Hitachi Unified Compute Platform Product Portfolio for Virtualization/Bare Metal

Reference Architecture Guide

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Revision history

Changes	Date
■ Updated title from "Unified Compute Platform Product Portfolio for VMware vSphere" to "Hitachi Unified Compute Platform Product Portfolio for Virtualization/Bare Metal". ■ Added support for Microsoft Hyper-V with Windows Server 2025 with VSP/VSP One Block storage systems.	April 2025
■ Added support for 100G NVMe TCP architecture with several logical designs for Red Hat Enterprise Linux 9.4.	March 2025
■ Added support for NVMe over TCP (NVMe/TCP). ■ Added information for Hitachi Remote Ops.	October 2024

Reference Architecture Guide

Use this reference architecture guide for Hitachi Unified Compute Platform offerings to implement your Virtualization environment. Unified Compute Platform (UCP) is a highly configurable and integrated converged infrastructure in which servers, network, and storage can be scaled independently to optimize performance and eliminate overprovisioning costs.

With the UCP product portfolio, Hitachi Vantara offers a streamlined, integrated, and automated platform for enterprise datacenters and hybrid cloud deployments. The UCP product portfolio improves time to production, makes enterprise- class applications more agile and resilient, and offers the flexibility to grow as business needs demand. It provides a single source of legendary service and support. The UCP product portfolio supports your business needs today, and lets you establish a flexible foundation for your future datacenter.

The UCP product portfolio can combine the following:

- Simplified management — Manage compute, network, and storage from one view.

- Policy-based workflows — Reduce manual processes with policy-based workflows.

- Federated control — Support multiple Virtualization environments with UCP Advisor and Smart Update Manager.

- Automation — Reduce errors caused by manual processes and automate deployment with rule-based validations.

- Remote operations — Enable call-home integration with Hitachi Remote Ops.

- Reliability — Improve IT stability with lifecycle management.

- Microsoft Windows Server Failover Cluster (Hyper-V) and management software stack (software and license supplied by the customer).

The following illustration shows an overview of Hitachi Unified Compute Platform.
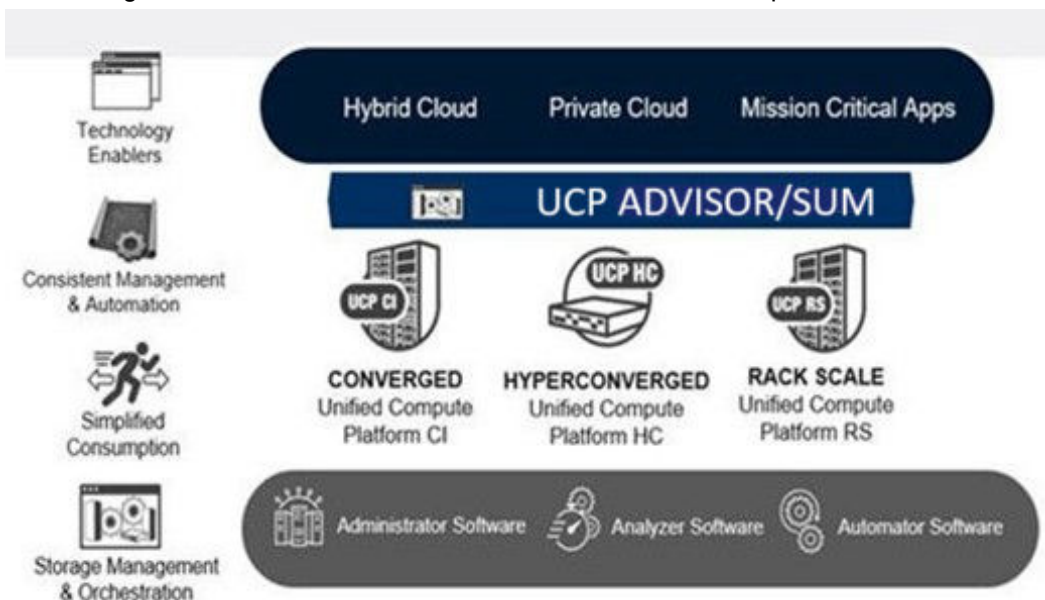
This reference architecture is for you if you are an IT administrator, system architect, consultant, or engineer to assist in planning, designing, and implementing UCP product portfolio solutions.

Overview

The UCP product portfolio offerings provide support for the following:

- Hitachi Advanced Server (1U-2 sockets) for management nodes

- A combination of Hitachi Advanced Server systems, for compute nodes

- Hitachi Virtual Storage Platform One (including both VSP One and VSP)

- Hitachi UCP Advisor for end-to-end management

- Arista switches or Cisco switches for Ethernet networking

- Brocade switches for Fibre Channel SAN

- VMware software stack for virtualized and managed infrastructure

> **Note:** Testing of this configuration was in a lab environment. Many factors 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.

Demanding faster delivery of new business services, you have the complexity and the cost of deploying and managing the technology resources to support them. IT departments spend almost a quarter of their time and resources evaluating and installing increasingly disparate hardware components.

The lack of a unified management framework and the need for highly specialized individuals who can design, configure, optimize, test and manage each component increases cost, complexity and risk. To address these issues, many organizations deploy converged infrastructure solutions.

Hitachi Vantara has answered these challenges by creating the UCP product portfolio. It is tailored for all workloads and business applications. With its pre-validated building blocks of compute, storage, and networking guaranteed to work together and deliver predictable performance, the UCP product portfolio meets these needs. It is a low-risk path to deploy a converged infrastructure that provides a solution capable of supporting any workload at any scale.

The UCP product portfolio is optimized, preconfigured, and pretested converged and hyperconverged infrastructure appliances for VMware vSphere and Microsoft Windows Server failover clustering. They offer a broad range of compute and storage components that can be scaled and configured independently to eliminate overprovisioning. You have a choice of operating environments to maximize your environment's flexibility.

Optimize your data center to run any application workload at any scale with the UCP product portfolio. You can choose between single-rack configurations and multi-rack configurations.

Single-rack configurations

A single-rack solution combines compute, storage, and networks all on the same rack and scales out to support these components:

- Hitachi Advanced Server:
  - Up to 4 × 1U Advanced Server units for management nodes
  - Up to 16 × 1U Advanced Server units for compute nodes
  - Up to 8 × 2U Advanced Server units for compute nodes
- 1 × Arista or 1 × Cisco management Ethernet switch
- 2 × Arista or 2 × Cisco top-of-rack Ethernet switches
- 1 × Virtual Storage Platform (VSP) storage system:
  - VSP E590 (supports up to 12 hosts)
  - VSP E790 (supports up to 12 hosts)
  - VSP E1090 (supports up to 20 hosts)
  - Hitachi Virtual Storage Platform One Block 24, VSP One Block 26, VSP One Block 28 (supports up to 16 hosts)

📄 **Note:** Please be aware that UCP HC has optional top of rack switching.

The single-rack solution is supported by a 24-port switch which makes the solution cost optimized.

The following figure shows a single rack solution.

Multi-rack configurations (UCP CI and UCP RS only)

A multi-rack UCP CI or UCP RS solution combines compute, networking, and storage on the same racks (up to four racks maximum). The storage racks are separate.

A multi-rack configuration scales out to support the following:

- Hitachi Advanced Server:

  - Up to 4 × Advanced Server systems used for management nodes (1U size) or up to 8 × Advanced Server systems for UCP RS

  - Up to 128 × Advanced Server systems used for compute nodes (1U size, 1-phase, or 3-phase PDU)

  - Up to 64 × Advanced Server systems used for compute nodes (2U size, 1-phase, or 3-phase PDU)

  - Up to 24 or up to 36 × Advanced Server systems with GPUs (based on PDU Type)

  - 2 × Arista or 2 × Cisco spine Ethernet switches

- Up to 8 Arista or Cisco leaf Ethernet switches

- Up to 4 Arista or Cisco management switches

- Up to 8 Brocade SAN switches

- 1 × Hitachi Virtual Storage Platform, an enterprise NVMe scale-out data platform

- 4 × Virtual Storage Platform (VSP) storage systems

The following figure shows a multi-rack solution.
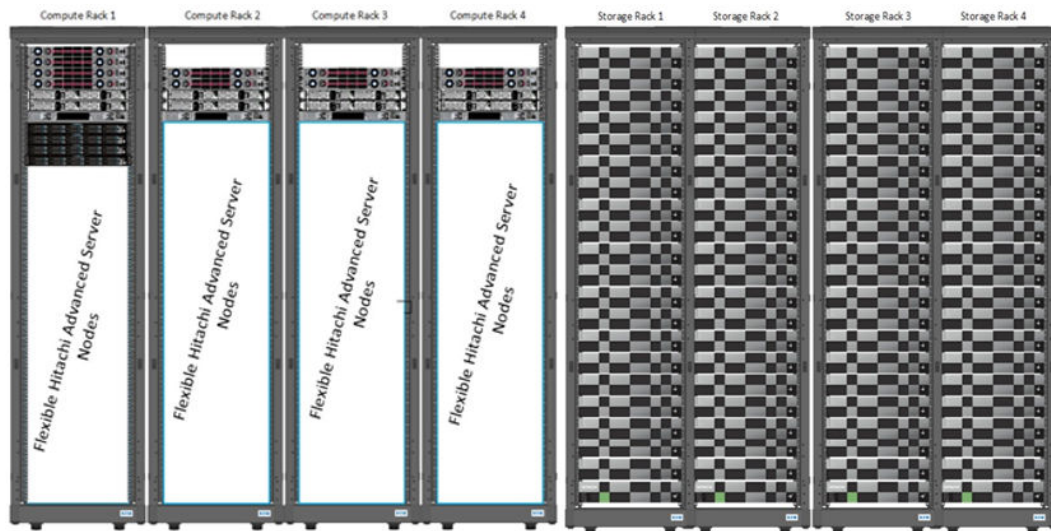
> 📄 **Note:** There is a total of 128 RU of allocated space for compute nodes which can be mixed from the supported hardware.

