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Deploy Hitachi Unified Compute Platform Select for VMware vSphere with Cisco Unified Computing System Mini Using Hitachi Virtual Storage Platform G800

TECHNICAL PAPER

Reference Architecture Guide

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Hitachi Data Systems

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Deploy Hitachi Unified Compute Platform Select for VMware vSphere with Cisco Unified Computing System Mini Using Hitachi Virtual Storage Platform G800

Reference Architecture Guide

This reference architecture guide describes deploying Hitachi Unified Compute Platform Select for VMware vSphere with Cisco Unified Computing System Mini (UCP Select for VMware vSphere with Cisco UCS Mini) using Hitachi Virtual Storage Platform G800 (VSP G800) storage. This paper describes how to build a virtual infrastructure with the following primary design goals:

- Availability
- Scalability
- Elasticity
- Manageability

The benefits of this solution include the following:

- Faster deployment
- Reduced risk
- Predictability
- Ability to scale out
- Lower cost of ownership

Hitachi Unified Compute Platform offers a converged infrastructure (CI), combining resources, servers, storage, networking, virtualization, and software management. UCP Select for VMware vSphere with Cisco UCS Mini is an offering that combines Hitachi storage with Cisco UCS servers and networking as a Cisco Validated Design (CVD), and it is pre-validated with VMware vSphere.

This reference architecture guide focuses on designing a virtual infrastructure capable of hosting virtual machines running general server application workloads. It is strongly recommended that you run a server capacity-planning pilot to gather sizing and IOPS information before designing your environment.

You need familiarity with the use and configuration of the following to use this reference architecture guide:

- Hitachi Virtual Storage Platform G800
- Cisco Unified Computing System Mini – Servers and Fabric Interconnects
- Cisco Nexus Switches
- Hitachi Storage Virtualization Operating System (SVOS)
- VMware vSphere 6
- Cisco Unified Compute Systems Director 5.5

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.

Solution Overview

This reference architecture for Hitachi Unified Compute Platform Select for VMware vSphere with Cisco Unified Computing System Mini creates a flexible end-to-end converged stack solution.

This is a data center architecture that integrates computing, networking and storage resources and it is managed through a single software application. It facilitates managing all of the infrastructure resources from a single user friendly UI. Cisco UCS Director is used to manage all devices.

This architecture uses following components to create Hitachi Unified Compute Platform Select for VMware vSphere with Cisco Unified Computing System Mini using Hitachi Virtual Storage Platform G800:

- **Hitachi Virtual Storage Platform G800** — The Hitachi Virtual Storage Platform (VSP) family of flash-accelerated storage systems offers the ultimate performance in enterprise storage technology, and the industry's only 100% data availability guarantee.
- **Hitachi Storage Virtualization Operating System** — The VSP family systems, based on Storage Virtualization Operating System, provide a uniquely scalable software-defined storage foundation that unlocks IT agility and enables the lowest storage total cost of ownership (TCO).
- **Cisco UCS Mini** — The Cisco Unified Computing System Mini (UCS) is a next-generation data center platform that unites compute, network, storage access, and virtualization into a cohesive system designed to reduce total cost of ownership and increase business agility. It is the ideal solution for customers who need fewer servers but still want the comprehensive management capabilities provided by Cisco UCS Manager.
- **Cisco Nexus 5548UP Unified Switch** — The Cisco Nexus 5548UP switch delivers innovative architectural flexibility, infrastructure simplicity, and business agility, with support for networking standards. For traditional, virtualized, unified, and high-performance computing (HPC) environments, it offers a long list of IT and business advantages. It consolidates LAN and storage traffic to Hitachi Virtual Storage Platform G800. Use of the Cisco Nexus switch is optional; users can use their existing network infrastructure.
- **VMware vSphere 6** —VMware vSphere 6 is an enterprise-class hypervisor for deploying and serving virtual computers. ESXi includes and integrates vital OS components, such as a kernel. It is a virtualization technology providing the infrastructure for the data center.
- **Cisco UCS Director 5.5**— Cisco UCS Director is a powerful tool for managing all infrastructures efficiently. Apart from provisioning, the automation feature of UCS Director also has extensive management, monitoring, and self-service provisioning of physical and virtual servers. It improves consistency, efficiency, and speed within your organization. It accomplishes this by replacing time-consuming manual provisioning and de-provisioning of data center resources with automated workflows.

The Hitachi Virtual Storage Platform G800 may be substituted with other models of the Hitachi Virtual Storage Platform family: This document supports use of VSP G200, VSP G400, and VSP G600.

Figure 1 illustrates the high-level logical design of this reference architecture.

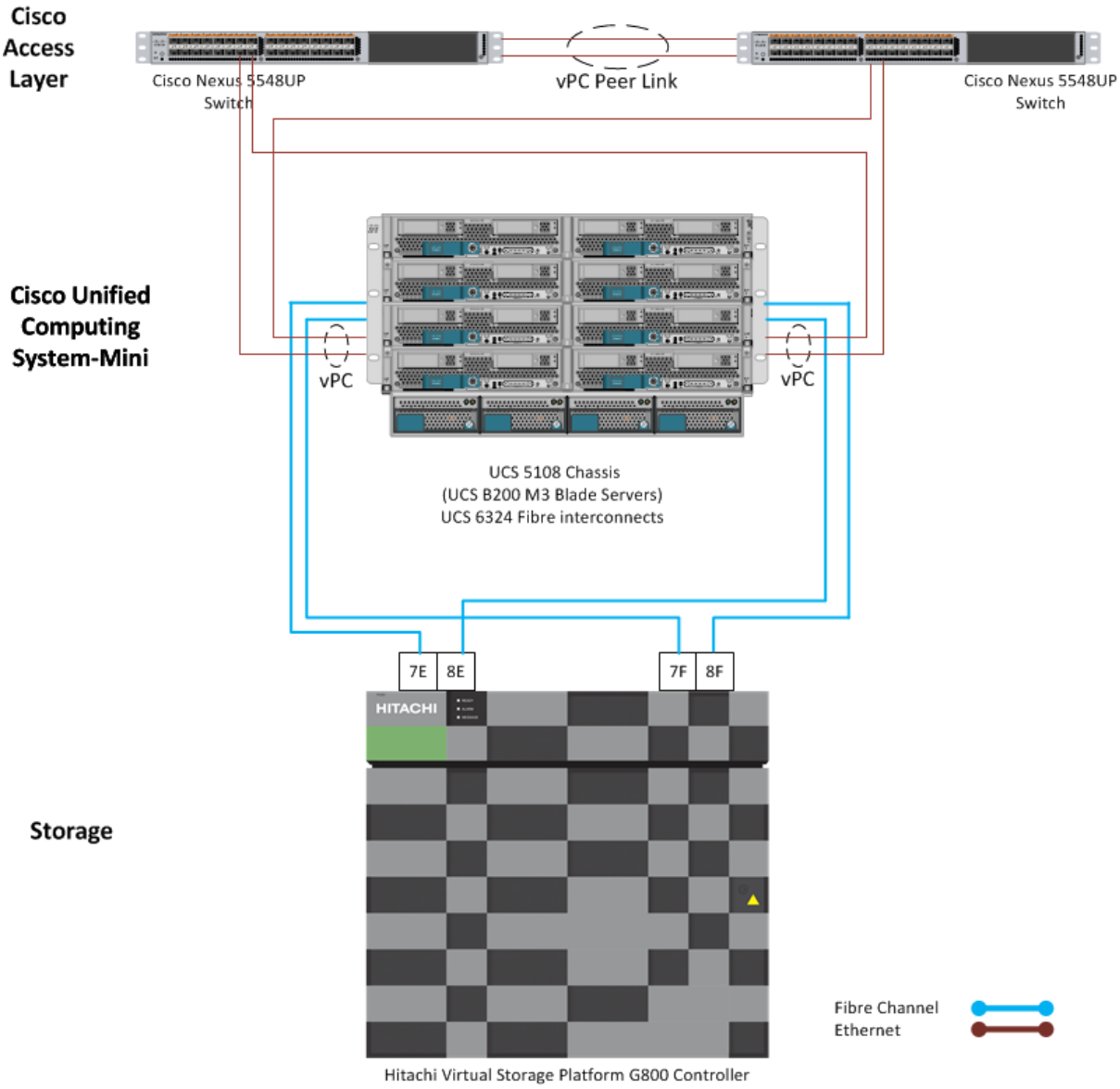

Figure 1

Key Solution Components

These are the key hardware and software components used to deploy this reference architecture on Hitachi Unified Compute Platform for VMware vSphere with Cisco Unified Computing System Mini using Hitachi Virtual Storage Platform G800.

Hardware Components

Table 1 lists detailed information about the hardware components needed for this solution.

Table 1. Hardware Components

Hardware	Description	Version
Hitachi Virtual Storage Platform G800	■ Dual controller ■ 16 × 8 Gb/sec Fibre Channel Ports ■ 256 GB total cache ■ 192 × 1.8 TB 10k RPM SAS disks, 2.5 inch SFF	83-04-01-60/00

Cisco Unified Computing System Mini	■ Cisco UCS 5108 Chassis
	  ■ 8-blade chassis
	  ■ 4 Power supply modules
	■ Cisco UCS B200 M3 Blade Servers
	  ■ 2 × 8 core Intel Xeon E5-2609 processor, 2.50 GHz
	  ■ 32 GB RAM using 4 × 8 GB DIMMS
	  ■ Cisco UCS 1240 Virtual interface card
	■ Cisco UCS 6324 Fabric Interconnect
	  ■ 2 × 6324 Fabric Interconnects
	  ■ 2 × 4 Unified Ports, Total 8 ports
		6324 : 5.0(30) N2 (3.11e)

Cisco Nexus 5548UP switch	■ 32 Unified Ports	6.0(2)N1(2)

Hitachi Virtual Storage Platform G800

Hitachi Virtual Storage Platform G800 provides an always-available, agile, and automated foundation that you need for a continuous-cloud infrastructure. This delivers enterprise-ready software-defined storage, advanced global storage virtualization and powerful storage.

VSP G800 is active-active, for zero downtime, zero recovery time and no data loss. VSP G800 now offers the best hybrid flash promotion using Hitachi Dynamic Tiering active flash, and industry-leading storage virtualization support for over 100 storage systems. Supporting always-on operations, Virtual Storage Platform G800 includes self-service, non-disruptive migration and active-active storage clustering for zero recovery time objectives. Automate your operations with self-optimizing, policy-driven management.

