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Maximize the Value of Your Virtualized Data Center

A Certified, Validated and Tested Architecture for VMware From Cisco and Hitachi Data Systems

Virtualized data center infrastructures demand a solid foundation that delivers scale, resilience, flexibility and efficiency. Hitachi and Cisco, today's leading advocates of data center infrastructure virtualization, have teamed to develop a blueprint for large-scale data center virtualization that satisfies these demands. Hitachi Unified Compute Platform (UCP) Select for VMware vSphere with Cisco Unified Computing System (UCS) gives you an integrated stack of certified, validated and tested compute, network and storage components. Use this solution to design and build a virtualized data center infrastructure that lowers capital and operating expenses (capex and opex). This solution delivers the highest performance, availability and efficiency in the industry.

Scalability and High Performance in a Single Footprint

Hitachi Unified Compute Platform Select for VMware vSphere with Cisco Unified Computing System is a complete, end-to-end reference stack for VMware vSphere that delivers top performance, availability and flexibility. It uses industry-leading solutions from Hitachi and Cisco, and is designed around Hitachi storage platforms (Virtual Storage Platform, Unified Storage VM, Unified Storage and NAS Platform), Cisco Unified Fabric Switching network and Cisco Unified Computing System. These compute, network and storage resources are natively integrated with VMware vSphere, creating a simple, flexible and cost-effective infrastructure for your virtualized data center.

Hitachi storage platforms are natively integrated with the vSphere API engine. Native integration means multiple VMware servers can offload workloads, such as VMotion, to Hitachi storage. This action frees resources on the server, reducing traffic on the network and dramatically improving infrastructure efficiency.
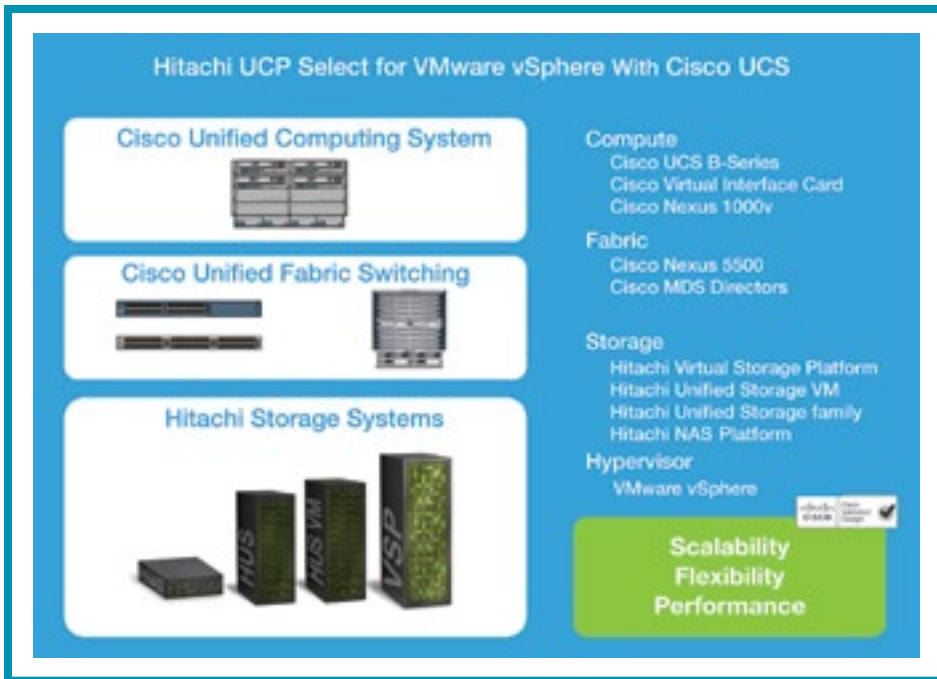
Hitachi Data Systems

Figure 1. Hitachi Unified Compute Platform Select for VMware vSphere With Cisco UCS

Using only tested and validated components, UCP Select for VMware vSphere with Cisco UCS reduces the risk of introducing new technologies to your data center. Hitachi and Cisco certify each component's interoperability. This verification gives you the confidence to size the infrastructure to satisfy today's data center requirements and the assurance of growing incrementally as needs change.