The following figure shows a rack layout example for a Multi-rack Hitachi Unified Compute Platform solution that is SAN attached using Fibre Channel switching between the host and storage system with Distributed Spine Design.

Rack #1 Layout

U#		U#
U42	40/100G (Spine)	U42
U41	Unused	U41
U40	10/25G (Leaf)	U40
U39	10/25G (Leaf)	U39
U38	Brocade Fibre Channel	U38
U37	Brocade Fibre Channel	U37
U36	1G (Mgmt)	U36
U35	Unused	U35
U34	Unused	U34
U33	Unused	U33
U32		U32
U31		U31
U30		U30
U29		U29
U28		U28
U27		U27
U26		U26
U25		U25
U24		U24
U23		U23
U22	Flexible Computing Region	U22
U21		U21
U20		U20
U19		U19
U18		U18
U17		U17
U16		U16
U15		U15
U14		U14
U13		U13
U12		U12
U11		U11
U10		U10
U9		U9
U8		U8
U7		U7
U6		U6
U5		U5
U4		U4
U3	Flex / Management Region	U3
U2		U2
U1		U1

PDU 3A, PDU 3B, PDU 2A, PDU 2B, PDU 1A, PDU 1B

Rack #2 Layout

U#		U#
U42	40/100G (Spine)	U42
U41	Unused	U41
U40	10/25G (Leaf)	U40
U39	10/25G (Leaf)	U39
U38	Brocade Fibre Channel	U38
U37	Brocade Fibre Channel	U37
U36	1G (Mgmt)	U36
U35	Unused	U35
U34	Unused	U34
U33	Unused	U33
U32		U32
U31		U31
U30		U30
U29		U29
U28		U28
U27		U27
U26		U26
U25		U25
U24		U24
U23		U23
U22		U22
U21		U21
U20		U20
U19		U19
U18		U18
U17	Flexible Computing Region	U17
U16		U16
U15		U15
U14		U14
U13		U13
U12		U12
U11		U11
U10		U10
U9		U9
U8		U8
U7		U7
U6		U6
U5		U5
U4		U4
U3		U3
U2		U2
U1		U1

PDU 3A, PDU 3B, PDU 2A, PDU 2B, PDU 1A, PDU 1B

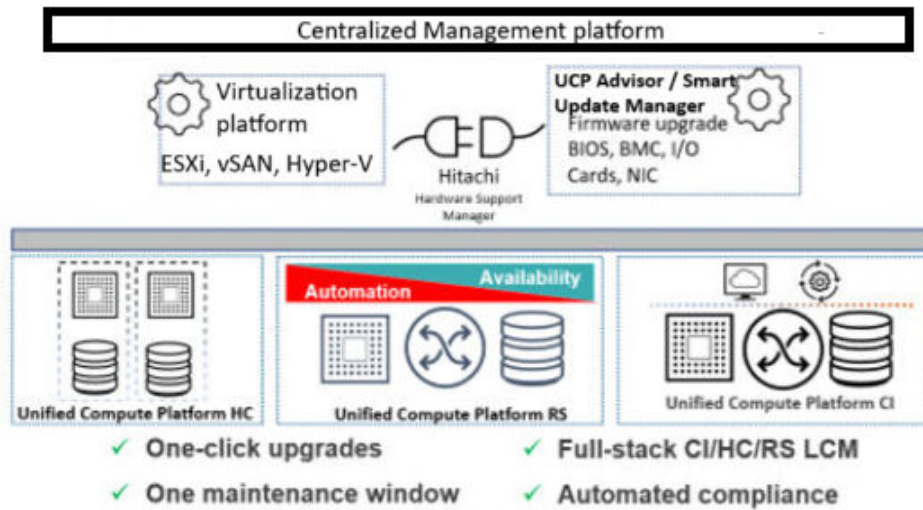**Note:** This design is an alternative to the default multi-rack design and has to be ordered explicitly.

Solution components

These major hardware and software components were used to implement this reference architecture for Hitachi UCP product portfolio for VMware vSphere.

The following tables lists details of the hardware and software components supported in the Hitachi UCP product portfolio.

	Hyperconverged		RS/Converged			
	Midmarket, Departmental, ROBO, VDI	**Private/ Hybrid Cloud**	**Big Data & Analytics**	**Midmarket, Ent. Core Small DC**	**Private Cloud, Ent. Core Large DC**	**Enterprise Business App Optimized**
	UCP HC	**UCP RS**	**UCP RS**	**UCP CI**	**UCP CI**	**UCP CI**
Storage	Internal Disk , External VSP	Internal Disk , External VSP	Internal Disk	VSP Series	VSP Series	VSP Series
Network	Cisco, Arista	Cisco, Arista	Cisco, Arista	Cisco, Arista, Broadcom Fibre Channel SAN	Cisco, Arista, Broadcom Fibre Channel SAN	Cisco, Arista, Broadcom Fibre Channel SAN
Compute	DS120 G1 & G2, DS220 G1 & G2, DS225, HA800/HA8x5	DS120 G1 & G2, DS220 G1 & G2, DS225, HA800/HA8x5	DS120 G1 & G2, DS220 G1 & G2, DS225, HA800/HA8x5	DS120 G1 & G2, DS220 G1 & G2, DS225, DS240, HA800/HA8x5	DS120 G1 & G2, DS220 G1 & G2, DS225, DS240, HA800/HA8x5	DS220 G1 &G2, DS240, HA800/HA8x5
Infrastructure Management	UCP Advisor, Ops Center	UCP Advisor, Ops Center	UCP Advisor, Ops Center	UCP Advisor, Ops Center	UCP Advisor, Ops Center	UCP Advisor, Ops Center
Software Stacks	VMware (vSAN) VMware Tanzu	VMware VCF VMware Tanzu		VMware Vsphere VMware Tanzu Red Hat Openshift Windows Server	VMware Vsphere VMware Tanzu Red Hat Openshift Windows Server	VMware Vsphere VMware Tanzu Red Hat Openshift Windows Server
Bare Metal			Ubuntu	Microsoft Windows, Red Hat Linux, Oracle Linux, Ubuntu, SUSE	Microsoft Windows, Red Hat Linux, Oracle Linux, Ubuntu, SUSE	Microsoft Windows, Red Hat Linux, Oracle Linux, Ubuntu, SUSE

The following table lists server details for all supported Hitachi Advanced Server models.

Hardware	Description
Hitachi Advanced Server HA810 G3	1U server, used for compute nodes and management nodes. ▪ 8 × SFF, Tiered and All NVMe ▪ 2 × PCIe M.2 form factor (boot device) ▪ Single socket and dual socket options
Hitachi Advanced Server HA820 G3	2U server, used for compute nodes. ▪ 24 × SFF, Tiered and All NVMe ▪ 2 × PCIe M.2 form factor (boot device) ▪ 12 × LFF, Tiered ▪ Single socket and dual socket options
Hitachi Advanced Server HA840 G3	2U server, used for compute nodes. ▪ 8 × SFF, Tiered and All NVMe ▪ 2× PCIe M.2 form factor (boot device) ▪ Four socket option
Hitachi Advanced Server HA805 G3	1U server, used for compute nodes and management nodes. ▪ 8 × SFF, Tiered and All NVMe ▪ 2 × PCIe M.2 form factor (boot device) ▪ Single socket

Hardware	Description
Hitachi Advanced Server HA815 G3	2U server, used for compute nodes and management nodes. • 8 × SFF, Tiered and All NVMe • 2 × PCIe M.2 form factor (boot device) • Single socket and dual socket options
Hitachi Advanced Server HA825 G3	2U server, used for compute nodes. • 8 × SFF, Tiered and All NVMe • 2 × PCIe M.2 form factor (boot device) • Single socket and dual socket options
Hitachi Advanced Server HA810 G2	1U server, used for compute nodes and management nodes. • 8 × SFF, Tiered and All NVMe • 2 × PCIe M.2 form factor (boot device) • Single socket and dual socket options
Hitachi Advanced Server HA820 G2	2U server, used for compute nodes. • 24 × SFF, Tiered and All NVMe • 2 × PCIe M.2 form factor (boot device) • 12 × LFF, Tiered • Single socket and dual socket options
Hitachi Advanced Server DS240 (used for compute nodes)	• 2U Server • 4 Intel Xeon processors • 48 slots for standard memory DIMMs • 16 SFF slots for HDD/SSD/NVMe drives
Hitachi Advanced Server DS225	• 2U server, used for compute nodes • 2 Intel Xeon processors • 24 slots for standard memory DIMMs • 32 GB SATADOM • 8 LFF slots for HDD/SSD/NVMe drives
Hitachi Advanced Server DS220 G2 (Whitley based chassis, and Ice Lake processors)	• 2U server, used for compute nodes • 2 × 3rd generation Intel Xeon processors (Ice Lake)

Hardware	Description

	▪ 2 × PCIe M.2 form factor (boot device)
	   • 128 GB/256 GB/512 GB
	▪ 12 SFF slots for HDD/SSD/NVMe drives
	   • All Flash SKU – 24x 2.5" NVMe SSD. Optional rear 2.5" NVMe
	   • Tiered SKU – 16x 2.5" SATA/SAS via expander + 8x 2.5" SATA/SAS/ NVMe. Optional rear 2.5" SATA/SAS/ NVMe HDD/SSD

