP HANA on vSAN solution. See https://developer.vmware.com/samples?id=6043 for more information.

Virtual machines must be installed prior to installing **setinfo vib**. Otherwise, you will need to reinstall setinfo vib to have vSAN data reflected in the virtual machine's VMX file.

To install setinfo vib and run the script, do the following:

1. Install setinfo vib on the VMware ESXi host.

2. Copy the `sapsysinfo.sh` script to the `tmp` directory of the virtual machine.

3. Run the `sapsysinfo.sh` script.

If an issue arises, download the sapsysinfo text and zip the file to attach to the SAP support ticket.

See the SAP Support website at https://accounts.sap.com/saml2/idp/sso for more information and the `sapsysinfo` script (SAP user credentials required).

Monitor cluster health status

VMware vSAN includes automated health checks that monitor the vSAN cluster, including all hosts that participate in the hyperconverged infrastructure. It has the option to perform an online health check against the VMware Compatibility Guide, or vSAN VCG, to verify the consistency of the configuration.

Procedure

1. To check vSAN health, open the vSAN cluster .
2. To review the different vSAN health check categories, on the **Monitor** tab select **vSAN > Health** > .
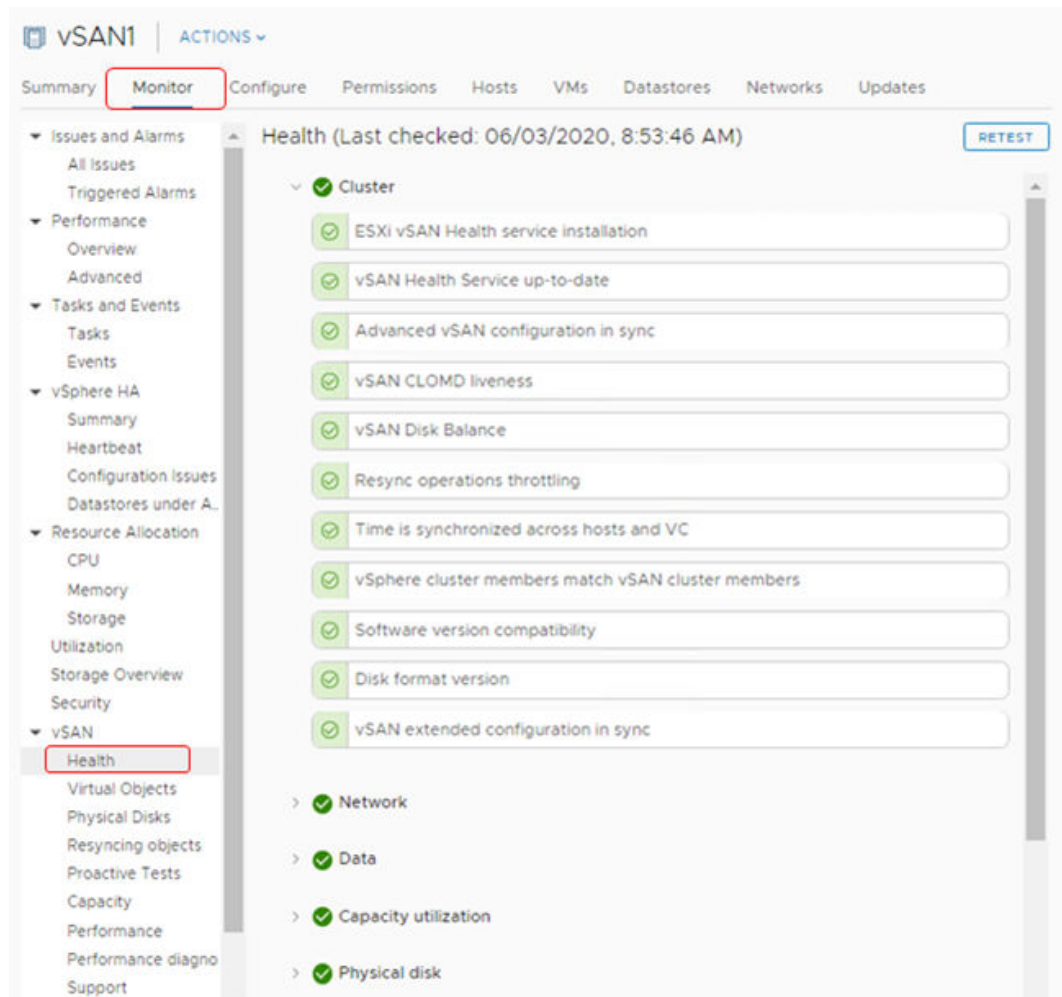
Virtual machine configuration parameters

To ensure that all performance requirements for SAP HANA are met, VMware and SAP released best practices for configuring the VMware ESXi server when running SAP HANA workloads. When provisioning virtual machines for SAP HANA, use hyperthreads on fewer NUMA nodes instead of only physical CPU cores spread over multiple NUMA nodes.

Also, add or change the parameters on the virtual machines, as listed in the following table.

For This	Use This
monitor.halt_in_monitor	TRUE
monitor.idleLoopSpinBeforeHalt	TRUE
tools.guestlib.enableHostInfo	TRUE
numa.nodeAffinity	example: 0,1
disk.EnableUUID	TRUE

Multiple virtual machine configurations

When running this solution in a single-virtual machine configuration, a Hitachi Advanced Server DS220 G2 V224N with two CPUs provides enough resources to run a virtual machine with a possible maximum of 224 vCPUs.

Depending on the number of virtual machines, as well as the requirements of the SAP HANA installation inside these virtual machines, further storage resources might be necessary. Contact your Hitachi Vantara account team to size storage.