UCP Select for VMware vSphere with Cisco UCS: Advantages

UCP Select for VMware vSphere with Cisco UCS is composed of Hitachi storage, Cisco Unified Fabric Switching and Cisco Unified Computing System (see Figure 1). In joining forces, Hitachi and Cisco have created an architecture that offers unequaled value in the virtualized data center. The solution provides you with:

■ **Ultimate VMware Infrastructure Flexibility.** UCP Select for VMware vSphere with Cisco UCS offers a range of solutions. It can satisfy the requirements of any VMware data center infrastructure, from high-end block- or file-based highly available configurations to midrange solutions based on cost-effective storage. Every component of the solution adheres to native vSphere integration best practices. Thus, the solution enables in-house IT experts to quickly and easily configure and deploy a VMware infrastructure, without complex, proprietary hardware integration.

■ **Collaborative Support Model.** Hitachi and Cisco have many years of experience supporting mutual customers. Both companies offer consistent high-quality, high-touch technical support. The collaborative support model formalizes this relationship, giving organizations an efficient and flexible support solution that provides clear ownership of problems, effective cross-vendor collaboration and fast problem resolution.

■ **Cloud-Ready.** UCP Select for VMware vSphere with Cisco UCS sizes resources to match demand and dynamically adjusts to accommodate changing application and infrastructure needs. This capability gives you the immediate flexibility, scalability and performance required to support private, public and hybrid cloud-based delivery of business workloads.

■ **High-Density Application Consolidation.** Hitachi storage systems natively support VMware vStorage API for Array Integration (VAAI), allowing VMware servers to offload I/O-intensive workloads, like vMotion, to Hitachi storage. Working with larger VMware vSphere virtual machine disk file (VMDK) capacity, this capability enables high-density consolidation of virtual machines (VMs) on Cisco UCS servers.

■ **High Performance.** Each component of UCP Select for VMware vSphere with Cisco UCS is designed for high performance. Hitachi Virtual Storage Platform and Hitachi Unified Storage VM are built on the Hitachi 5th-generation Hi-Star crossbar switch architecture, the industry's highest performing storage architecture. Hitachi NAS Platform offers the highest-performing clustered network storage available, capable of sustained, predictable and consistent performance under various loads. Hitachi Unified Storage 100 offers best-in-class performance with both hard drives and solid-state drives (SSDs). Cisco UCS servers continually raise the bar on performance, with over 81 new record-setting benchmark studies in the past 3 years alone. Cisco UCS Unified Fabric Switching delivers low-latency, lossless 10Gb/sec Ethernet connectivity.

■ **Scalability.** UCP Select for VMware vSphere with Cisco UCS provides the flexibility to accommodate dynamically changing workloads. Virtual Storage Platform delivers massive scalability with a unique 3-dimensional scaling approach: up, out and deep. Virtual Storage Platform and Unified Storage VM controllers are able to virtualize multivendor storage systems, giving older technologies access to advanced features, including vSphere APIs. Hitachi NAS Platform, paired with any of the Hitachi storage platforms, provides highly scalable file-based storage for VMware environments based on NFS or SMB. In addition, Cisco virtual network adapters, embedded in Cisco UCS, combine with flexible unified port configuration and innovative fabric extender technology. Together, they ensure consistent, best-in-class network performance and reliability, even as new workloads are added.