Cisco Unified Computing System Mini

Cisco Unified Computing System Mini unites compute, network, storage access, and virtualization into a cohesive system designed to reduce total cost of ownership and increase business agility. It integrates low-latency, lossless 10 Gigabit Ethernet unified network fabric with enterprise-class x86-architecture servers. Cisco UCS Mini brings all the power of the UCS solution at a price point and scale for smaller use cases. It is suitable for branch and remote offices, point-of-sale locations, and smaller IT environments.

Cisco Unified Computing System Mini consists of the following components:

- Cisco Unified Computing System 6324 Fabric Interconnect

  This is a family of line-rate, low-latency, lossless, 10 Gb/sec Ethernet and Fibre Channel over Ethernet interconnect switches. They provide the management and communication backbone for Unified Computing System Mini. This supports VM-FEX technology.

- Cisco UCS 5100 Series Blade Server Chassis

  This supports up to eight blade servers and up to two fabric extenders in a six rack unit enclosure.

- Cisco UCS Manager

  This provides unified, embedded management of all software and hardware components in the Cisco UCS.

Cisco Nexus 5500 Series Switch

The Cisco Nexus 5000 series switch enables consistent low-latency Ethernet solutions. It supports front-to-back or back-to-front cooling. The data ports are in the rear, bringing switching into close proximity with servers making cable runs short and simple. The switch series is highly serviceable, with redundant, hot-pluggable power supplies and fan modules. It uses data center-class Cisco NX-OS software for high reliability and ease of management.

The Cisco Nexus 5548UP is a 1RU 10 Gigabit Ethernet, Fibre Channel, and FCoE switch offering up to 960 Gb/sec of throughput and up to 48 ports. The switch has 32 unified ports and one expansion slot that supports modules with 10 Gigabit Ethernet and FCoE ports, and it connects to Fibre Channel SANs with 8/4/2/1 Gb/sec Fibre Channel switch ports, or both.

This solution uses two Cisco Nexus 5548 switches. Users may choose to use the existing network infrastructure. This existing switch infrastructure must be connected to both UCS 6324 Fabric Interconnects and must also provide a path connecting the two Fabric Interconnects for all VLANs uplinked from the Fabric Interconnects

Cisco UCS Director

- This is used to manage all devices and infrastructure once the devices are discovered in the Director. UCSD allows users to manage and configure devices and also provides workflows to streamline IT operations.

Software Components

Table 2 lists detailed information about the software components used in this solution.

Table 2. Software Components

Software	Version
Hitachi Storage Virtualization Operating System	80-01-24/00or later
VMware vSphere	6
Cisco Nexus 1000v Series Switch (optional-distributed virtual switch)	1000v: 4.2(1)SV2(2.2)
VM-FEX technology (distributed virtual switch)	cisco-vem-v161-5.5-1.2.7.1
Nexus Operating System	7.0(2)N1(1)
Cisco UCS Manager	3.11e
Cisco UCS Director	5.5
VMware vCenter	6
Hitachi Storage Plug-in for VMware vCenter	2.6.0
Hitachi Storage Provider for VMware vCenter	3.2.1
Hitachi Storage Connector for Cisco UCS Director	2.0.0

Hitachi Storage Virtualization Operating System

Hitachi Storage Virtualization Operating System delivers the storage return on investment, security and quality of service to applications that companies require to thrive in today's information economy. It is the standard operating system for Virtual Storage Platform G series and VSP F series systems.

SVOS is an integrated software system that brings forth the heritage of the unique embedded virtualization capabilities of Hitachi Virtual Storage Platform and provides the foundation for global storage virtualization.

It delivers software-defined storage by abstracting and managing heterogeneous storage to provide a unified virtual storage layer, resource pooling, and automation. And SVOS performs these tasks at enterprise scale with enterprise performance and reliability.

Cisco VM-FEX

Cisco VM-FEX technology collapses virtual switching infrastructure and physical switching infrastructure into a single, easy-to-manage environment. Its benefits include the following:

- Simplified operations: Eliminates the need for a separate, virtual networking infrastructure
- Improved network security: Contains VLAN proliferation
- Optimized network utilization: Reduces broadcast domains
- Enhanced application performance: Offloads virtual machine switching from host CPU to parent switch application-specific integrated circuits (ASICs)

VM-FEX is supported on Red Hat Kernel-based Virtual Machine (KVM) and VMware ESX hypervisors. Live migration and vMotion are also supported with VM-FEX.

Cisco UCS Manager

Cisco UCS Manager provides unified, centralized, embedded management of all Cisco Unified Computing System software and hardware components across multiple chassis and thousands of virtual machines. Use this software to manage the entire Cisco UCS as a single logical entity through a graphical user interface, a command-line interface, or an XML API.

The Cisco UCS Manager resides on a pair of Cisco UCS 6200 series Fabric Interconnects using a clustered, active-standby configuration for high availability. The software provides a single interface for performing server provisioning, device discovery, inventory, configuration, diagnostics, monitoring, fault detection, auditing, and statistics collection. Cisco UCS Manager service profiles and templates support versatile role- and policy-based management. System configuration information can be exported to configuration management databases to facilitate processes based on IT Infrastructure Library concepts.

Service profiles let you treat Cisco UCS servers as raw computing capacity to be allocated and reallocated as needed. The profiles define server I/O properties and are stored in the Cisco UCS 6200 series Fabric Interconnects. Using service profiles, you can provision infrastructure resources in minutes instead of days, creating a more dynamic environment and more efficient use of server capacity.

Cisco UCS Director

Cisco UCS Director is a unified management solution that enhances the value of shared infrastructure solutions, which bring together compute, network, and storage resources. Together, Cisco UCS Director and shared infrastructures improve IT agility, protect investments, simplify deployment of new services, and optimize asset use.

Cisco UCS Director lets you establish automation at the core of IT. And you can use it with other Cisco solutions to extend automation further so that you can convert many more offerings into orderable automated services. It provides in-build workflows to accomplish tasks across all devices, which can be automated as well. Multi-vendor devices are supported. In this setup, Cisco UCS Director is used to manage the devices.

Initial configuration is necessary before devices can be managed by UCS Director.

Storage parity groups first need to be created using Storage Navigator. Later, configuration can be performed using UCS Director (pool, LDEV, Hostgroup creation).

VMware vSphere 6

VMware vSphere 6 is a virtualization platform that provides a data center infrastructure. It features vSphere Distributed Resource Scheduler (DRS), high availability, and fault tolerance.

VMware vSphere 6 has the following components:

- **ESXi 6** — This is a hypervisor that loads directly on a physical server. It partitions one physical machine into many virtual machines that share hardware resources.
- **vCenter Server 6** — This allows management of the vSphere environment through a single user interface. With vCenter, there are features available such as vMotion, Storage vMotion, Storage Distributed Resource Scheduler, High Availability, and Fault Tolerance.
- **vSphere web client** — Provides the simplest way to manage your ESXi host and operate its virtual machines. vSphere Web Client can be used to connect to and operate vCenter Server using a Web browser.

VMware vCenter Server

Use VMware vCenter Server to manage VMware vSphere. It provides advanced data management that improves storage operations, provisioning, optimization, and resilience for Hitachi storage environments. There is unified management of all hosts and virtual machines from a single console, aggregating performance monitoring of clusters, hosts, and virtual machines.

VMware vCenter Server gives you insight into the status and configuration of clusters, hosts, virtual machines, storage, guest operating systems, and other critical components of a virtual infrastructure. Using VMware vCenter Server, you can manage 100 or more virtualization environment workloads, more than doubling typical productivity in managing physical infrastructure. vSphere Web Client is used to manage all the ESX hosts and virtual machines.

Hitachi Storage Plug-in for VMware vCenter

Hitachi Storage Plug-in for VMware vCenter provides a scalable and extensible platform that forms the foundation for virtualization management. It centrally manages VMware vSphere environments, allowing you improved control over the virtual environment.

Storage Plug-in for VMware vCenter connects to VMware vCenter Server. It associates the Hitachi storage system information with VMware ESX datastore and virtual machine information.

Hitachi Storage Provider for VMware vCenter is a VMware vCenter 6 plug-in that provides integrated information of physical storage resources. The information is based on topology, capability, and state. This information is then used by VMware vSphere for various features, including VMware Storage Distributed Resource Scheduler (SDRS) and profile-based storage.

Storage Provider for VMware vCenter enables coordination between vSphere and vCenter with the storage system. It provides built-in storage insight in vCenter to support intelligent virtual machine storage provisioning, bolster storage troubleshooting, and enable new SDRS-related use cases for storage.

Hitachi Storage Connector for Cisco UCS Director

Hitachi Storage Connector for Cisco UCS Director makes it easy to add, manage and leverage the ingenuity and quality of best-in-class Hitachi storage platforms within UCS ecosystems. This solution incorporates a pre-certified, fully integrated adapter for UCS Director that optimizes virtualization, simplifies operations, and extends the value of Hitachi storage assets.

Solution Design

This is the detailed design for the reference architecture with Hitachi Unified Compute Platform Select for VMware vSphere with Cisco Unified Computing System Mini using Hitachi Virtual Storage Platform G800. It includes software and hardware design information required to build the basic infrastructure for the virtualized data center environment.

This solutions architecture includes the following:

- Two Cisco UCS 6324UP Fabric Interconnects built into UCS-mini chassis
- One Cisco UCS 5108 chassis with 8 Half Blade B200 M3 servers
- One Hitachi VSP G800
- Two Cisco Nexus 5548 switches (optional)

To provide you with options for setting up your environment, this solution uses a cell component architecture. It has cell components with pre-defined elements necessary to configure, size, and plan your implementation of this solution. These cell components provide the following:

- **Infrastructure cell for compute resources** - Foundation for compute components
- **Infrastructure cell for storage resources** - Foundation for storage components
- **Application cell for Hitachi Unified Compute Platform Select management**- Resource to manage this environment
  - This cell is required only if an existing resource for managing a VMware vSphere environment does not exist.
- **Application cell for VMware vSphere** - Resource for hosting virtual machines running general server application workloads.
- **Expansion cell for compute resources** - Compute resources for scaling out the Unified Compute Platform Select for VMware vSphere environment.
- **Expansion cell for storage resources** - Storage resources for scaling out the Unified Compute Platform Select for VMware vSphere environment.