Hitachi Advanced Server DS220 G2 LFF (Whitley based chassis LFF (Large Form Factor), and Ice Lake processors)	▪ 2U server, used for compute nodes
	▪ 2 × 3rd generation Intel Xeon processors (Ice Lake)
	▪ 2 × PCIe M.2 form factor (boot device)
	   • 128 GB/256 GB/512 GB
	▪ 12 LFF slots for HDD/SSD/NVMe drives
	   • Tiered SKU – 4x 3.5" SATA/SAS + 8x
	   • 3.5" SATA/SAS/ NVMe

Hitachi Advanced Server DS220[*]	▪ 2U server, used for compute nodes ▪ 2 Intel Xeon processors ▪ 24 slots for standard memory DIMMs and DCPMM DIMMs ▪ 32 GB SATADOM ▪ 24 SFF slots for HDD/SSD/NVMe drives (SFF Chassis), or 12 LFF slots for HDD/SSD/NVMe

Hitachi Advanced Server DS120 G2 (Whitley based chassis, and Ice Lake processors)[*]	▪ 1U server, used for compute nodes and management nodes
	▪ 2 × 3rd generation Intel Xeon processors (Ice Lake)
	▪ 2 × PCIe M.2 form factor (boot device)
	   • 128 GB/256 GB/512 GB
	▪ 12 SFF slots for HDD/SSD/NVMe drives
	   • All Flash SKU – 12 × 2.5" SATA/ NVMe SSD/HDD
	   • Tiered SKU – 8 × 2.5" SATA/SAS/ NVMe SSE/HDD + 4 × SATA/SAS SSD/HDD

Hitachi Advanced Server DS120[*]	▪ 1U server, used for compute nodes and management nodes ▪ 2 Intel Xeon processors ▪ 24 slots for standard memory DIMMs and DCPMM DIMMs

Hardware	Description
	▪ 32 GB SATADOM ▪ 12 SFF slots for HDD/SSD/NVMe drives

* These servers are end of sales (EOS).

The following table lists details for bolt-on storage.

> 📄 **Note:** Only Virtual Storage Platform (VSP) F series and VSP G series support bolt-on storage.

Storage (Bolt-on)	Dedicated	Shared
Virtual Storage Platform G200	Yes	No
Virtual Storage Platform G350, Virtual Storage Platform F350	Yes	No
Virtual Storage Platform G370, Virtual Storage Platform F370	Yes	No
Virtual Storage Platform G400, Virtual Storage Platform F400	Yes	Yes
Virtual Storage Platform G600, Virtual Storage Platform F600	Yes	Yes
Virtual Storage Platform G700, Virtual Storage Platform F700	Yes	Yes
Virtual Storage Platform G900, Virtual Storage Platform F900	Yes	Yes
Virtual Storage Platform G1000	Yes	Yes
Virtual Storage Platform G1500, Virtual Storage Platform F1500	Yes	Yes
Virtual Storage Platform E series	Yes	Yes
Virtual Storage Platform One Block 24/26/28	**Yes**	**Yes**

Follow these configuration rules to connect a dedicated or shared (bolt-on) VSP series storage system to the UCP product portfolio.

▪ The dedicated or shared Virtual Storage Platform must have a minimum of four available Fibre Channel ports, two for management and two for the compute cluster. The recommended number is 16 Fibre Channel ports, two for management and 14 for the compute cluster.

▪ You cannot connect the dedicated or shared Virtual Storage Platform to your SAN. You can only connect this storage to the Brocade Fibre channel switches on the UCP product portfolio as an isolated SAN.

Connect the storage system ports to the fabrics so the fabric and storage system can sustain possible failures while maintaining data connectivity:

▪ Connect half of Cluster 1 (Controller 1) ports and half of Cluster 2 (Controller 2) ports to Fabric A.

▪ Connect the other half of Cluster 1 (Controller 1) ports and the other half of Cluster 2 (Controller 2) ports to Fabric B.

Software components

The following software components are part of the Hitachi UCP product portfolio:

▪ Hitachi UCP Advisor

▪ VMware vSphere/Microsoft Windows Server 2025 (software and license supplied by the customer)

▪ Hitachi Storage Virtualization Operating System RF (for UCP CI and UCP RS only)

▪ Smart Update Manager (optional)

Solution design

This is the detailed design for the UCP product portfolio for Virtualization/BareMetal. Topics include the following:

Physical design

The following figure shows a high-level physical design of the UCP product portfolio with the following hardware:

▪ Two/whole solution Cisco or Arista — spine Ethernet switches (per solution)

▪ Two/rack Cisco or Arista — leaf Ethernet switches (per rack)

▪ One Cisco or Arista management switch (per rack)

▪ Four Hitachi Advanced Server compute nodes

▪ One Hitachi Virtual Storage Platform

Customer Network

Port Channel/LAG

Cisco or Arista Spine Switch   Cisco or Arista Spine Switch

Cisco or Arista Leaf Switch   Cisco or Arista Leaf Switch

Cisco or Arista Management Switch

-Workload Domain w/ VSAN

Hitachi Advanced Server DS/HA
Management Cluster

-Workload Domain w/ VSP SAN Storage

Brocade (Fabric A)   Brocade (Fabric B)

HITACHI

Hitachi VSP 5000 series, E series, G Series, F Series and VSP One

———	40/100 GbE Customer Network
———	40/100 GbE Network
———	10/25/100 GbE Network
———	1 GbE Management Nework
———	32/64 Gb Fibre Channel Link

RAID and dynamic provisioning pool configuration

The storage implementation for this solution uses a RAID 10 (2D+2D) configuration for the management pool and RAID 10 (2D+2D) or RAID 6 (4P+2D) configuration for the compute pool.

Use the management pool to store the infrastructure virtual machines. These provide the management layer for the UCP product portfolio. Both RAID 10 and RAID 6 offer the best performance and redundancy for its intended usage.

While using dynamic provisioning pools provides the best performance for VMware virtual machine file placements, it also allows ease of scaling by adding additional disk resources to gain performance or capacity without interrupting VMware ESXi server operations.

Physical network architecture

The UCP product portfolio supports Arista or Cisco Nexus switches for networking.

The following figure shows a single-rack network topology using two Cisco top-of-rack switches to provide 10/25/100 GbE connections for server communications. One Cisco switch provides 1 GbE connections for management.

The following figure shows a multi-rack network topology using Cisco spine-leaf design. Two Cisco spine switches provide 40/100 GbE connections to the leaf switches. Two Cisco leaf switches provide 10/25/100 GbE connections for server communications. One Cisco switch provides 1 GbE connections for management.
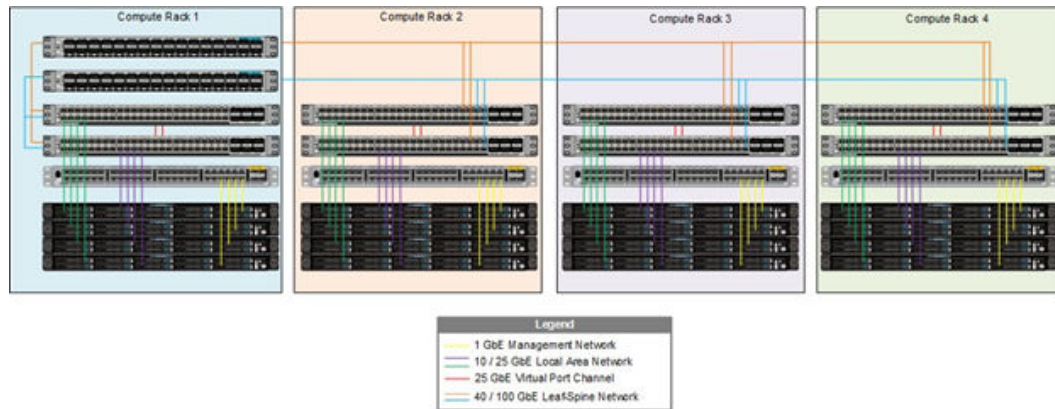
The following fig shows a multi-rack distributed spine network topology using a Cisco spine-leaf design. It is different from the default design and must be ordered explicitly.
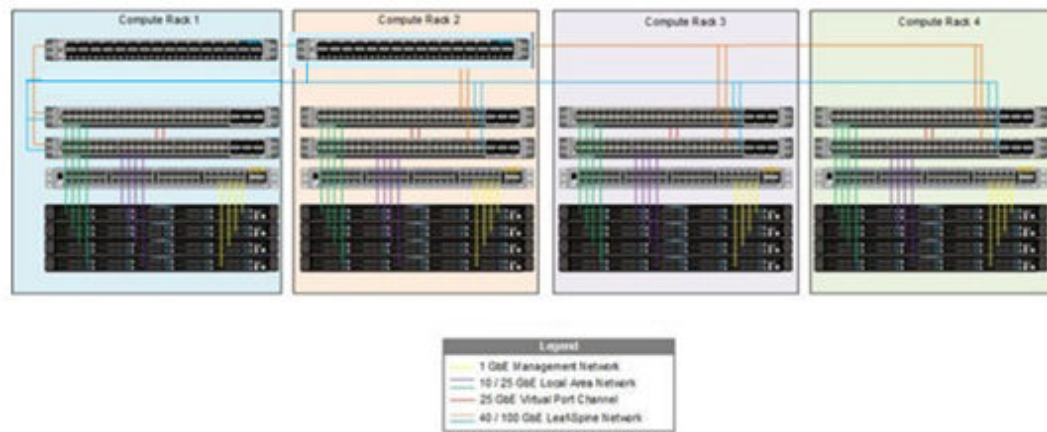
Virtual network architecture or VMware vSphere

The UCP product portfolio supports VMware vSphere standard switches or vSphere distributed switches (vDS) for virtual network configuration.

You can define an uplink port group or dvuplink port group during the creation of the distributed switch that can have one or more uplinks.

Identify each distributed port group using a network label, which must be unique to the current datacenter. NIC teaming, failover, load balancing, VLAN, security, traffic shaping, and other policies are configured on distributed port groups.