■ **No Single Point of Failure.** UCP Select for VMware vSphere with Cisco UCS has no single point of failure. Cisco Unified Fabric Switching uses multiple, fully redundant SAN data paths dynamically, without the need for fine-grained SAN management. Hitachi storage platforms are the industry's most robust storage systems and benefit from a fully redundant switching
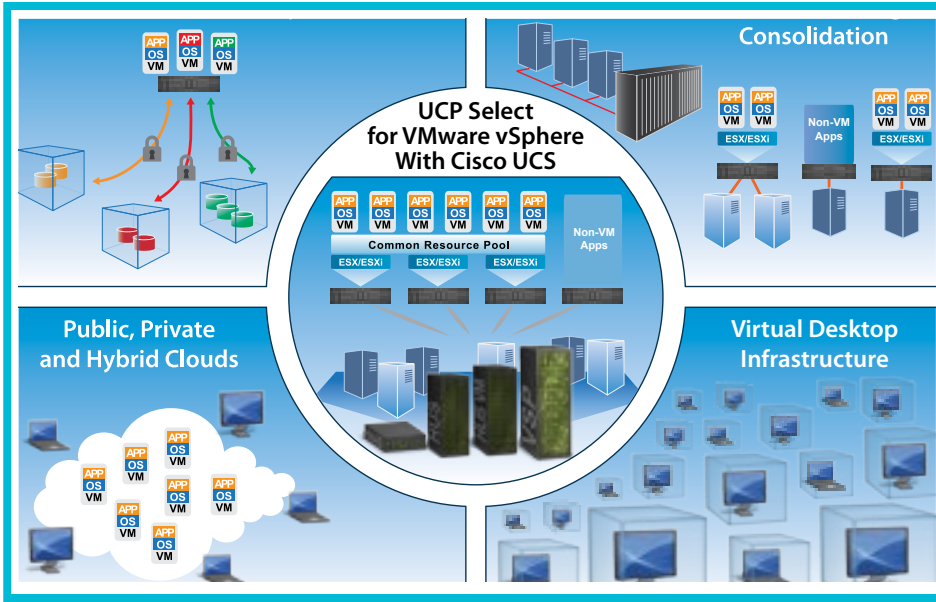
Figure 2. Hitachi Unified Compute Platform Select for VMware vSphere With Cisco UCS Use Cases

architecture. Virtual Storage Platform and Unified Storage VM are the only storage systems in the industry to offer a 100% data availability warranty.

■ **Reduce, Reuse, Recycle.** Hitachi storage virtualization technology coupled with Hitachi Dynamic Provisioning reduces the storage needed for each VM and eliminates the need to manage many small VMFS volumes. Older modular storage systems virtualized by Virtual Storage Platform or Unified Storage VM inherit support for native vSphere APIs. In this way, the solution extends their useful lifespan in the virtualized data center.

Quality Components in a Tested and Validated Framework

The quality of the companies and technologies involved and the level of interoperability testing performed to achieve validation enhance the value of UCP Select for VMware vSphere with Cisco UCS. Hitachi and Cisco set the standard for technology leadership and high customer satisfaction. The 2 companies have fully tested and qualified all Hitachi storage platforms on the Cisco UCS server platform. Over 140 combinations of operating system, host bus adapter (HBA), storage and networking components have been tested and validated. Every component of the reference architecture benefits from innovative design

and advanced feature sets, which are geared to address critical business needs.

Hitachi Storage

Hitachi Data Systems offers a complete portfolio of state-of-the-art block- and file-based storage solutions, with a range of capabilities that can satisfy the needs of any VMware infrastructure. Storage platforms certified, validated and tested by Hitachi and Cisco for the UCP Select for VMware vSphere with Cisco UCS framework include: Hitachi Virtual Storage Platform, Hitachi Unified Storage VM, Hitachi Unified Storage family and Hitachi NAS Platform.

Hitachi Virtual Storage Platform

Hitachi Virtual Storage Platform is the most intelligent and powerful enterprise storage system in the industry. Based on Hi-Star crossbar switch architecture, Virtual Storage Platform supports massive scalability, up to 192GB/sec aggregate internal bandwidth, 255PB of internal and external storage and up to 1TB of directly addressable cache.

In addition to performance and scalability, Virtual Storage Platform emphasizes high availability, with capabilities that include: heterogeneous asynchronous remote replication over any distance; copy-on-write snapshots; nondisruptive microcode and hardware updates; automatic failover with redundant, hot-swappable components; dual data and control paths connecting

every component; active-active dual-ported disk drives; and mirrored cache for all write data.

Differentiating features of Virtual Storage Platform include:

■ **The Industry's Only 3-D Scaling Storage System.** 3-D scaling is the unique ability of Virtual Storage Platform to scale in 3 dimensions: up, out and deep. Scale up to 192GB/sec aggregate internal bandwidth, up to 2,048 SAS 2.5 in. drives or 1,280 SATA 3.5 in. drives and 256 flash drives. Combine multiple Virtual Storage Platform systems in a single logical unit for scale out. Extend the advanced functionality of the Virtual Storage Platform controller to up to 120 virtualized 3rd-party storage systems to scale deep.