Each cell defines the compute, network, and storage resources necessary to support a specific workload. Solutions can be designed, and planned using pre-defined cell components, with each cell designed for a different function.

Designing with cells offers a more efficient, flexible, and granular approach to sizing and scaling converged solutions than the more common uniform building blocks.

This design defines compute and storage resource groups to support a specific usage scenario.

Figure 2 illustrates a high-level concept of the cell architecture. Note that the vCPU, vRAM, and capacity numbers are for illustration only. Your solution may be different.

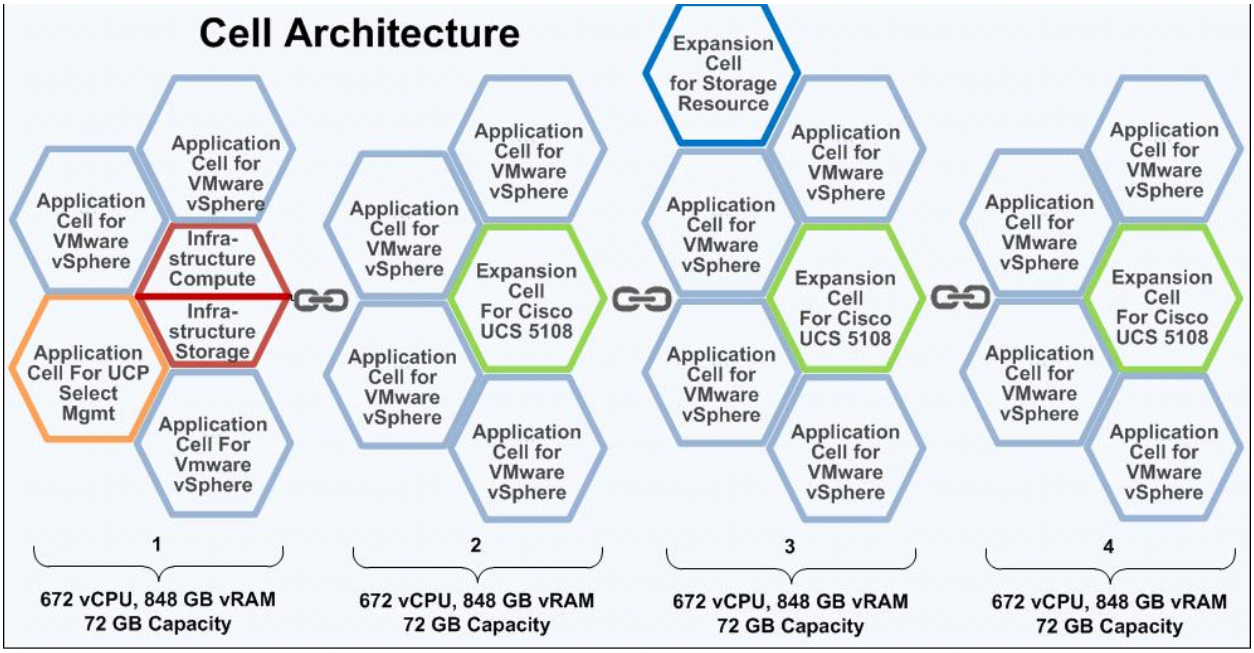

Figure 2

Infrastructure Cell for Compute Resources

The infrastructure cell for compute resources provides the foundation for the compute components needed to start building this solution.

Figure 3 shows the infrastructure cell for compute resources.

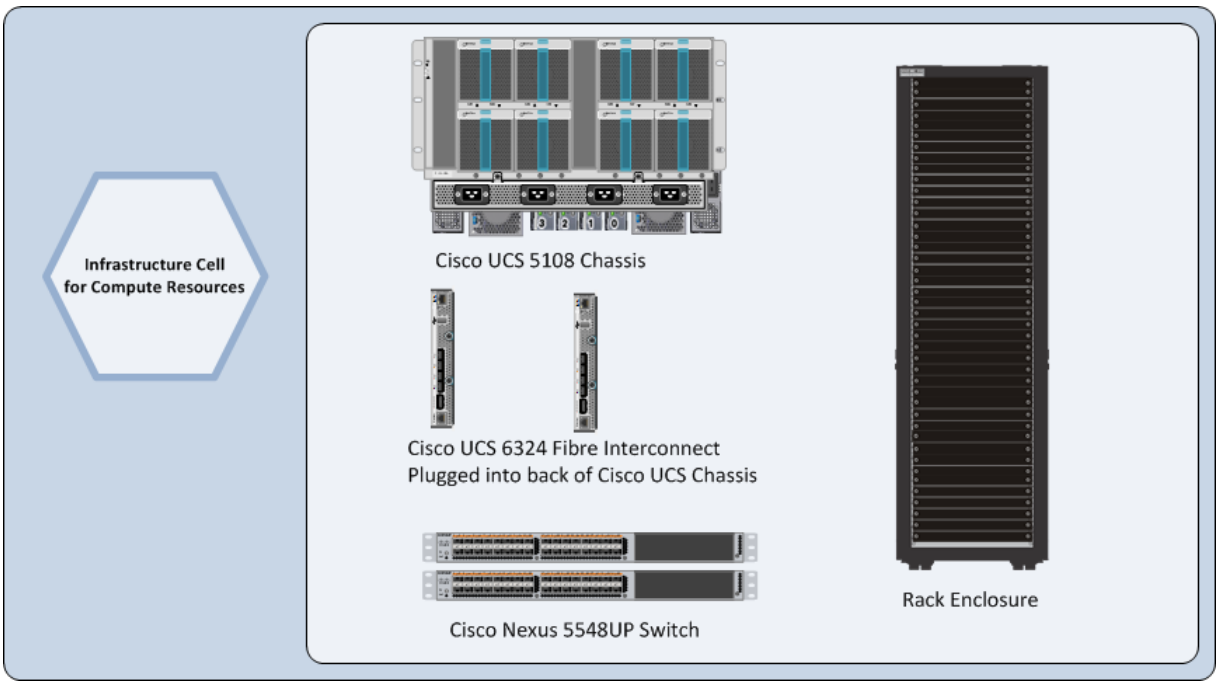

Figure 3

Use the infrastructure cell for compute resources in conjunction with the following cells:

- Infrastructure cell for storage resources
- Application cell for Hitachi Unified Compute Platform Select management
- Application cell for VMware vSphere
- Expansion cell for compute resources

The infrastructure cell for compute resources and the infrastructure cell for storage resources are the core infrastructure cells required to build solution. Every infrastructure cell for compute resources requires one infrastructure cell for storage resources.

Table 3. Hardware Components for the Infrastructure Cell for Compute Resources

Hardware	Description	Version	Quantity
Cisco Unified Computing System Mini	Cisco UCS 5108 chassis ■ 8-blade chassis ■ 8 cooling fan modules ■ 4 power supply modules ■ Cisco UCS 6324 Fabric Interconnect ■ 4 unified ports	FI 6324 : 5.0(30)N2 (3.11e)	1
Cisco Nexus 5548UP switch	■ 32 unified ports	6.0(2)N1(2)	2

The hardware in the infrastructure cell for compute resources makes up the core compute hardware in this solution for Unified Compute Platform Select for VMware vSphere with Cisco UCS Mini.

Chassis Components

The Cisco UCS 5108 blade chassis has the following:

- Redundant management modules to provide high availability access to manage and monitor the chassis, switch modules, and server blades
- Redundant switch modules for high availability and maximum throughput
- Hot-swappable power and fan modules allow for non-disruptive maintenance
- Cisco UCS 5108 chassis houses two Cisco 6324 Fabric Interconnects

Network Infrastructure

The network design used in this solution provides ample bandwidth and redundancy for the following:

- A fully populated infrastructure cell for compute resources
- An infrastructure cell for storage resources

Figure 4 shows the physical network configuration of the infrastructure cell for compute resources.

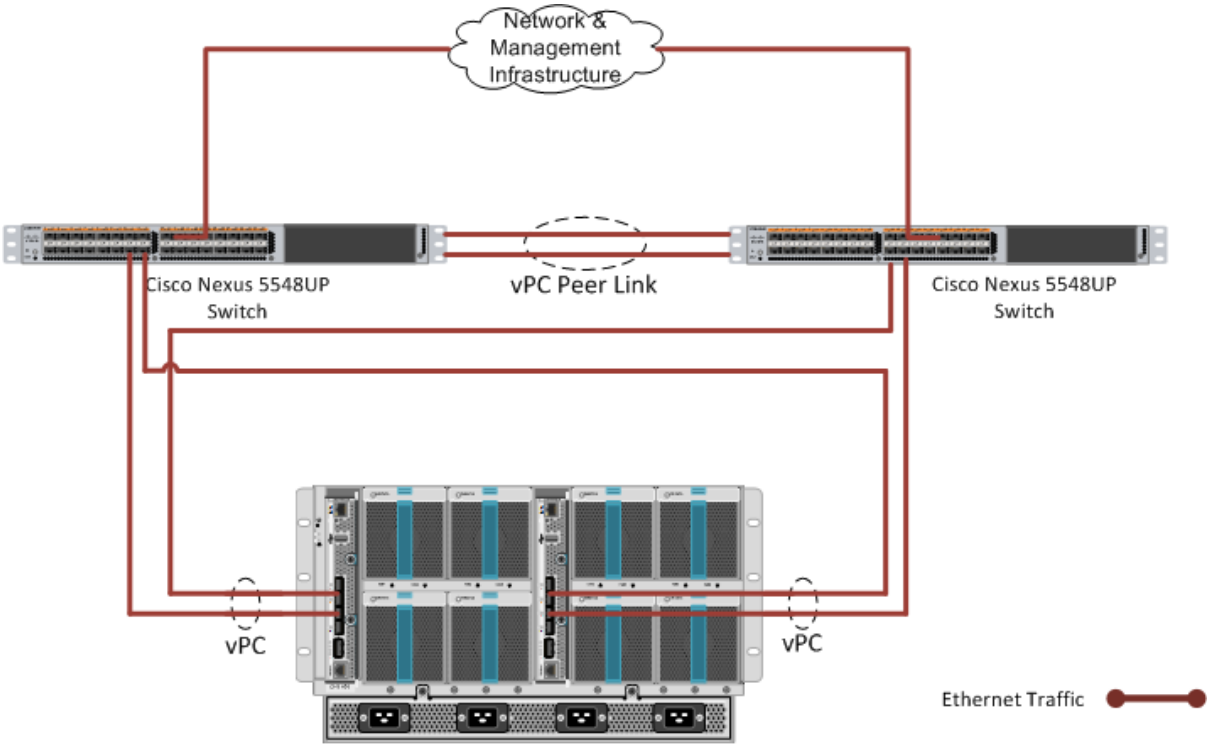

Figure 4

The network design also allows for the utilization of advanced features inherent in the Nexus 5500UP switch family and the Cisco 6324 Fabric Interconnects, such as Unified Switching Technology from Cisco that help provide the following:

- Nonstop networking
- Simplified, automated networks
- An evolutionary approach that protects existing IT investments

See the Cisco website for more information about the Cisco Nexus switch family and Cisco Fabric Interconnect switches.