VMware recommends these best practice configurations for security and best performance when deploying vSphere distributed switches for virtual networks:

- Use a minimum 10 GbE dual-port network adapter.

- Use vLANs on virtual networks to improve security and performance.

  - Host management network (configure as untagged traffic) — Dedicate this network to managing the VMware ESXi hosts.

  - vSAN network (configure as tagged traffic) — Dedicate this network to the vSAN traffic.

  - vMotion network (configure as tagged traffic) — Dedicate this network to live migration of virtual machines from host to host and datastore to datastore.

  - Virtual machine network (configure as tagged traffic) — Dedicate this network to virtual machines running in a production network.

- For best performance, use VMXNET 3 virtual machine NICs.

- For best performance, configure all VMkernel network adapters in a vSphere distributed switch with the same MTU.

NVMe over TCP (NVMe/TCP)

NVMe/TCP is a way of achieving NVMe-oF which runs over Ethernet and uses NVMe commands and data inside a TCP datagram. NVMe/TCP enables a larger number of queues and queue paths for data transport compared to iSCSI, resulting in a significant increase in throughput and reduction in latency.

What makes NVMe/TCP particularly beneficial is that it does not require any special hardware to deploy and can use any Ethernet NICs and switches. This makes it simpler and less expensive to deploy and maintain. Because it can be deployed on any TCP network, it can be used on-premises or in the cloud.

📄 **Note:** Windows Server 2025 does not officially support NVMe TCP at the moment this RA is released, while the feature is on Microsoft roadmap. Contact Microsoft for the latest update.

The following are topology diagrams for implementing 100G NVMe TCP with a single 100G shared NIC.

Multi-rack setup

Single rack setup

Single rack setup

100G NVMe TCP Network Architecture

1G link(s) – BMC Management	
100G link(s) – NVMe TCP Connections	
100G link(s) – Data Path	
400G link(s) – InterSwitch links	
100G or 400G link(s) – Uplink	
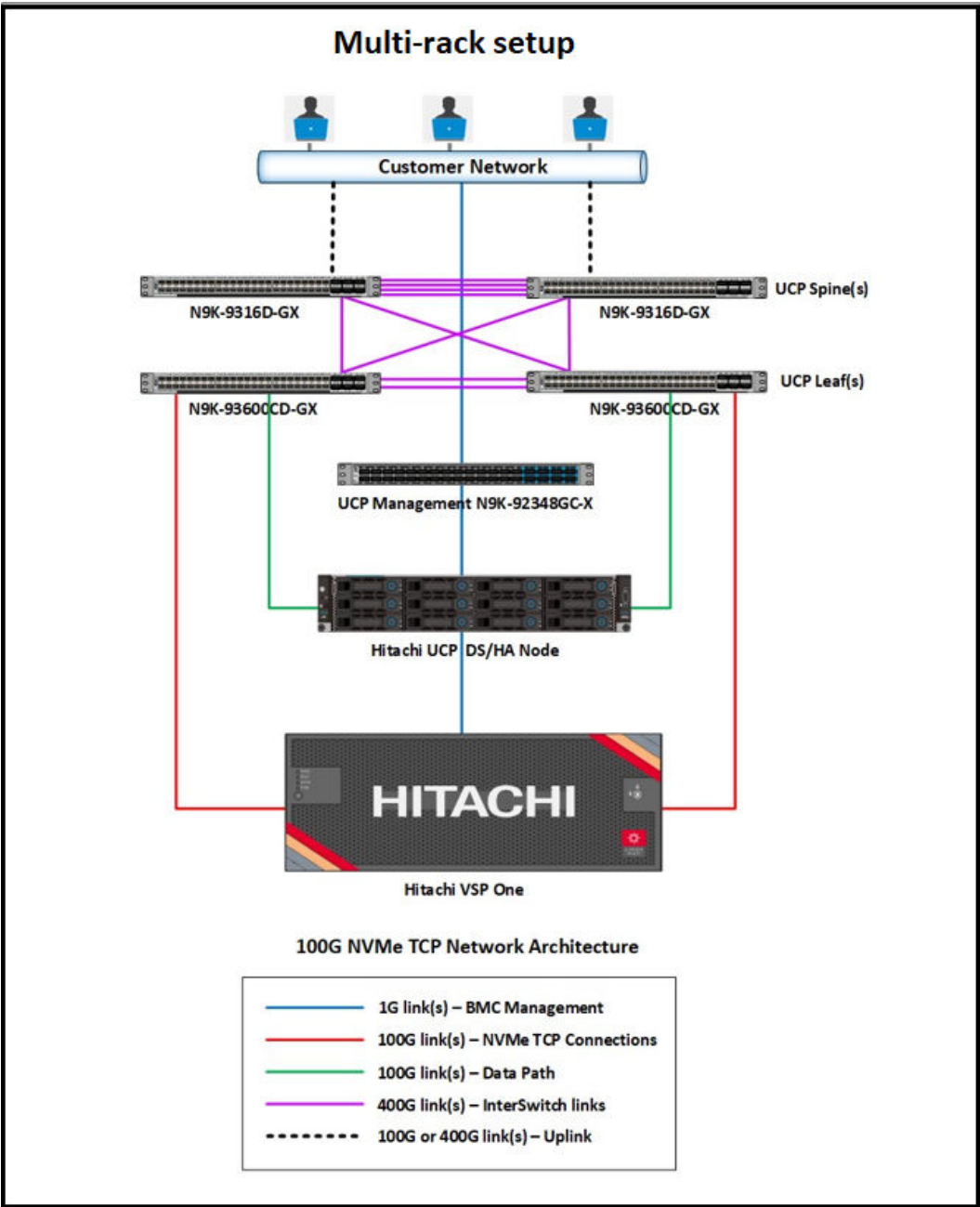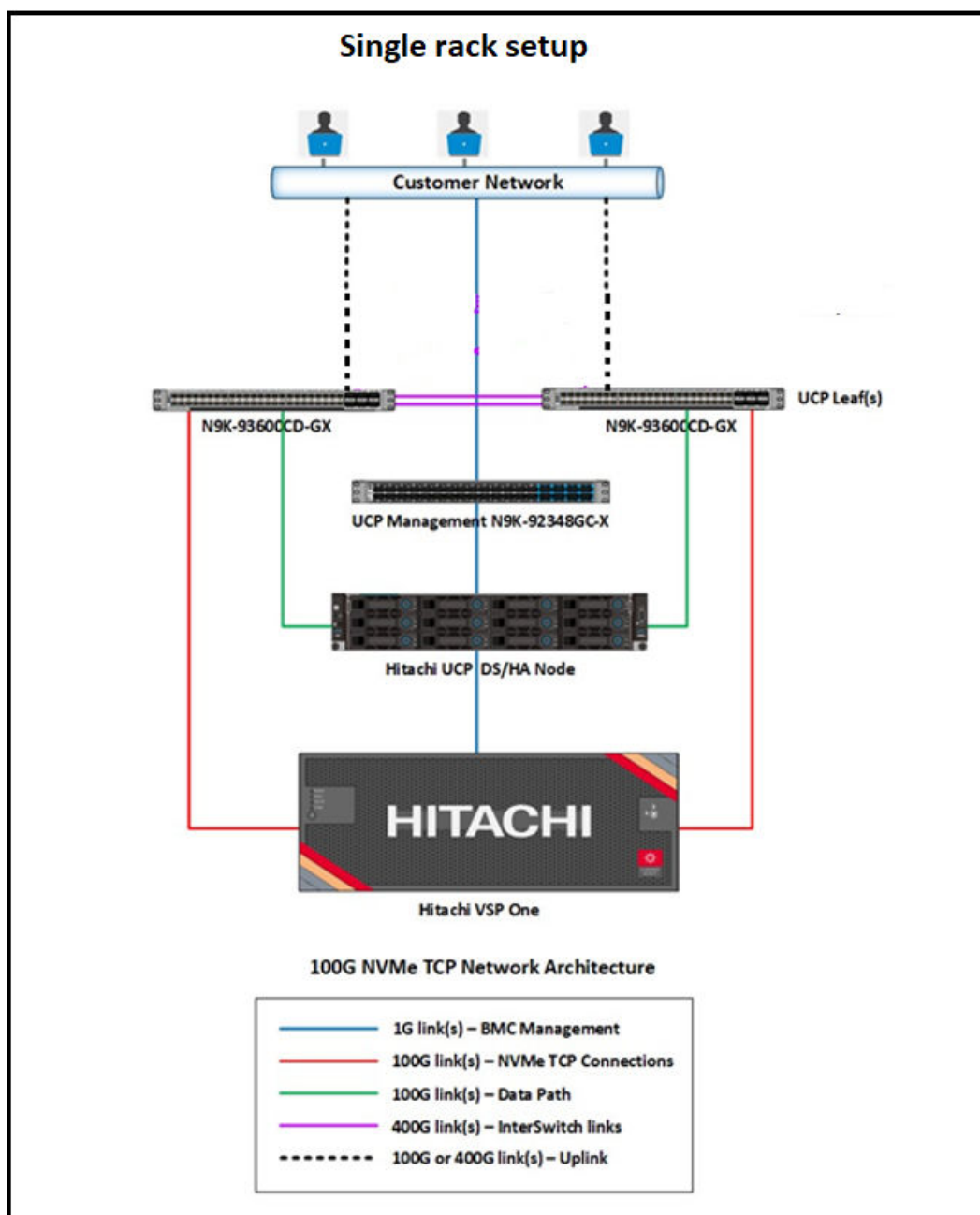
This configuration can be deployed in a single and multi-rack design.

- 100G NIC card failure

  If any one of the interfaces of a dual port card goes down, another interface will still work with an NVMe TCP connection.