■ **Industry-Leading Storage Virtualization.** Virtual Storage Platform is able to virtualize multivendor storage systems. Virtualized storage systems inherit the advanced features of the Hitachi storage controller. For VMware infrastructures, this virtualization means giving new life to storage systems incompatible with VMware vSphere. Hitachi Dynamic Provisioning virtualizes the controller's RAID arrays, enabling just-in-time provisioning of disk resources and optimal use of available capacity.

■ **Native Support for VMware vStorage API for Array Integration (VAAI).** VAAI is a set of vSphere primitives for offloading data-related processing from ESX servers. VAAI frees host resources to support higher-density VM deployments. Virtual Storage Platform offers native support for VAAI APIs. This support increases performance and availability for all UCP Select

for VMware vSphere with Cisco UCS components and enables any 3rd-party tools that support vSphere VAAI APIs.

Hitachi Unified Storage VM

Today's data centers contain a range of storage assets from different vendors, each with varying capabilities. This fragmentation adds to storage management complexity, increases costs and creates efficiency and interoperability challenges for data center managers.

Hitachi Unified Storage VM is an entry-level enterprise storage platform, designed around the same high-performance switch architecture that powers Hitachi Virtual Storage Platform. It offers the identical virtualization features as Virtual Storage Platform and can eliminate infrastructure fragmentation by aggregating multivendor external storage systems in a single pool of virtualized capacity. All virtualized external storage gains access to the advanced features of the Unified Storage VM controller, including thin provisioning, data replication, logical partitioning and native support for VMware VAAI APIs.

Differentiating features of Hitachi Unified Storage VM include:

- **Enterprise-Class Performance, Scalability and Availability.** Benefiting from the architecture of the industry-leading Virtual Storage Platform, Unified Storage VM provides up to 64PB of raw external capacity. It offers forty-eight 8Gb/sec Fibre Channel interfaces and 256GB of cache for each of the 2 active, fully redundant virtual controllers. The storage system is available as an all-flash platform, with Hitachi Accelerated Flash storage, for the most demanding enterprise workloads.
- **Management Simplicity.** Unified Storage VM supports external storage arrays from

> A certified end-to-end reference stack for VMware vSphere from Hitachi and Cisco brings unequaled value to the virtualized data center.

hundreds of vendors and can virtualize up to 16,384 external volumes. External storage systems appear as a single pool of virtual storage and inherit access to advanced features of the Unified Storage VM controller. This access includes a common suite of tools for storage management and provisioning.

- **Increased Efficiency.** Hitachi Unified Storage VM creates a common pool of shared storage from the resources of virtualized external storage systems. Therefore, latent capacity in the storage infrastructure can be fully used, increasing efficiency and extending the useful lifespan of legacy storage devices. Automated data placement puts the right data in the right place at the right time, for both internal and externally virtualized storage.

Hitachi Unified Storage 100 Family

Hitachi Unified Storage 100 family offers the fastest midrange storage system available in the industry, with support for both block-and file-based storage access. The midrange system provides a cost-efficient solution while delivering high-end performance and storage functionality, including thin provisioning, data deduplication and autotiering.

Differentiating features of Unified Storage 100 family include:

- **Dynamic Provisioning.** Like Virtual Storage Platform and Unified Storage VM, the Hitachi Unified Storage 100 family supports Hitachi Dynamic Provisioning software. Dynamic Provisioning allocates file- and block-based storage capacity from a single pool of resources. Thin provisioned volumes are initially sized to meet existing requirements but grow automatically as application needs change. This flexibility eliminates costly and error prone administrator intervention.
- **Legendary Hitachi Storage Availability.** Unified Storage 100 family offers the same legendary 99.999% data availability provided by other Hitachi storage platforms. The systems are fully redundant. Parts are hot-swappable and intelligent automation provides foolproof failover, data migration, tiering and load balancing.
- **Lower Storage Infrastructure Costs.** Unified Storage 100 family provides close to 4PB of storage capacity for increased

VM density and the consolidation of multiple midtier VMware applications on a single platform. Simplified operations, streamlined management and greater capacity efficiencies combine to lower the cost of the VMware storage infrastructure substantially.