SAN Infrastructure

The Cisco UCS Mini supports directly attaching storage to the Cisco UCS 6324 Fabric Interconnect. This removes the requirement to have a dedicated Fibre Channel switching environment as all SAN switching and zoning are performed by the Cisco UCS 6324 Fabric Interconnect and managed through the Cisco UCS Director.

The Hitachi Virtual Storage Platform G800 controller used for this solution has 4 ports for connections. For this reference architecture, storage is directly attached to the Cisco Fiber Interconnect 6324 residing in Cisco UCS chassis. Two Storage ports are used for providing SAN boot LUNs for 8 blades. The other two ports are used as data LUNs. This solution supports only Fibre Channel access to storage. Scalability is achieved by adding storage capacity (disk/shelves) to an existing HA pair.

Figure 5 illustrates the physical SAN architecture of the infrastructure cell for storage.

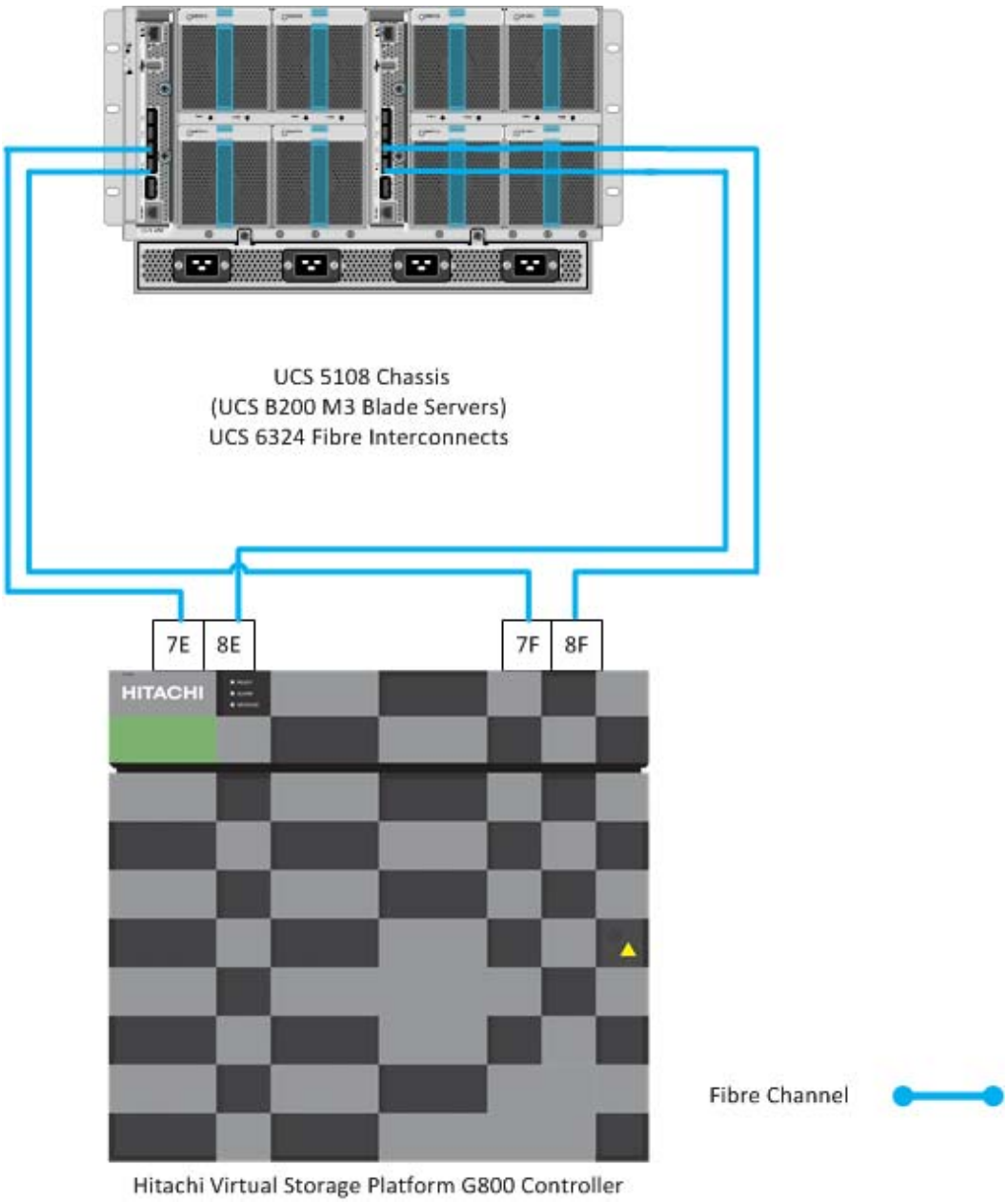

Figure 5

Infrastructure Cell for Storage Resources

The infrastructure cell for storage resources contains all of the base storage hardware required to start building this solution.

Figure 6 shows the infrastructure cell for storage resources.

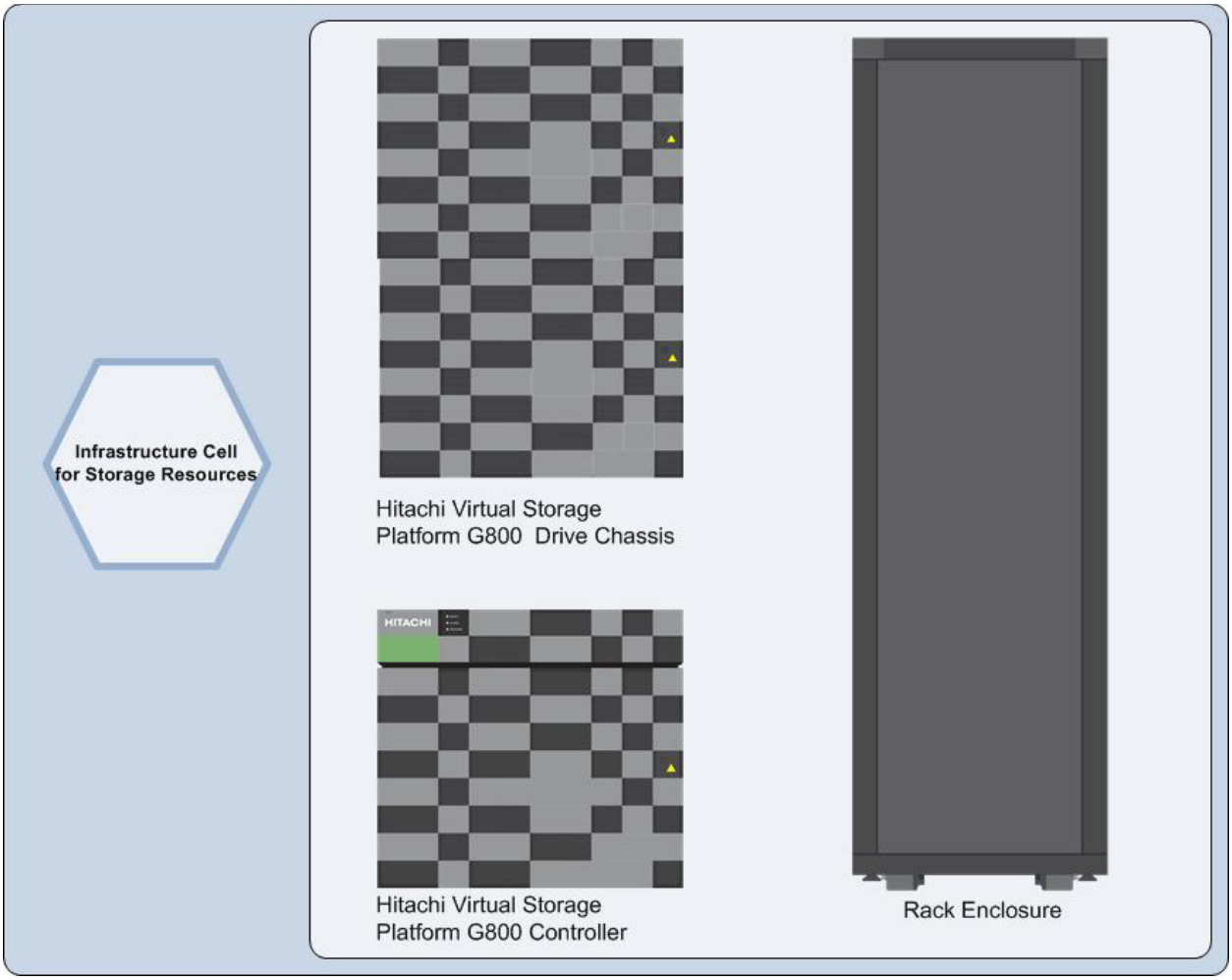

Figure 6

Use an infrastructure cell for storage resources in conjunction with the following cells:

- Infrastructure cell for compute resources
- Application cell for Hitachi Unified Compute Platform Select management
- Application cell for VMware vSphere

The infrastructure cell for storage resources provides the storage infrastructure for the other cells in the solution. Once an infrastructure cell for storage resources is fully populated, add additional infrastructure cells for storage resources to scale out the solution.

Table 4 shows the hardware components of the infrastructure cell for storage.

Table 4. Infrastructure Cell for Storage Resources Hardware

Hardware	Description	Version	Quantity
Hitachi Virtual Storage Platform G800	■ Dual Controllers and Fibre Channel Modules ■ 16 × 8 GB/sec Fibre Channel Ports ■ 215 GB total cache	83-04-01-60/00	1
SFF disk drive chassis expansion for Hitachi Virtual Storage Platform G800	■ Contains disks for other cells		1

The infrastructure cell for storage resources contains a Hitachi Virtual Storage Platform G800 controller and a disk drive chassis. This disk drive chassis holds disks for this infrastructure cell. Add storage disks to this cell for the following:

- Application cell for Hitachi Unified Compute Platform Select management
- Hot spares (optional)

Note — Scalability limits depend on application workloads running on this infrastructure.