- Leaf switch failure

  Dual port 100G NIC card interfaces should be spread across 2 × 93600CD-GX leaf switches to manage single point of failure at the leaf switches layer.

- Storage array controller failure

  100G CHBs should be spread to function from different storage system controllers. Leaf switch to CHB connections should be made accordingly to manage failure.

- Path failure

  Multiple NVMe over TCP storage adapters should be created. So, if any of the adapters goes down, another adapter will still work with the NVMe TCP connection.

- Traffic separation (for VMware vSphere only – similar rules apply to Hyper-V environments)

  Different vLANs can be configured to separate the network traffic on ESXi for the following purposes:

    - VMware ESXi host management
    - Virtual machine traffic
    - Storage backend traffic (NVMe TCP / iSCSI)
    - VMware vMotion
    - VMware vSAN (if used)

NVMe TCP is currently offered with several other options for Red Hat Enterprise Linux 9.4 as follows:

1. 100G (Data) / 100G (Storage) with Single Rack

   This configuration supports up to 16 Hosts with 4:1 fan-in ratio (limited by switch port count) and has an oversubscription ratio = 1:1 (considering data Ethernet traffic).

2. 25G (Data) / 100G (Storage) with Single Rack

   This configuration supports up to 16 Hosts with 4:1 fan-in ratio (limited by switch port count) and has an oversubscription ratio = 1:1 (considering data Ethernet traffic).

3. 100G (Data) / 100G (Storage) with Multi Rack using Standard / Distributed Spine

   This configuration supports up to 20 Hosts per rack (80 total across 4 racks) with 5:1 fan-in ratio) based on physical rack space availability and/or switch port availability.

4. 25G (Data) / 100G (Storage) with Multi Rack using Standard / Distributed Spine

   This configuration supports up to 32 Hosts per rack (128 total across 4 racks) with 8:1 fan-in ratio) based on physical rack space availability and/or switch port availability.

Microsoft Hyper-V with VSP/VSP One Block storage systems.

Hyper-V, developed by Microsoft, is a technology designed for hardware virtualization. Essentially, it allows you to create and operate virtual computers, called virtual machines, on a single physical machine. Each virtual machine functions as a complete computer, with its own operating system and software, enabling diverse workloads to coexist efficiently.

Microsoft Windows Server Failover Clustering (WSFC) is built upon Hyper-V, providing users with high standard high availability and BCDR (Business Continuity/Disaster Recovery) capabilities.
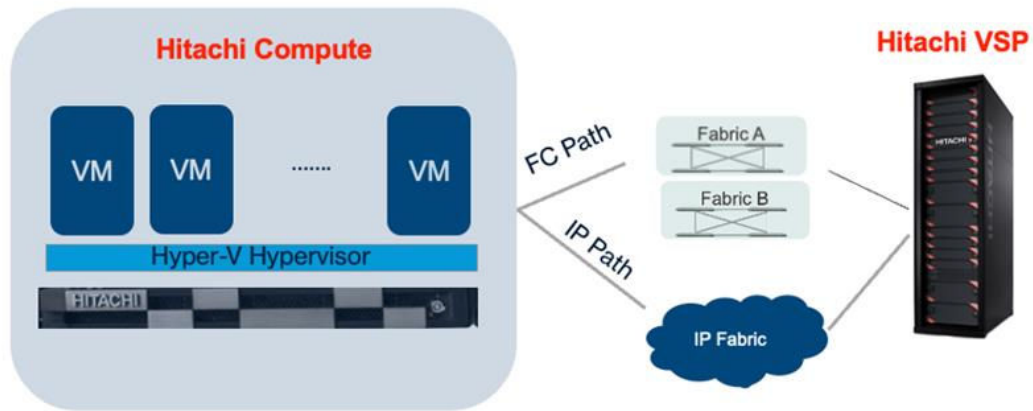
By hosting multiple virtual machines on the same hardware, Hyper-V maximizes resource utilization and saves both time and money. It also keeps these virtual machines isolated from one another, ensuring that issues like system crashes in one machine won't impact the others. This is particularly useful for scenarios like testing different operating systems, isolating development environments, or giving distinct groups access to unique computing spaces.

Here are some of the key ways Hyper-V can assist you:

- Build or Enhance Private Clouds: Create a flexible and scalable IT environment by using shared resources, which can adapt dynamically to changing demands.

- Optimize Hardware Usage: By consolidating multiple workloads onto fewer physical machines, you can save space, reduce energy costs, and make your hardware more efficient.

- Ensure Business Continuity: Hyper-V helps mitigate the effects of downtime, whether planned or unplanned, keeping your critical systems running smoothly.

- Expand Virtual Desktop Infrastructure (VDI): Enable centralized desktop management, enhancing security, regulatory compliance, and agility. By deploying Hyper-V alongside Remote Desktop Virtualization Host, you can provide virtual desktops or desktop pools tailored to your users' needs.

- Streamline Development and Testing: With virtual environments, you can mimic various setups without the hassle or expense of maintaining separate physical systems for testing.

- Windows Server 2025 Hyper-V (user-supplied software and license) with VSP One Block (24/26/28) currently is being offered with Hitachi Advanced Server HA8x0 G2, Hitachi Advanced Server HA8x0 G3, Hitachi Advanced Server HA8x5 G3, and Hitachi Advanced Server DS G2 servers. Note: UCP CI does not pre-install the Windows software stack or bundle the software licenses. Contact Hitachi Vantara if you have questions regarding the deployment.

Hyper-V with VSP/VSP One Block (24/26/28) is currently being offered with Hitachi Advanced Server HA8x0 G2, Hitachi Advanced Server HA8x0 G3, Hitachi Advanced Server HA8x5 G3.

Product descriptions

The following products are used in this reference architecture.

Hardware components

These hardware components are a part of the UCP product portfolio for VMware vSphere reference architecture.

Hitachi Advanced Server

Designed to unlock the full benefits of the hybrid cloud, Hitachi Advanced Server models deliver high performance and enhanced security while reducing operational costs. Global enterprises, cloud service providers, and governments trust Hitachi servers to run bare metal, virtualized, or containerized applications. Powered by industry-leading scalable processors, Hitachi servers are ideal to deliver edge, core, and cloud IT services.

Hitachi Advanced Server supports a variety of GPUs for parallel processing which is used in a wide range of applications, including graphics and video rendering.

Hitachi servers are designed and optimized to maximize performance for VMware, Red Hat, Oracle, bare metal, virtual desktop infrastructure (VDI), SAP, analytics, high-performance computing (HPC), and other enterprise workloads.

Hitachi Virtual Storage Platform

This enterprise-class, flash array evolution storage, Hitachi Virtual Storage Platform (VSP) has an innovative, scale-out design optimized for NVMe and storage class memory. It achieves the following:

- **Agility using NVMe:** Speed, massive scaling with no performance slowdowns, intelligent tiering, and efficiency.

- **Resilience:** Superior application availability and flash resilience. Your data is always available, mitigating business risk.

- **Storage simplified:** Do more with less, integrate AI (artificial intelligence) and ML (machine learning), simplify management, and save money and time with consolidation.

Hitachi Virtual Storage Platform One Block

The Hitachi Virtual Storage Platform One Block series simplifies system setup and management through Hitachi Clear Sight and VSP One Block Administrator. Dynamic Drive Protection reduces RAID complexity, and always-on compression and deduplication enhance simplicity.

Dynamic Carbon Reduction optimizes energy usage by switching CPUs to ECO mode during low activity. Adaptive Data Reduction (ADR) is always on, enhancing efficiency and reducing the overall CO2 footprint.

Thin Image Advanced (TIA) integrates with major snapshot ecosystems, prioritizing security by defending against threats and ensuring data confidentiality. CyberArk Privileged Access Manager plugins enhance block storage system security by prioritizing data confidentiality, ensuring compliance, and actively defending against security threats.

Hitachi Virtual Storage Platform One Block 20 includes 3 dedicated models. All have the same capacity (72 NVMe flash drives, the appliance and 2 × media trays) and they support Fibre Channel, iSCSI, and NVMe TCP connectivity. The new capabilities remove complexity: data reduction is always on, Dynamic Drive Protection removes complicated RAID setup, and Dynamic Carbon Reduction delivers real world reduction in power consumption. In addition, the models are FIPS compliant.

- VSP One Block 24 – 256 GB Cache + SW Advanced Data Reduction (ADR) + 24 cores

- VSP One Block 26 – 768GB Cache + 2x Compression Accelerator Module (CAM) + 24 cores

- VSP One Block 28 – 1TB Cache + 4x CAM + 64 cores

In short, the Hitachi Virtual Storage Platform One Block series combines simplicity, sustainability, and robust security features to optimize system management, energy efficiency, and data protection.

Hitachi Virtual Storage Platform E series family

The Hitachi Virtual Storage Platform E series family provides agile and automated storage built upon the innovative technologies found in our high-end enterprise systems. The expansion of the VSP E series portfolio includes 2 new all-NVMe flash models that deliver super charged, ultra-low latency performance for the business-critical applications that small and midsized businesses rely on.

- Improve IT agility: "Faster-to-market" for IT projects with proven high-performance infrastructure. Brings "enterprise-class" features and benefits to customers of all sizes whose business is outpacing their existing infrastructure and supports modern business processes like DevOPs.

- Financial elasticity that aligns costs to business goals, growth, and use: Customers can "have it their way" with purchase, lease, or cloud-like consumption models.

- Improved workforce efficiency: a better digital experience which boosts customer satisfaction (with both internal LOBs and end-users) and increases business productivity and profitability.

Hitachi Virtual Storage Platform F Series family

Use Hitachi Virtual Storage Platform F series family storage for a flash-powered cloud platform for your mission critical applications. This storage meets demanding performance and uptime business needs. Extremely scalable, its 4.8 million random read IOPS allows you to consolidate more applications for more cost savings.