Hitachi NAS Platform

Hitachi NAS Platform is an advanced, VM-aware network-attached storage (NAS) solution for Hitachi storage systems. Incorporating Hitachi NAS Platform with Hitachi Virtual Storage Platform, Hitachi Unified Storage VM, or Hitachi Unified Storage 100 family systems gives a broad range of configuration options. These choices satisfy any performance, scalability, availability, efficiency and cost requirements. For example, in a virtual desktop infrastructure (VDI) environment, demand for number of desktops, uptime, performance, anticipated growth and cost can dictate which of the Hitachi storage platforms is paired with Hitachi NAS Platform to best satisfy the needs of the infrastructure.

Differentiating features of Hitachi NAS Platform include:

- **Industry-Leading NAS Platform.** Hitachi NAS Platform provides an industry-leading series of NAS solutions, with the performance, availability and efficiency required to satisfy existing requirements and the scalability to meet future demands. The platform uses dedicated Field-Programmable Gate Arrays (FPGAs) developed to provide exceptionally high performance and scalability. FPGAs perform parallel processing of file system operations, snapshots, cache and free space allocation and IP protocol acceleration. This action enables management and provisioning tasks to be performed without impact to host applications.
- **Hardware-Accelerated Data Deduplication.** Data duplication is a continual problem for file-based storage, often accounting for up to 90% of used file system capacity. Hitachi NAS Platform deduplication capabilities are designed into the dedicated FPGAs that power the system. Hardware acceleration enables deduplication to run continuously, in parallel with host applications. File server load is constantly monitored and the priority
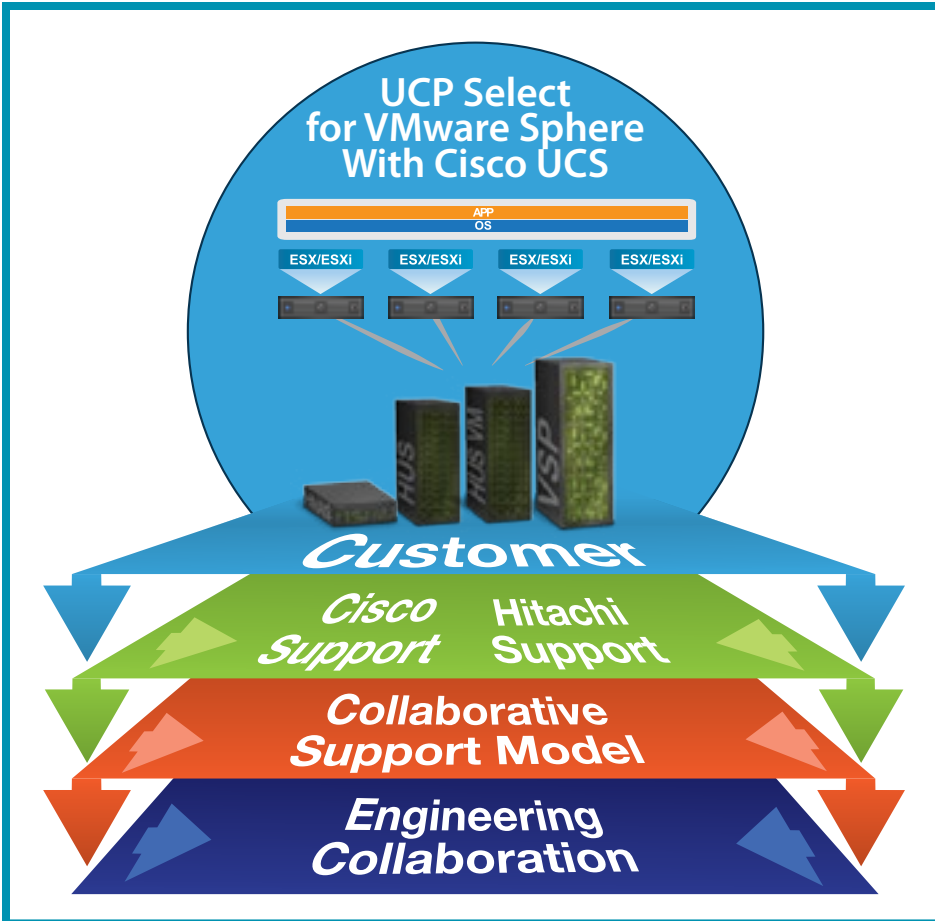
Figure 3. Hitachi Unified Compute Platform Select Collaborative Support Model

of processes is automatically adjusted to ensure that host applications are not affected by deduplication processing. The feature is fully automated, requiring little or no administrator intervention, and delivers substantial efficiency gains.