Application Cell for Hitachi Unified Compute Platform Select Management

The application cell for Hitachi Unified Compute Platform Select management contains the compute and storage components for hosting the VMware vSphere infrastructure services as well as Hitachi Command Suite shared management framework for advanced data management.

Note — This cell is required only if an existing configuration for managing a VMware vSphere environment or a configuration for managing Hitachi Command Suite does not exist.

Figure 7 shows the application cell for UCP Select management.

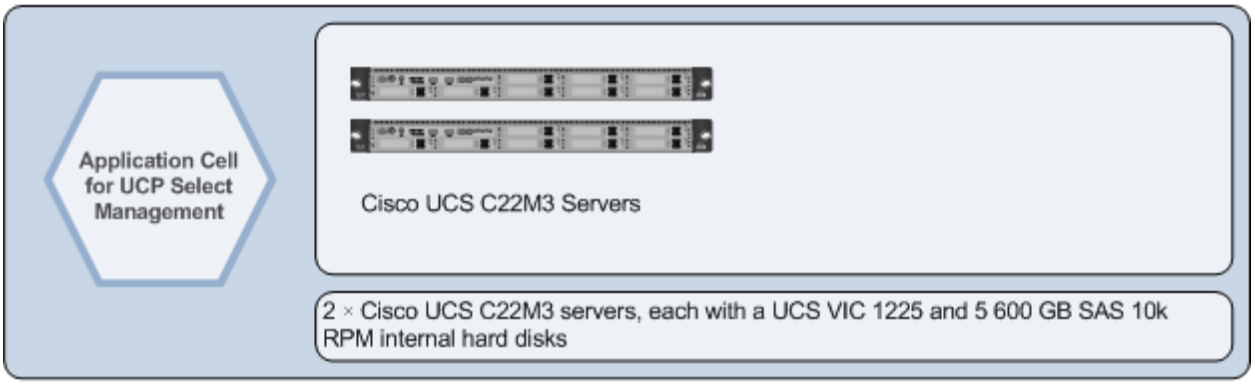

Figure 7

Note — Scalability limits depend on application workloads running on this infrastructure.

Compute Infrastructure

The application cell for Hitachi Unified Compute Platform Select management provides enough capacity to support an emergency high availability event if one single server fails. Use VMware High Availability and VMware Distributed Resource Scheduler to configure a cluster dedicated to the application cell for Unified Compute Platform Select management to ensure virtual machine failover in the event of a hardware failure.

Table 5 shows the details of the hardware configuration in the application cell for Unified Compute Platform Select management.

Table 5. Application Cell for Unified Compute Platform Select Management Hardware

Hardware	Description	Version	Quantity
Cisco UCS C22 M3 rack mounted Servers	■ 2 × 8 core Intel Xeon E5-2450 processors, 2.10 GHz ■ 64 GB RAM	C22M3: 2.0.9c	2
SFF Disk Drives (Internal)	■ 600 GB 10k RPM SAS drives in a RAID10 (2D+2D) configuration		4
	■ Hot Spare		1

The compute infrastructure of the application cell for UCP Select management supports all associated Hitachi Command Suite, Microsoft® SQL Server®, Microsoft Active Directory®, and VMware vCenter and their associated requirements.

Manage your environment using the resources in this section or by connecting to a preexisting VMware vSphere and Hitachi Command Suite management environment.

Network Infrastructure

Configure each of the C22M3 servers with two NICs connected to the infrastructure network. All management and vMotion traffic flows over these NICs.

Optionally, with the release of the new UCS Manager 2.2(6c) these C22M3 servers can be directly connected to the Cisco UCS fabric without using Cisco UCS fabric extenders and can be configured for high availability. This means these C22M3 servers are no longer standalone, but are deployed in an integrated model and managed by Cisco UCS Manager.

Storage Infrastructure

The storage infrastructure of the application cell for Hitachi Unified Compute Platform Select management consists of five units of 600 GB 10k RPM SAS drives internal to each of the UCS C22M3 servers. Configure the storage into a single RAID-10 (2D+2D) group. The RAID group provides an overall capacity of 1.2 TB. Configure 1 unit of 600 GB 10k RPM SAS drives internal as a spare to protect against a single drive failure.

Optionally, the storage infrastructure may reside on one of the dynamic provisioning pools on Hitachi Virtual Storage Platform G800, and may be set up for SAN boot.

Server Configuration Sizing Guidelines

Apply the proper resource allocation for virtual machines used to manage the following:

- Hitachi Unified Compute Platform Select for VMware vSphere with Cisco Unified Computing System Mini using Hitachi Virtual Storage Platform G800
- Hitachi Command Suite shared management environment

If using a separate environment outside of this solution for management, use the virtual machine sizing recommendations in Table 6.This table lists the virtual machine configurations used for each component of the management infrastructure used in this reference architecture.

Table 6. Virtual Machine Sizing Recommendations

Virtual Machine Purpose	Configuration	Quantity
Microsoft® Active Directory®, DNS, DHCP	■ vCPU — 1 ■ vMemory — 4 GB	1
VMware vCenter	■ vCPU — 2 ■ vMemory — 8 GB	1
Microsoft SQL Server® 2008 database for VMware vCenter	■ vCPU — 2 ■ vMemory — 8 GB	1
Hitachi Tuning Manager v8.0	■ vCPU – 2 ■ vMemory – 8 GB	1
Cisco UCS Director v5.5	■ vCPU – 2 ■ vMemory – 8 GB	1
Hitachi Storage Connector for Cisco UCS Director	■ vCPU — 1 ■ vMemory — 4 GB	1
Hitachi Storage Provider for VMware vCenter (VASA Provider) v3.2.1	■ vCPU — 1 ■ vMemory — 4 GB	1

Application Cell for VMware vSphere

The application cell for VMware vSphere contains all of the compute and storage components necessary to run general server application workloads consisting of the following:

- 64 virtual CPUs (32 virtual CPUs per blade server)
- 64 GB of physical memory (32 GB of physical memory per blade server)
- 36 TB of storage capacity in dynamic provisioning pool (9 groups configured as RAID-6 (6D+2P) created from 72 × 900 GB 10k RPM SAS hard disk drives)

It is possible to overcommit resources to the virtual machines running under VMware vSphere and care should be taken to avoid any performance issues.

Figure 8 shows the application cell for VMware vSphere.

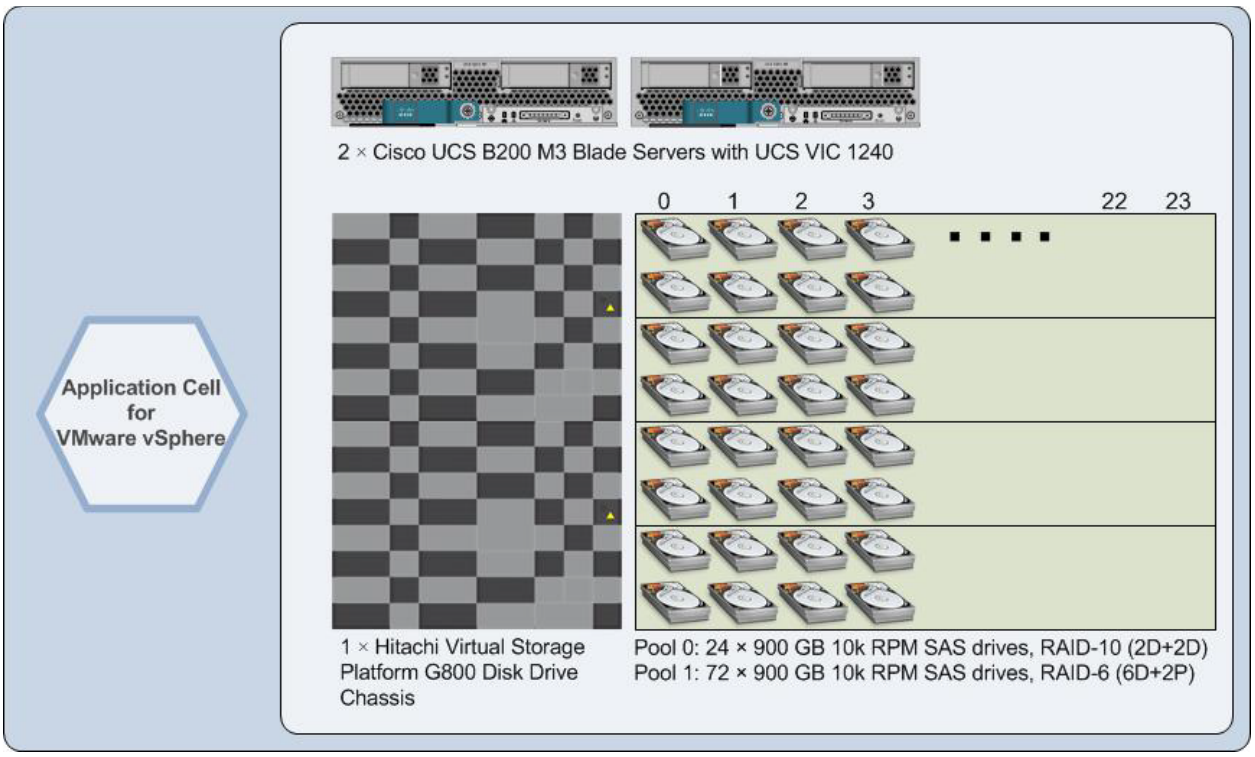

Figure 8

Use the application cell for VMware vSphere in conjunction with the following cells:

- Infrastructure cell for compute resources
- Infrastructure cell for storage resources
- Expansion cell for compute resources (used for scale-out)

To start building a scalable Unified Compute Platform Select for VMware vSphere with Cisco UCS using Hitachi Virtual Storage Platform G800 environment, do the following:

- Add the compute components of the application cell for VMware vSphere to the infrastructure cell for compute
- Add the storage components to the infrastructure cell for storage resources

Note — Scalability limits depend on application workloads running on this infrastructure.

Compute Infrastructure

The application cell for VMware vSphere supports a maximum density of 132 virtual CPUs and 128 GB of virtual machine memory.