Hitachi Virtual Storage Platform F series family delivers superior all-flash performance for business-critical applications, with continuous data availability.

Hitachi Virtual Storage Platform G series family

The Hitachi Virtual Storage Platform G series family enables the seamless automation of the data center. It has a broad range of efficiency technologies that deliver maximum value while making ongoing costs more predictable. You can focus on strategic projects and consolidating more workloads while using a wide range of media choices.

The benefits start with Hitachi Storage Virtualization Operating System RF. This includes an all new enhanced software stack that offers up to three times greater performance than our previous midrange models, even as data scales to petabytes.

Hitachi Virtual Storage Platform G series offers support for containers to accelerate cloud-native application development. Provision storage in seconds, and provide persistent data availability, all the while being orchestrated by industry leading container platforms. Move these workloads into an enterprise production environment seamlessly, saving money while reducing support and management costs.

Arista Data Center switches

Arista Networks builds software-driven cloud networks for data center, cloud, and campus environments. Arista delivers efficient, reliable and high-performance Universal Cloud Network architectures, based on 10 GbE, 25 GbE, 40 GbE, 50 GbE, and 100 GbE platforms delivered with an extensible operating system - Arista EOS.

Cisco Nexus switches

The Cisco Nexus switch product line provides a series of solutions that make it easier to connect and manage disparate data center resources with software-defined networking (SDN). Leveraging the Cisco Unified Fabric, which unifies storage, data, and networking (Ethernet/IP) services, the Nexus switches create an open, programmable network foundation built to support a virtualized data center environment.

Brocade switches from Broadcom

Brocade and Hitachi Vantara have partnered to deliver storage networking and data center solutions. These solutions reduce complexity and cost, as well as enable virtualization and cloud computing to increase business agility.

Brocade Fibre Channel switches deliver industry-leading performance with seventh generation 64Gb/sec Fibre Channel interfaces, simplifying scale-out network architectures. Get the high-performance, availability, ease of management, and support for the next generation of Hitachi Virtual Storage Platform storage systems on a solid storage network foundation that can grow as your need grows.

Software components

These software components are a part of the UCP product portfolio for Virtualization/Bare Metal reference architecture.

Hitachi Storage Virtualization Operating System RF

Hitachi Storage Virtualization Operating System RF powers the Hitachi Virtual Storage Platform (VSP) family. It integrates storage system software to provide system element management and advanced storage system functions. Used across multiple platforms, Storage Virtualization Operating System includes storage virtualization, thin provisioning, storage service level controls, dynamic provisioning, and performance instrumentation.

Flash performance is optimized with a patented flash-aware I/O stack, which accelerates data access. Adaptive inline data reduction increases storage efficiency while enabling a balance of data efficiency and application performance. Industry-leading storage virtualization allows SVOS RF to use third-party all-flash and hybrid arrays as storage capacity, consolidating resources for a higher ROI and providing a high-speed front end to slower, less-predictable arrays.

Hitachi Unified Compute Platform Advisor

Hitachi Unified Compute Platform Advisor (UCP Advisor) is a comprehensive cloud infrastructure management and automation software that enables IT agility and simplifies day 0-N operations for edge, core, and cloud environments. The fourth-generation UCP Advisor accelerates application deployment and drastically simplifies converged and hyperconverged infrastructure deployment, configuration, life cycle management, and ongoing operations with advanced policy-based automation and orchestration for private and hybrid cloud environments.

The centralized management plane enables remote, federated management for the entire portfolio of converged, hyperconverged, and storage data center infrastructure solutions to improve operational efficiency and reduce management complexity. Its intelligent automation services accelerate infrastructure deployment and configuration, significantly minimizing deployment risk and reducing provisioning time and complexity, automating hundreds of mandatory tasks.

UCP Advisor improves predictability with guided lifecycle management capabilities for the complete data center infrastructure stack, including servers and switches from Arista, Brocade, and Cisco, and non-disruptively patches and upgrades infrastructure.

UCP Advisor provides deep integration with VMware management software, improving administrator productivity with intuitive and intelligent operations and automation. It complements VMware vRealize software to further streamline the administration and automation of software-defined data center (SDDC). Automated workflows deliver IT agility using UCP Advisor REST APIs and vRealize Orchestrator and when used with vRealize Automation, enable self- services multi-cloud environments.

It provides comprehensive visibility and monitoring of the infrastructure for collective insight into health and operational efficiency. It automates network configuration operations and system monitoring including generating reports for compliance. UCP Advisor and the integrations with vRealize Log Insight provide rich log analytics and auditability enabling comprehensive visibility of the infrastructure for better resource planning.

UCP Advisor best practices

The following are UCP Advisor best practices:

- Two nodes are set up in a VMware cluster, with VMware high availability enabled on the cluster.

- A shared LUN of 2 TB from VSP storage on the ESXi hosts.

- A service console VM should be installed on one ESXi host. Master Node VM, Worker Node VM 1, and Worker Node VM 2, and the Gateway VM should be on another host.

- If a Firewall is enabled on ESXi hosts, the ports listed in the following tables should be allowed to pass the traffic.

Source	Destination	Protocol/Port
Ethernet/Fibre Channel Device	UCP Advisor Master Node IP	TCP/22
Server BMC	UCP Advisor Master Node IP	TCP/UDP/111, 2048-2050, 32765, 32767, 32768
Client	UCP Advisor Master Node IP	TCP/443, 8443
Client	UCP Advisor Master Node IP	TCP/6443
Client	UCP Advisor Master Node IP	TCP/6782
VCSA	UCP Advisor Master Node IP	TCP/8877
UCP Advisor Master Node/Worker Nodes	UCP Advisor Master Node/Worker Nodes	TCP/23023
UCP Advisor Master Node/Worker Nodes	UCP Advisor Master Node/Worker Nodes	TCP/23033
UCP Advisor Master Node/Worker Nodes	UCP Advisor Gateway VM	NFS/2049 HTTPD/18443 File manager service/23019 TCP/8444

UCP Advisor Worker Node1	VCSA	TCP/443
Storage	UCP Advisor Worker Node1	UDP 9444-9449
UCP Advisor Worker Node1	Storage	UDP 9444-9449
UCP Advisor Worker Node1	Ethernet/Fibre Channel Device	TCP/22,TCP/443
UCP Advisor Master Node/Worker Nodes	Server BMC	TCP/443, UDP/161-162, UDP/623
UCP Advisor Gateway VM	Storage	TCP/443, UDP 9444-9449
UCP Advisor Gateway VM	Network	TCP/22, TCP/443
UCP Advisor Gateway VM	Server	TCP/443, UDP 161-162, UDP 623
SSH client	UCP Advisor VMs	TCP/22

UCP Advisor Service Console VM

Source	Destination	Protocol/Port
Service Console VM	Server BMC (Redfish)	TCP/HTTP/UDP80/443/623
Service Console VM	ESXi	SSH/22
Service Console VM	vCenter (Pyvomi)	TCP/HTTP 80/443

References

See the latest version of the following UCP Advisor documents:

- *HitachiUnified Compute Platform (UCP) Advisor Software Installation Guide* at « Unified Compute Platform (UCP) Advisor Software Installation Guide » • Search Results • Welcome to the Hitachi Vantara Documentation Portal

- *Hitachi Unified Compute Platform (UCP) Advisor Administration Guide* at « Unified Compute Platform (UCP) Advisor administration Guide » • Search Results • Welcome to the Hitachi Vantara Documentation Portal

Smart Update Manager

Smart Update Manager (SUM) is a tool designed to maintain and update the firmware, drivers, and system software of Hitachi Advanced Servers and associated infrastructure. Here are some key points regarding SUM:

- Discovery Engine: Identifies installed versions of hardware, firmware, and software on nodes.

- Orderly Updates: Ensures updates are deployed in the correct order, meeting all dependencies.

- Interdependency Checking: Avoids issues by checking for interdependencies.

- Guided Update Process: Offers both automatic and step-by-step updates.

- Web Interface: Accessible via a web browser.

- Custom Baselines and ISOs: Allows creation of custom baselines and ISOs.

- iLO Repository Support: Supports iLO Repository for G2/iLO5 and newer version nodes.

- Simultaneous Deployments: Can deploy firmware and software to multiple remote nodes simultaneously.

- Offline Deployments: Supports local offline firmware deployments.

- Extensive Logging: Provides detailed logs in all modes.
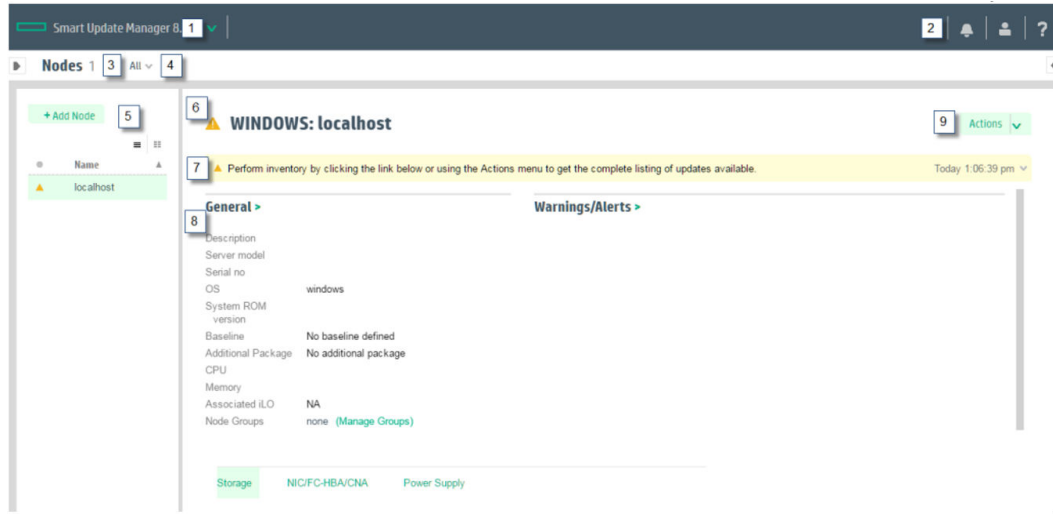
Item	Element Name	Description
1	Main Menu	Provides links to all application screens.
2	Activity List	Displays brief status updates and shows the status of recent activities via the activity icon. Click the icon to open the Activity panel.
	Login Information	Shows the currently logged-in user and provides a logout option.
	Help	Opens the help panel for user assistance.
3	Screen Name	Displays the name of the current screen.
4	Screen Filters	Allows filtering of screen objects based on specified criteria.
5	Screen List	Displays a list of items relevant to the current screen. The "Add" button adapts based on the screen context (e.g., "Add Node").
6	Baseline or Node Name	Lists the selected baseline or node from the screen list. For example, shows the name of the selected baseline.
7	Informational Highlight	Highlights important information pertinent to the selected item. Click to expand and view all details.
8	Item Details	Provides comprehensive details about the selected item.
9	Actions	Lists available actions that can be performed on the selected item.