In virtualized environments, one virtual machine counts as one SAP HANA node, according to SAP requirements. In a single-server environment, the maximum number of virtual machines is two when using 1-socket virtual machines on a 2-socket server.

According to SAP Note 2393917 at https://accounts.sap.com/saml2/idp/sso (SAP user credentials required), SAP and VMware support a co-deployment of production and non-production virtual machines on the same server. It is also possible to separate the production and non-production SAP HANA virtual machines on different servers.

Non-production virtual machines do not have the same performance requirements as production virtual machines. SAP gives no performance guarantee for non-production SAP HANA installations. However, in both cases, you must ensure that the production SAP HANA instances and virtual machines are not negatively impacted by the non-production systems running in parallel.

Guest Operating System configuration

The following are supported as guest operating systems for the virtual machines:

- SUSE Linux Enterprise Server for SAP Applications 15 SP3
- Red hat Enterprise Linux Server for SAP Solutions 8.4

Changing the configuration settings is only supported along the guidelines from SAP and the operating system distributor. Otherwise, changes can cause significant performance problems. The following SAP Notes for SUSE Linux Enterprise Server are a good starting point for information on this topic (SAP user credentials required):

- 1944799 - SAP HANA Guidelines for SLES Operating System Installation

- 2009879 - SAP HANA Guidelines for Red Hat Enterprise Linux (RHEL) Operating System

- 2235581 – SAP HANA: Supported Operating System

The initially delivered configuration of the operating system should persist. Do not make any modifications to the operating system, except as noted or approved by SAP. See *Architecture Guidelines and Best Practices for Deployments of SAP HANA On VMware vSphere* at sap_hana_on_vmware_vsphere_best_practices_guide-white-paper.pdf and *SAP HANA on Hyperconverged Infrastructure (HCI) Solutions Powered by VMware vSAN* at https://core.vmware.com/resource/sap-hana-hyperconverged-infrastructure-hci-solutions-powered-vmware-vsan for updated information from VMware.

SAP HANA installation and configuration

This section outlines the SAP HANA configuration on a scale-up environment for the Hitachi Solution for SAP HANA running on VMware vSphere.

Operating system boot configuration

This virtualized SAP HANA system uses one 100 GB VMDK for the SAP HANA operating system, including the `/usr/sap/` directory for files related to the SAP application.

SAP HANA volume configuration

Follow these SAP rules for allocation of SAP HANA volumes:

- 4 paravirtual SCSI controllers for each of these virtual disk groups:
  - Operating system
  - Data
  - Log
  - Shared
- 4 SAP HANA data volumes
  - The size of each VMDK is equal to this calculated value: (memory of virtual machine × 1.2)/4
- 4 SAP HANA log volumes
  - Any virtual machine smaller than 512 GB should use the minimum size of 128 GB per VMDK.
  - Any virtual machine larger than 512 GB should use this calculated minimum value: (memory of virtual machine/4) per VMDK
- 1 SAP HANA shared volume
  - If the virtual machine is larger than 1 TB, then the VMDK minimum size is 1 TB.

The logical volume manager (LVM) configures the SAP HANA persistent storage volumes from virtual machines. With four VMDKs for the SAP HANA log, the LVM creates a single 4-way striped volume on which to create the XFS file system to store the SAP HANA log volumes. Similarly, the same volumes will be deployed for SAP HANA data volumes.

For SAP HANA shared, create 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, install the latest SAP HANA Datacenter Service Point (DSP) stack on the SAP HANA server, upgraded to the required SAP HANA revision.

Install the following SAP HANA software components on the SAP HANA node for VMware vSphere server:

- SAP HANA database
- SAP HANA client
- SAP Host agent

Configuration file settings (global.ini)

For optimal use of the system with a SAP HANA database, use the parameters listed in this global.ini file for your operating system release. Follow SAP Note 2399079 (SAP user credentials required) to set up these parameters defined in global.ini for SAP HANA 2.0.

SUSE Enterprise Linux 15 SP3 operating system

The following is the sample global.ini file configured and used for validation on a solution using SUSE Linux Enterprise Server 15 SP3:

```
[communication]
tcp_backlog = 2048

[fileio]
max_parallel_io_requests[data] = 128
max_submit_batch_size[data] = 64
size_kernel_io_queue[data] = 512
async_read_submit[data] = on
async_write_submit_blocks[data] = all
min_submit_batch_size[data] = 16
async_write_submit_active[data] = on
max_parallel_io_requests[log] = 128
max_submit_batch_size[log] = 64
size_kernel_io_queue[log] = 512
async_read_submit[log] = on
async_write_submit_blocks[log] = all
min_submit_batch_size[log] = 16
async_write_submit_active[log] = on

[multidb]
mode = multidb
database_isolation = low
singletenant = yes

[persistence]
basepath_datavolumes = /hana/data/HIT
basepath_logvolumes = /hana/log/HIT
```

Red Hat Enterprise Linux for SAP Solutions 8.4 operating system

The following is the sample global.ini file configured and used for validation on a solution using Red Hat Enterprise Linux for SAP Solutions 8.4:

```
[communication]
tcp_backlog = 2048

[fileio]
max_parallel_io_requests[data] = 128
max_submit_batch_size[data] = 64
size_kernel_io_queue[data] = 512
async_read_submit[data] = on
async_write_submit_blocks[data] = all
min_submit_batch_size[data] = 16
async_write_submit_active[data] = on
max_parallel_io_requests[log] = 128
max_submit_batch_size[log] = 64
size_kernel_io_queue[log] = 512
async_read_submit[log] = on
async_write_submit_blocks[log] = all
min_submit_batch_size[log] = 16
async_write_submit_active[log] = on

[multidb]
mode = multidb
database_isolation = low
singletenant = yes
```

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