It is possible to overcommit resources and increase these maximum density limits. However, in such a maximum density configuration, in case of a server blade failure, a cell cannot support the failover of virtual machines.

To provide high availability, do the following:

- Reduce the number of virtual CPUs and virtual machine memory per host up to 50%.
- Configure a VMware High Availability and VMware Distributed Resource Scheduler cluster dedicated to application cells for VMware vSphere.

Place additional hosts from each application cell for VMware vSphere into the cluster. When scaling the solution, increase the numbers of virtual machines per host as you add more resources to the cluster.

Based on VMware maximums, each High Availability and Distributed Resource Scheduler cluster can support up to 16 application cells for VMware vSphere (64 hosts).

Table 7 shows the details of the hardware used in the application cell for VMware vSphere.

Table 7. Application Cell for VMware vSphere Hardware

Hardware	Description	Version	Quantity
Cisco UCS B200 M3 blade servers	■ 2 × 8 core Intel Xeon E5-2650 processors, 2.0 GHz ■ 128 GB RAM ■ 1240 VIC	B200 M3: v2.2.(1d)	2
SFF disk drives ■ 900 GB 10k RPM ■ Installed in the infrastructure cell for storage resources disk drive chassis	■ RAID-6 (6D+2P)		72
	■ Hot spare		4
SFF disk drive chassis			1

Network Infrastructure

Configure each UCS VIC 1240 on board the B200M3 server blade to obtain two logical NICs per VIC 1240 port. Use Cisco UCS Manager to create a single service profile template that can be applied to each B200 M3 blade server.

The Cisco UCS VIC offers each virtual machine a virtual Ethernet interface (vNIC). This vNIC provides direct access to the Fabric Interconnects and Nexus 5500 series switches, where forwarding decisions can be made for each virtual machine using a VM-FEX interface.

Figure 9 illustrates the networking details for the Cisco UCS B200 M3 to the Cisco 6324 Fabric Interconnects.

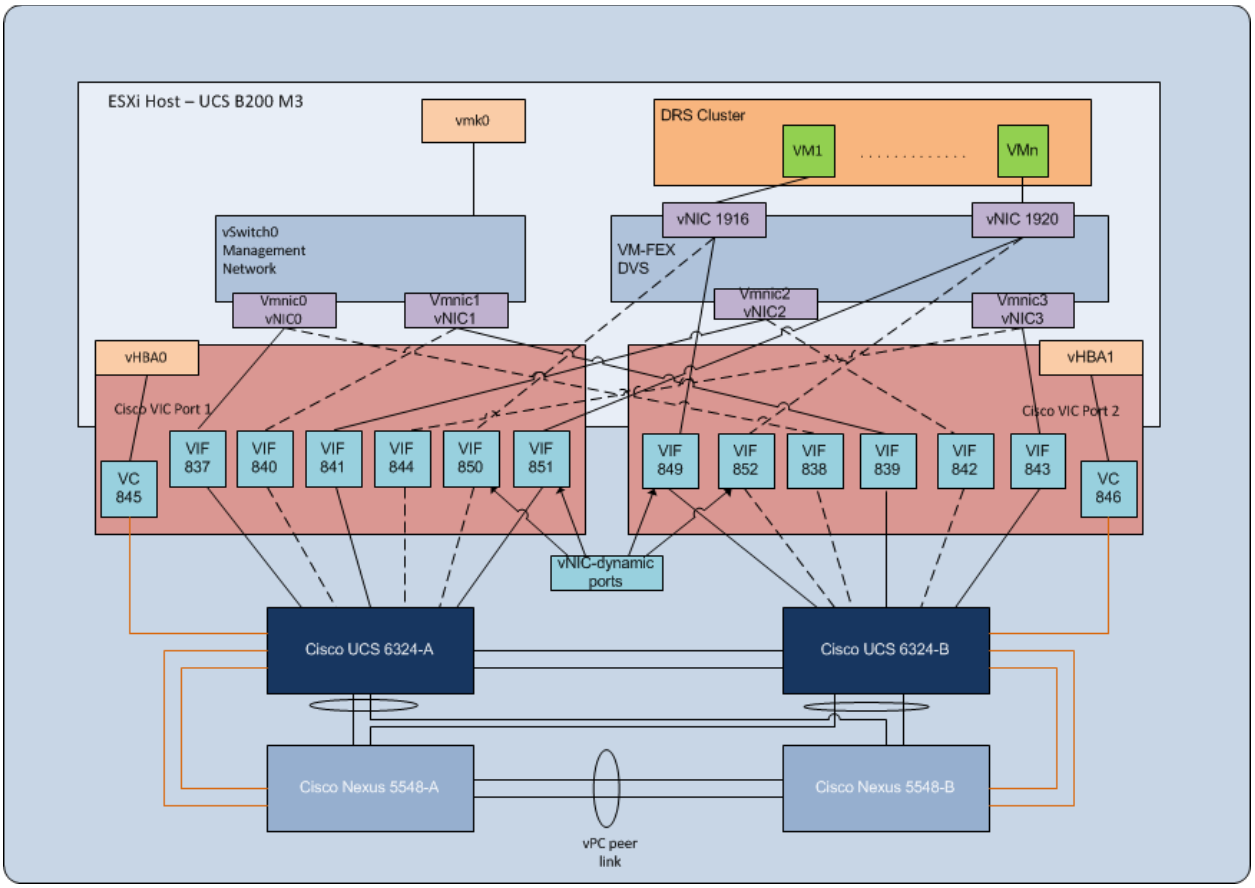

Figure 9

As shown in Figure 9, the path for a single virtual machine is fully redundant across the Cisco fabric. The virtual machine has an active virtual interface (VIF) and standby VIF defined on the adapter, and the adapter is dual-homed to Fabric A and Fabric B.

Combined with the Cisco UCS fabric failover, the VM-FEX solution provides fault tolerance and removes the need for software-based high availability teaming mechanisms. If the active uplink fails, the vNIC automatically fails over to the standby uplink and simultaneously updates the network through gratuitous ARP. In this figure, the active links are solid and the standby links are dashed.

Following best practice, separate the following traffic to achieve greater security and better performance as follows:

- **ESXi-Mgmt** — Chassis management connections and primary management of the ESXi hypervisors. Also used for Vmotion and the virtual machine network.

Storage Infrastructure

The storage infrastructure of the application cell for VMware vSphere consists of 72 units of 900 GB 10k RPM SAS drives in two dynamic provisioning pools with the following configuration:

- **Number of SFF Disk Drive Chassis**—1
- **Number of Hard Disk Drives**—120
- Hitachi Dynamic Provisioning (DP) **Pool 0**—24 drives consisting of 2 parity groups configured as RAID-10 (2D+2D)
- Hitachi Dynamic Provisioning (DP) **Pool 1**—72 drives consisting of 3 parity groups configured as RAID-6 (6D+2P)

Figure 10 shows the storage configuration for the application cell for VMware vSphere.

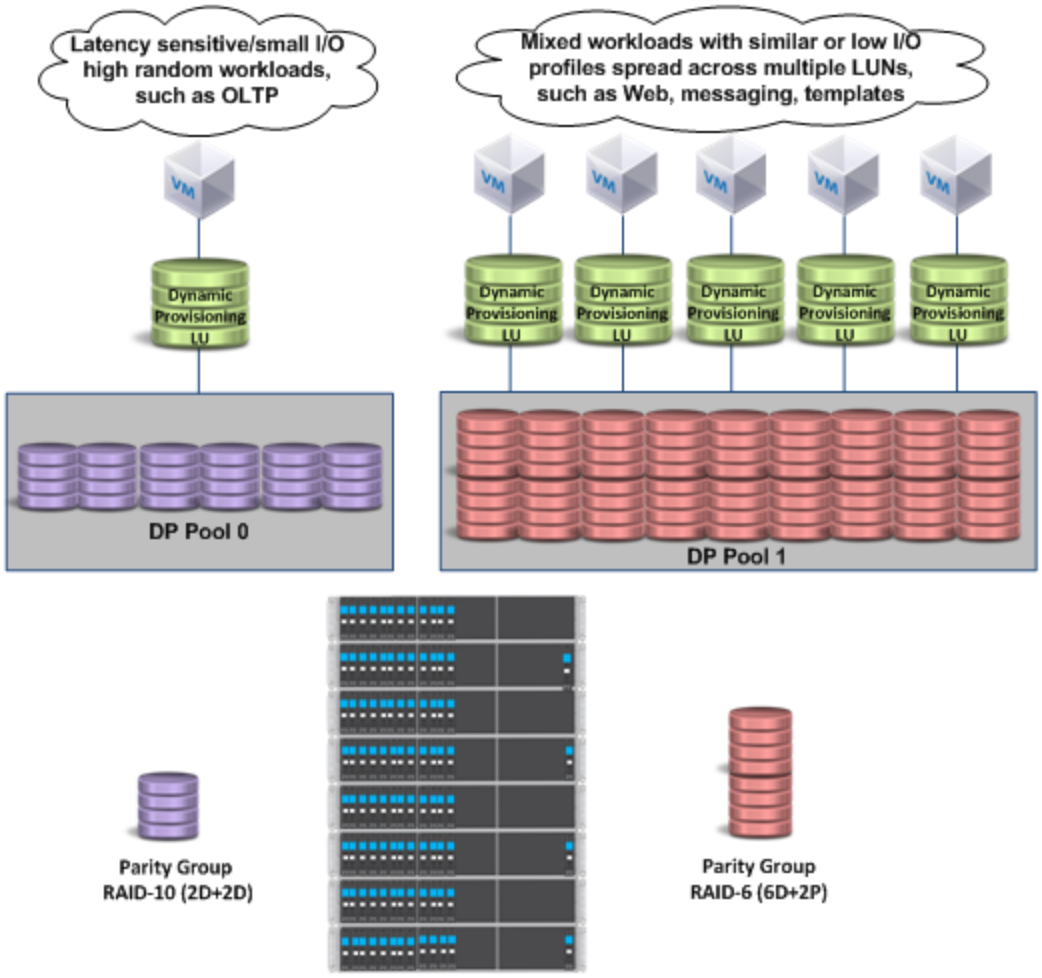

Figure 10

Use RAID-10 to maximize performance for random workloads, which is common with virtualized environments.

Use RAID-6 for balanced performance and efficient use of pool space. Hitachi Data Systems recommends RAID-6 when you need a guarantee against data loss and are following other associated recommendations.