SUM can deploy updates to up to 50 nodes at a time. The GUI is web-based and includes features like an activity list, login information, help panel, and various screen options. SUM complements UCP Advisor in terms of providing streamlined LCM experiences of non-VMware software stacks, including Windows Hyper-V. See the official Hitachi documentation at https://docs.hitachivantara.com/v/u/en-us/advanced-server-ha820-g3/mk-90has8003.

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.

iSCSI 10/25Gb configuration

iSCSI is a protocol that uses the TCP protocol to transport SCSI commands, enabling the use of the existing TCP/IP networking infrastructure as a SAN. As with SCSI over Fibre Channel (FC), iSCSI presents SCSI targets and devices to iSCSI initiators (requesters). Unlike NAS, which presents devices at the file level, iSCSI makes block devices available via the network. Block devices are presented across an IP network to your local system. These can be consumed in the same way as any other block storage device.

Software iSCSI adapter

A software iSCSI adapter is VMware code built into the VMkernel. It enables your host to connect to the iSCSI storage device through standard network adapters. The software iSCSI adapter manages iSCSI processing while communicating with the network adapter as shown in the following figure. With the software iSCSI adapter, you can use iSCSI technology without purchasing specialized hardware.
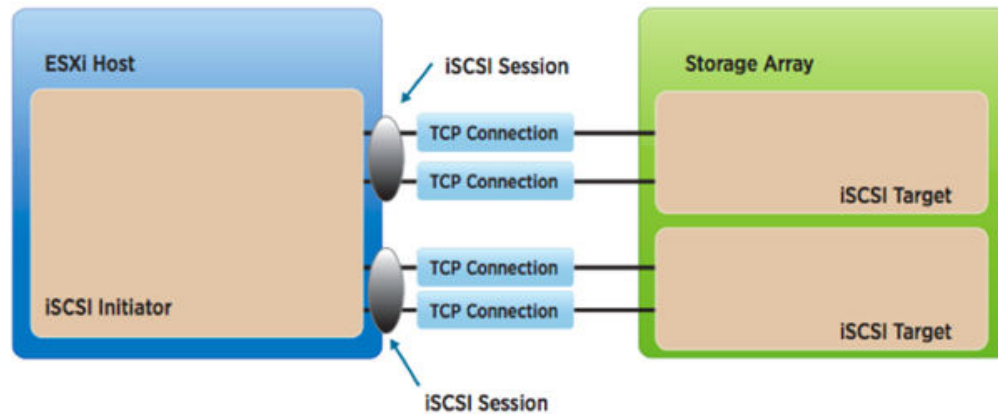
The following illustration shows the iSCSI topology.
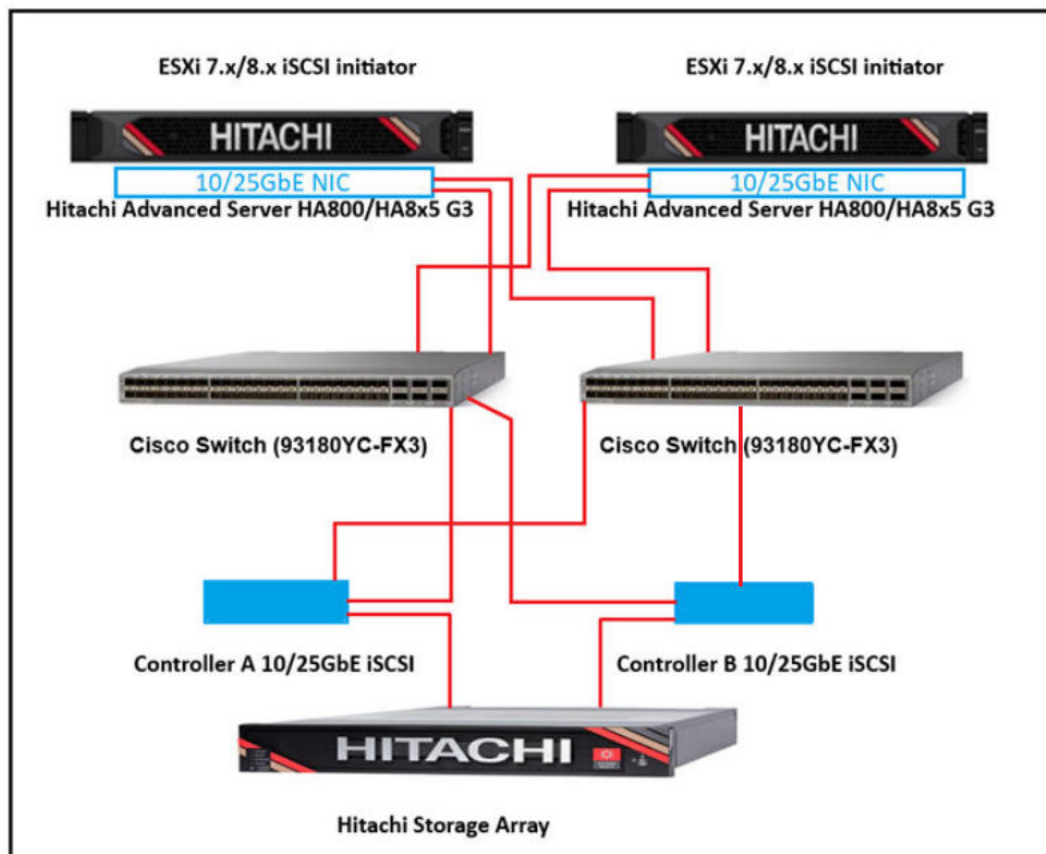
**Best practices for iSCSI 10/25G implementation**

Follow these best practices for iSCSI 10/25G implementation:

- Have a dedicated LAN for iSCSI traffic and do not share the network with other network traffic. It is also a best practice not to oversubscribe the dedicated LAN.

- Because iSCSI leverages the IP network, VMkernel NICs can be placed into teaming configurations. However, VMware recommends using port binding rather than NIC teaming.

- To improve throughput, 25 GbE is preferred over 10 GbE. Additional throughput can also be achieved by increasing the size of the payload in each frame from a default MTU of 1,500 to an MTU of 9,000.

iSCSI port binding best practices

With port binding, the SCSI protocol will not only load balance across all bound ports and failover to other bound ports on link failure, but it will also use SCSI sense code errors to trigger failover as well. When not using Port Binding, you are relying on vSphere and the network stack to determine the best path to use for iSCSI traffic. If paths are not clearly defined, other issues can arise such as longer scan times, and inconsistent connectivity. This isn't always the case but it is something to consider.

Reliable storage should always be your priority. This overview is one of the most reliable and common configurations for iSCSI. A few key configurations for this setup are having your virtual infrastructure VMkernels for iSCSI storage on the same VLAN/subnet as your storage system, and the storage controllers are also on that same subnet/VLAN.
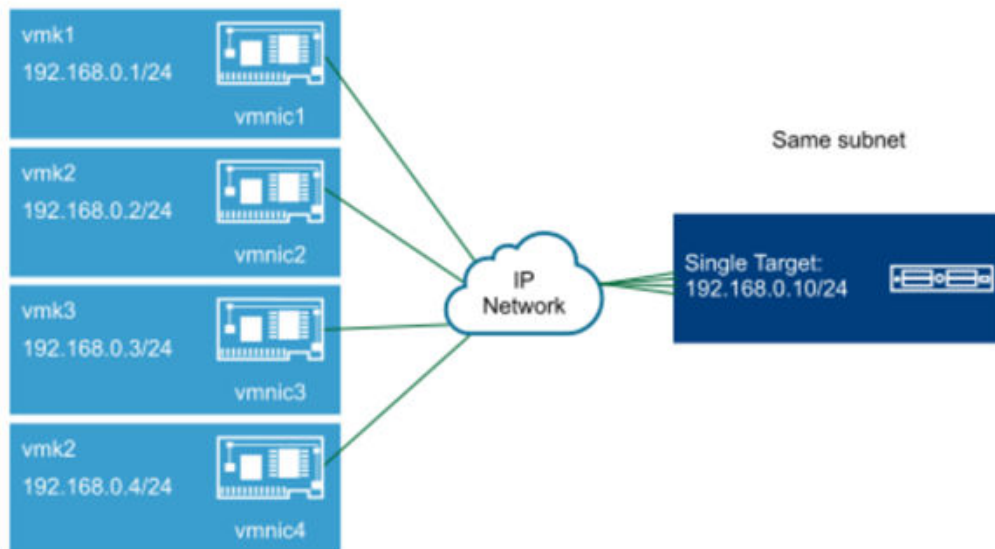
Configuring the VMware iSCSI software initiator for multipathing

To configure the VMware iSCSI software initiator for multipathing, see "Configure the Software iSCSI Adapter" and "Multiple Network Adapters in iSCSI or iSER Configuration" in the *vSphere Storage Guide* in the VMware vSphere Product Documentation at https://docs.vmware.com/en/VMware-vSphere/index.html.