Create two dynamic provisioning pools to separate virtual machine workloads with different performance characteristics.

Because of its wide striping capability, Hitachi Dynamic Provisioning can balance the I/O load in dynamic provisioning pools of RAID groups. Mixing workloads in a single dynamic provisioning pool is possible to obtain certain levels of performance. However, grouping virtual machines with similar I/O profiles optimizes storage performance, and results in more efficient use of disk resources. Within a Hitachi Dynamic Provisioning (DP) pool, create additional LUNs as necessary to spread the workload and avoid possible queue depth issues.

SAN Infrastructure

Use Cisco UCS Director to create a single service profile template that can be applied to each of the B200 M3 blade servers.

Configure each UCS VIC 1240 onboard the B200M3 server blade to obtain one logical HBA per VIC 1240 port.

The Cisco UCS virtual interface card (VIC) offers each virtual machine a virtual HBA interface, or vHBA. This vHBA provides direct access to the Fabric Interconnects where forwarding decisions can be made for each virtual machine using a VM-FEX interface.

This setup uses direct attach storage. Storage is directly connected to UCS blade chassis. The environment uses the Fibre Channel zoning feature provided by the Fabric Interconnects of the Cisco UCS 6324. This results in four paths that are available to each ESXi host providing the following:

- Resiliency to failure
- Redundant paths to the storage subsystem

The storage multipath policy for each target in ESXi was set to **round robin**. This results in optimal load distribution during an all-paths available situation.

Separate zones are created for SAN Boot configuration and data LUNs.

Table 8 shows the zone configuration used for the application cell for VMware vSphere.

Table 8. Application Cell for VMware vSphere Zone Configuration

Host	Host HBA Number	Fabric		Zone Name	Storage Port
UCSESX01	HBA1	Fabric A	Boot Zone	ucs_CSC-UCS-Mini-1_A_B_UCS_Mini_Blade1_fca1 vsan 10	7E
			Data Zone	ucs_CSC-UCS-Mini-1_A_D_UCS_Mini_Blade1_fca1 vsan 10	8E
	HBA2	Fabric B	Boot Zone	ucs_CSC-UCS-Mini-1_B_B_UCS_Mini_Blade1_fcb1 vsan 11	7F
			Data Zone	ucs_CSC-UCS-Mini-1_B_D_UCS_Mini_Blade1_fcb1 vsan 11	8F
UCSESX02	HBA1	Fabric A	Boot Zone	ucs_CSC-UCS-Mini-1_A_B_UCS_Mini_Blade2_fca1 vsan 10	7E
			Data Zone	ucs_CSC-UCS-Mini-1_A_D_UCS_Mini_Blade2_fca1 vsan 10	8E
	HBA2	Fabric B	Boot Zone	ucs_CSC-UCS-Mini-1_B_B_UCS_Mini_Blade2_fcb1 vsan 11	7F
			Data Zone	ucs_CSC-UCS-Mini-1_B_D_UCS_Mini_Blade2_fcb1 vsan 11	8F

Table 8. Application Cell for VMware vSphere Zone Configuration (Continued)

Host	Host HBA Number	Fabric		Zone Name	Storage Port
UCSESX03	HBA1	Fabric A	Boot Zone	ucs_CSC-UCS-Mini-1_A_B_UCS_Mini_Blade3_fca1 vsan 10	7E
			Data Zone	ucs_CSC-UCS-Mini-1_A_D_UCS_Mini_Blade3_fca1 vsan 10	8E
	HBA2	Fabric B	Boot Zone	ucs_CSC-UCS-Mini-1_B_B_UCS_Mini_Blade3_fcb1 vsan 11	7F
			Data Zone	ucs_CSC-UCS-Mini-1_B_D_UCS_Mini_Blade3_fcb1 vsan 11	8F
UCSESX04	HBA1	Fabric A	Boot Zone	ucs_CSC-UCS-Mini-1_A_B_UCS_Mini_Blade4_fca1 vsan 10	7E
			Data Zone	ucs_CSC-UCS-Mini-1_A_D_UCS_Mini_Blade4_fca1 vsan 10	8E
	HBA2	Fabric B	Boot Zone	ucs_CSC-UCS-Mini-1_B_B_UCS_Mini_Blade4_fcb1 vsan 11	7F
			Data Zone	ucs_CSC-UCS-Mini-1_B_D_UCS_Mini_Blade4_fcb1 vsan 11	8F
UCSESX05	HBA1	Fabric A	Boot Zone	ucs_CSC-UCS-Mini-1_A_B_UCS_Mini_Blade5_fca1 vsan 10	7E
			Data Zone	ucs_CSC-UCS-Mini-1_A_D_UCS_Mini_Blade5_fca1 vsan 10	8E
	HBA2	Fabric B	Boot Zone	ucs_CSC-UCS-Mini-1_B_B_UCS_Mini_Blade5_fcb1 vsan 11	7F
			Data Zone	ucs_CSC-UCS-Mini-1_B_D_UCS_Mini_Blade5_fcb1 vsan 11	8F
UCSESX06	HBA1	Fabric A	Boot Zone	ucs_CSC-UCS-Mini-1_A_B_UCS_Mini_Blade6_fca1 vsan 10	7E
			Data Zone	ucs_CSC-UCS-Mini-1_A_D_UCS_Mini_Blade6_fca1 vsan 10	8E
	HBA2	Fabric B	Boot Zone	ucs_CSC-UCS-Mini-1_B_B_UCS_Mini_Blade6_fcb1 vsan 11	7F
			Data Zone	ucs_CSC-UCS-Mini-1_B_D_UCS_Mini_Blade6_fcb1 vsan 11	8F
UCSESX07	HBA1	Fabric A	Boot Zone	ucs_CSC-UCS-Mini-1_A_B_UCS_Mini_Blade7_fca1 vsan 10	7E
			Data Zone	ucs_CSC-UCS-Mini-1_A_D_UCS_Mini_Blade7_fca1 vsan 10	8E
	HBA2	Fabric B	Boot Zone	ucs_CSC-UCS-Mini-1_B_B_UCS_Mini_Blade7_fcb1 vsan 11	7F
			Data Zone	ucs_CSC-UCS-Mini-1_B_D_UCS_Mini_Blade7_fcb1 vsan 11	8F

Table 8. Application Cell for VMware vSphere Zone Configuration (Continued)

Host	Host HBA Number	Fabric		Zone Name	Storage Port
UCSESX08	HBA1	Fabric A	Boot Zone	ucs_CSC-UCS-Mini-1_A_B_UCS_Mini_Blade8_fca1 vsan 10	7E
			Data Zone	ucs_CSC-UCS-Mini-1_A_D_UCS_Mini_Blade8_fca1 vsan 10	8E
	HBA2	Fabric B	Boot Zone	ucs_CSC-UCS-Mini-1_B_B_UCS_Mini_Blade8_fcb1 vsan 11	7F
			Data Zone	ucs_CSC-UCS-Mini-1_B_D_UCS_Mini_Blade8_fcb1 vsan 11	8F

Scaling Using Expansion Cell for Compute Resources

With Cisco UCS Mini there are limited options for scaling out. This solution suggests starting with a single blade and adding more blades as needed. Cisco UCS 5108 chassis supports eight blade servers. Once the chassis is fully populated, setup can be further scaled out with the help of Cisco rack servers.

This solution supports maximum of 15 servers, 8 blade servers, and 7 rack mounted servers.

Figure 11 shows the expansion cell for compute resources.

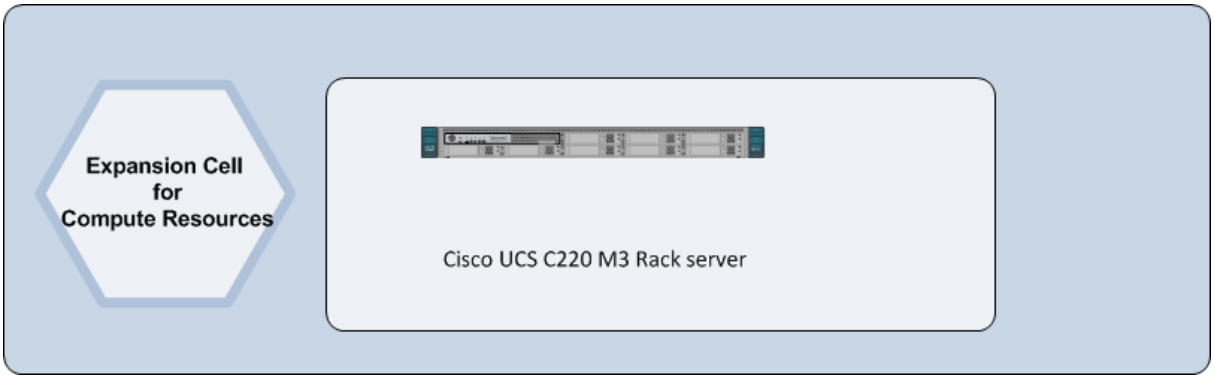

Figure 11

Use an expansion cell for compute resources in conjunction with the following cells:

- Infrastructure cell for compute resources
- Application cell for VMware vSphere

Once the chassis in the infrastructure cell for compute resources becomes fully populated, use an expansion cell for compute resources to provide additional resource capacity. This expansion cell for compute resources uses the storage and networking infrastructure provided in the following:

- Infrastructure cells for compute resources
- Storage resources

House this cell in the rack enclosure of the infrastructure cell for compute resources.

Cisco UCS Mini can accommodate up to Seven rack mounted servers to an expansion compute resource infrastructure cell. Cisco UCS Mini supports eight blade servers and up to seven Rack servers for the expansion.

Figure 12 shows fully scaled out setup. Seven rack servers have been connected with the help of QSSFP port on the Cisco 6324 Fabric interconnect.

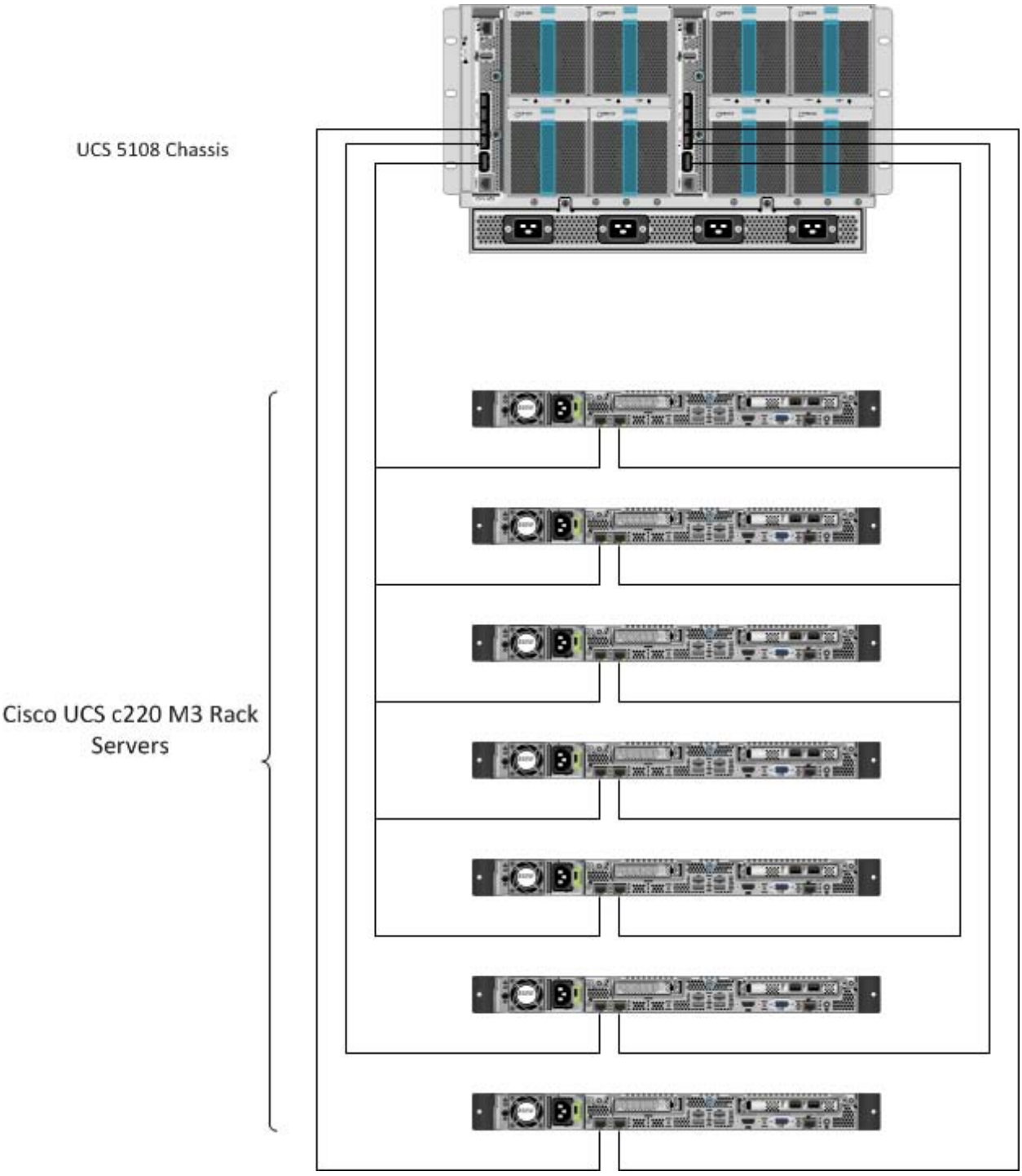

Figure 12

Note — Scalability limits depend on application workloads running on this infrastructure.

Chassis Components

The expansion cell for compute resources uses the same chassis components contained in the infrastructure cell for compute resources.

Networking Infrastructure

The networking for the expansion cell for compute resources uses the same networking configurations as the infrastructure cell for compute resources.

Storage Infrastructure

The Cisco UCS Mini supports attaching storage directly to the Cisco UCS 6324 Fabric Interconnect. This removes the requirement to have a dedicated Fibre Channel switching environment as all SAN switching and zoning are performed by the Cisco UCS 6324 Fabric Interconnect and managed through the Cisco UCS Director. Use four of the open storage target ports on Hitachi Virtual Storage Platform G800 in the infrastructure cell for storage resources. Follow the same storage configuration described for the infrastructure cell for compute resources to use the storage ports.

Scalability is achieved by adding storage capacity (disk/shelves) to existing storage ports.

Scale Using Expansion Cell for Storage Resources

Use an expansion cell for storage resources to scale out the VMware vSphere solution beyond the first infrastructure cell for storage resources.

The expansion cell for storage contains one 2.5 inch SFF disk drive chassis for Hitachi Virtual Storage Platform G800.

Use an expansion cell for storage resources in conjunction with the following cells:

- Infrastructure cell for storage resources
- Application cell for VMware vSphere

Once the original infrastructure cell for the storage drive chassis becomes fully populated, use an expansion cell for storage resources to provide additional capacity.

Put hot spares for the first application cells in the disk drive chassis for the infrastructure cell for storage resources. When the disk drive chassis in the infrastructure cell is filled, use the expansion cell for storage resources.

Engineering Validation

This describes the test methodology, test load, and the verification tests used to validate this reference architecture for Hitachi Unified Compute Platform Select for VMware vSphere with Cisco Unified Computing System Mini using Hitachi Virtual Storage Platform G800. The reference architecture consists of systems and solutions that are designed, tested, and documented to facilitate and improve your deployment. Cisco UCS Director has been used to manage the devices in the setup.

Test Methodology

The focus of the methodology was to validate the benefits of Hitachi Unified Compute Platform Select for VMware vSphere with Cisco Unified Computing System Mini reference architecture using Hitachi Virtual Storage Platform G800. This includes the following features that provide better utilization of compute resources:

- Move functions previously handled by the server onto the storage platform
- Better control how storage traffic flows through the system

The following are the system validation tests, including differentiated feature benefit analysis:

- High availability/resiliency

  System resiliency (high availability) testing was limited to major component failures in order to demonstrate system resiliency at each layer of the solution. The test cases included testing and validating the following:

  - I/O Module failure and recovery
  - Fabric Interconnect failure and recovery
  - Fabric Interconnect SAN uplink failure and recovery
  - Nexus 5000 failure and recovery
  - Hitachi Virtual Storage Platform G800 controller failure (FED failure on one cluster) and recovery
  - Demonstrate VMware vMotion — Migrate virtual machine server between two ESX hosts
  - Demonstrate high availability failover for UCS blade server with VMware High Availability
- High availability of Hitachi Virtual Storage Platform G800
- Hitachi Dynamic Provisioning
- Advanced Cisco UCS SAN features
  - Link aggregation (F-port trunk)
  - F-port (port channel)

Test Infrastructure

Testing involved these cells:

- Infrastructure cell for compute resources
- Infrastructure cell for storage resources
- Application cell for Unified Compute Platform Select management
- Application cell for VMware vSphere
  - 128 vCPUs
  - 512 GB vRAM
  - 2 TB HDP Pool capacity

Figure 13 shows the cells used to validate this reference architecture.

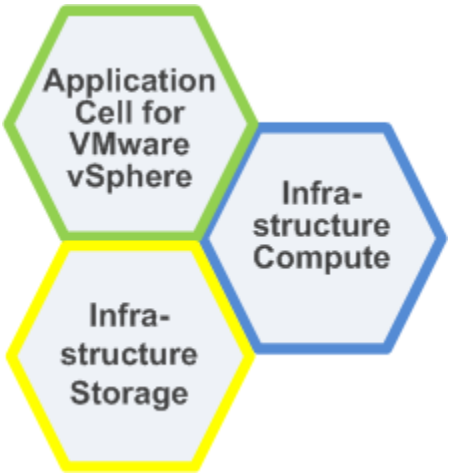

Figure 13

Each application cell for VMware vSphere ran eight virtual machines with Microsoft Windows Server® 2012 R2. Each virtual machine had two vCPUs, 4 GB RAM, and 100 GB storage space.

Test Load

The system was subjected to load while when performing the system tests. DVD Store, IOMeter, and IOZone were used to produce storage, compute, and SAN load. NetPerf was used to create the IP network traffic load. An additional server was installed to run NetPerf and generate IP traffic to the Nexus 5548 switch.

Interoperability Verification

Before and during the build of the environment, it was ensured that all hardware components, firmware, and deployed were supported in the Hitachi Interoperability Reporting Tool database. All make, model, and version numbers have been documented.

Test Results

All of the tests were completed successfully.

Test Name	Test Objective	Result
I/O Module failure and recovery	To test the ability of the setup to withstand IOM failure and service availability through the other module.	Pass
Fabric Interconnect Failure and recovery	To test the ability of the setup to withstand Fabric Interconnect switch failure and service availability through the other Fabric Interconnect.	Pass
SAN cable / port failure / recovery	To test the ability of the setup to withstand SAN port failure and service availability through the other SAN port and fabric.	Pass
Migration of VM with Vmotion between 2 ESX hosts	To test the mobility of VMs within the environment. VM properties, profiles, and functionality still persist after migrating to the other ESX.	Pass
Hitachi Virtual Storage Platform G800 controller failure and recovery	To test the ability of the setup to withstand storage controller failure and service availability through the other storage controller.	Pass
VSP G800 firmware upgrade	To test the ability of the setup to run without any disruption while storage code is being upgraded.	Pass

Conclusion

Hitachi Unified Compute Platform Select for VMware vSphere with Cisco Unified Computing System Mini using Hitachi Virtual Storage Platform G800 gives you a build-as-you-go model that uses performance-proven hardware resources. The modular design, using a cell architecture, permits implementing an initial environment for modest needs that gives you the flexibility to scale out as your IT needs grow.

Validation with general server application workloads of this reference architecture in the ISV Solutions and Engineering laboratory at Hitachi Data Systems provides general guidance on the virtual resources available with this solution.

Use Hitachi Dynamic Provisioning to reallocate I/O capabilities dynamically, as necessary. Having the capability to provision additional spindles to an already provisioned datastore within vSphere allows for nondisruptive upgrades to the underlying storage infrastructure. This provides immediate benefits to your environment without confusing shuffling of virtual machines, datastores, or LUs.

Each implementation has its own unique set of data center and application requirements. Design your implementation of this environment by understanding the I/O workload of the server applications in your environment. Creating an environment that meets your unique needs results in increased ROI from avoiding over- or under-provisioning resources.

For More Information

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

Live and recorded product demonstrations are available for many Hitachi products. To schedule a live demonstration, contact a sales representative. To view a recorded demonstration, see the Hitachi Data Systems Corporate Resources website. Click the **Product Demos** tab for a list of available recorded demonstrations.

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