If you have previous experience configuring iSCSI for multipathing, here are a few key points for a successful configuration:

- Verify that there is one VMkernel interface for each physical NIC to be used for storage traffic, following the virtual switch port binding.

- Adjust the failover order on each VMkernel interface for a 1:1 VMkernel to physical NIC ratio.

- Add both VMkernel interfaces to the iSCSI software adapter network port binding. If the prerequisite failover orders have not been set, the vSphere client will not allow the operation.

- Rescan the iSCSI software adapter for new volumes.

Windows Server 2025 Failover Clustering (software and license supplied by the customer)

Windows Server 2025 introduces advanced Failover Clustering capabilities, delivering high availability and fault tolerance for mission-critical applications and services.
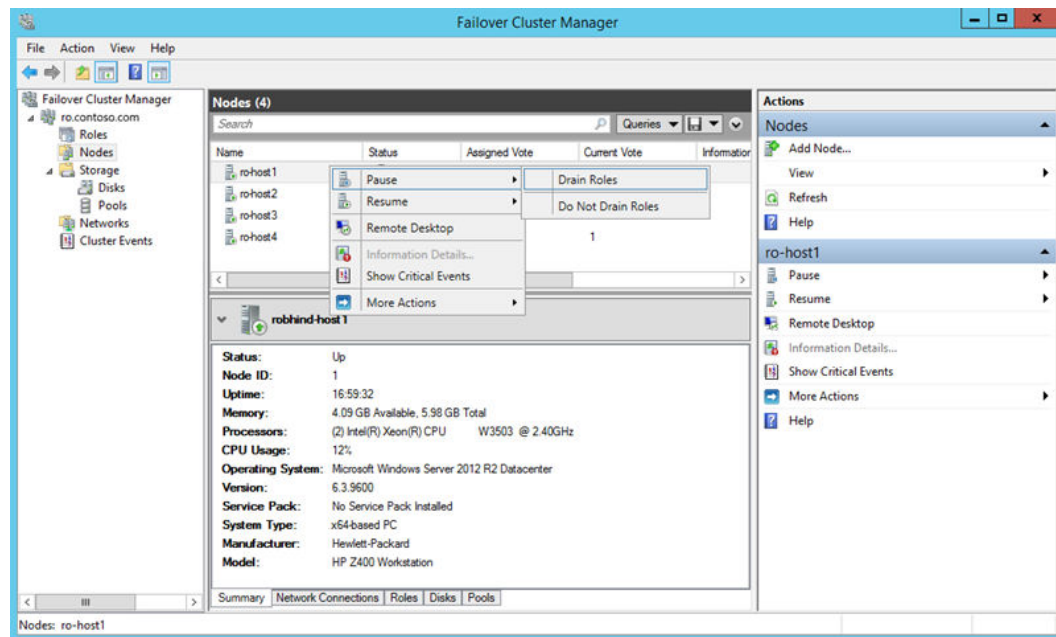
Cluster Architecture

Cluster Nodes

A Failover Cluster comprises multiple interconnected Windows Server instances (nodes) that collaboratively host workloads. In the event of a node failure, workloads automatically transition to another operational node, ensuring minimal service disruption.

Cluster Management Tools

Failover Cluster Manager

See https://learn.microsoft.com/en-us/windows-server/failover-clustering/cluster-operating-system-rolling-upgrade.

The primary graphical interface for configuring and managing Failover Clusters. It enables administrators to:

- Define and manage clustered roles

- Configure cluster storage and networking

- Monitor cluster health and performance

Windows Admin Center (WAC)

A modern, web-based management platform that offers streamlined cluster management capabilities, including:

- Simplified deployment and configuration

- Real-time monitoring and diagnostics

- Integration with Azure services for hybrid management

System Center Virtual Machine Manager (SCVMM)

When managing Hyper-V clusters, SCVMM provides advanced virtualization management features:

- Live Migration: Seamlessly move running virtual machines between nodes without downtime.

- Storage Migration: Transfer virtual machine storage across different locations without service interruption.

- Workload Balancing: Automatically distribute virtual machines across nodes to optimize resource utilization.

High Availability Features

Automatic Failover

Ensures that clustered roles (applications, services, virtual machines) automatically fail over to a healthy node upon detecting a failure, maintaining continuous availability.

Storage Spaces Direct (S2D)

S2D is Microsoft's software-defined storage solution that enables the creation of highly available and scalable storage systems using local drives on cluster nodes.

Hitachi Ops Center

Hitachi Ops Center is an integrated suite of applications that enable you to optimize your data center operations through integrated configuration, analytics, automation, and copy data management. These features allow you to administer, automate, optimize, and protect your Hitachi storage infrastructure.
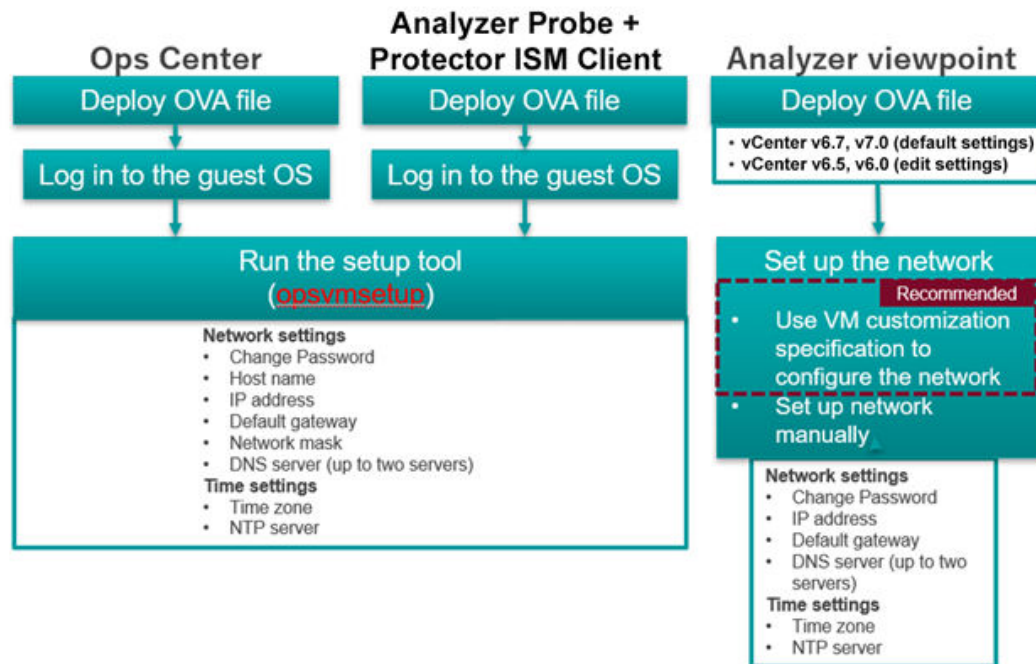
See the *Ops Center Administrator Getting Started Guide* at https://docs.hitachivantara.com/r/en-us/ops-center-administrator/11.0.x/mk-99adm000 for information about Hitachi Ops Center system requirements.

Hitachi Remote Ops

The Hitachi Remote Ops Monitor Agent application is a Java application that runs on a customer supplied host platform (Windows, Linux, or virtual instance of one of these operating systems). The application monitors the devices on the customer's network that it is configured to monitor and will report the status of the device to the Hitachi Remote Ops Center at Hitachi Vantara by an HTTPS session through the public Internet. The data reflecting the status is sent to the Hitachi Remote Ops Center immediately if a potential error condition is detected and the status and configuration information (microcode version, type of HDDs installed, etc.) will be sent on a daily basis even if no error condition exists.

Hitachi Remote Ops prerequisites

Verify the following:

- The minimum version of Hitachi Remote Ops is 9.5.

- A Linux x86_64 or Windows host platform is available for running the Hitachi Remote Ops Monitor Agent.

- There is a TCP/IP LAN connection between Hitachi Remote Ops and the monitored hardware.

For installing and configuring Hitachi remote ops, see the *Remote Ops Monitor Agent Installation Guide* at https://docs.hitachivantara.com/r/en-us/remote-ops/9.7/mk-24hrop001.

> 📄 **Note:** Only registered users can access this content.

Summary

With UCP CI, you have the flexibility to design the right-sized solution. Modernizing legacy systems with UCP CI also means the ability to leverage a Converged Platform that is designed and tested to expand as your business needs grow. Build your technology foundation with either external storage, hyperconverged infrastructure, multiple choices of hypervisors, or integrated VMware Cloud Foundation, without being locked into a singular storage architecture.

Hitachi Unified Compute Platform Advisor (UCP Advisor) reduces management complexity with a unified management tool for the full-stack infrastructure, including compute, networking, and storage. This fourth generation management software accelerates application deployment and drastically simplifies converged and hyperconverged infrastructure deployment, configuration, lifecycle management, and ongoing operations with advanced policy-based automation and orchestration for private and hybrid cloud environments.

Never again be subjected to dealing with multiple vendors while you struggle with sub-par performance or downtime — or just trying to schedule upgrades. Trust a one-stop converged solution to eliminate multiple contracts, streamline operations, and eventually deliver peace of mind. Experience the power of one with a single partner, and a single contract for the entire stack of compute, networking switch, storage, and management software.

Hitachi Vantara