- **Hitachi NAS Virtual Infrastructure Integrator Software for VMware.** Hitachi NAS Virtual Infrastructure Integrator software is a management console plug-in for VMware vCenter. It simplifies management of VM backups, restores, cloning and data store management for virtual machine administrators. Hitachi NAS Virtual Infrastructure Integrator increases an administrator's visibility into data stores connected to VMware ESX clusters, drives data efficiencies and provides administrators with the tools to protect virtual machines.

Cisco Infrastructure

The Cisco Unified Fabric Switching and Cisco Unified Computing System are pillars of the Cisco Unified Data Center. UCS unites compute, storage, network and management resources to simplify IT operations and deliver comprehensive optimization for virtualized environments. Cisco UCS and Unified Fabric Switching components include:

- Low-latency, lossless 10 Gigabit per second Ethernet (Gb/sec Ethernet) unified network fabric.
- High-performance blade- or rack-mounted x86-architecture servers powered by Intel Xeon processors.
- Cisco UCS Director (UCSD), a self-service provisioning and orchestration solution for cloud computing and data center automation.

- Line-rate, low-latency, lossless, 10Gb/sec Ethernet fabric interconnect switches.
- I/O modules (fabric extenders), which provide up to sixteen 10Gb/sec Ethernet connections between the UCS blade chassis and fabric interconnects.
- Myriad network adapters, including adapters optimized for virtualization, converged network adapters (CNAs) for access to the unified fabric and compatibility with existing driver stacks, Fibre Channel HBAs and high-performance Ethernet adapters.
- Embedded centralized management for up to 20 UCS blade chassis and 160 blade servers in a single compute domain.
- The UCS fabric computing architecture, which eliminates the need for multiple sets of adapters, cables and switches, per blade chassis, for LANs, SANs and high-performance computing networks; it lowers data center total cost of ownership (TCO) and increases business agility.

The Cisco Nexus and MDS Director and Fabric family of switches are part of the foundation of Cisco Unified Fabric Switching. They offer comprehensive data center network features to address the business, application and operational requirements of an evolving physical and virtual data center. Cisco Unified Fabric Switching provides infrastructure simplicity and reduced total cost of ownership.

Cisco Prime Data Center Network Manager (DCNM) is a cross-management platform for efficiently implementing, visualizing and managing Cisco Unified Fabric Switching. DCNM provides enhanced visibility and automated fabric provisioning in a dynamic data center, and includes a comprehensive feature set and customizable dashboard.

Cisco UCS provides a low-latency, lossless, virtualization-aware network to carry all VM traffic. Security isolation, visibility and control are equivalent to a physical network. Fabric extenders pass network traffic to parent fabric interconnects, where it is centrally processed and managed. The Unified Fabric Switching design allows dynamic changes in I/O configuration, without the need to install adapters or recable racks and switches.

A simplified and secure infrastructure, Cisco UCS delivers advanced features, such as virtual storage area networks (VSANs), link encryption and port channels. These features allow administrators to logically, securely and functionally partition a single physical LAN or SAN fabric or switch into multiple domains, each with its own security policies and fabric services. At the same time, they can use load-sharing technology to optimize link utilization. Together, these features give improved network flexibility to support greater business agility.

VMware Virtualization Platform

VMware vSphere is the industry's most complete virtualization platform. VMware vSphere infrastructure services transform IT hardware into a high-performance shared-computing resource, with application services that help IT organizations deliver the highest levels of availability, security and scalability.

vSphere enables IT organizations to delay costly and disruptive data center expansion projects by consolidating multiple VMs on a single physical server without sacrificing performance or throughput. Administrators use vSphere to create powerful, multicore VMs and VM clusters that span multiple physical servers to support even the most demanding application workloads. Comprehensive virtualization of server, storage and networking hardware significantly reduces management complexity.

VMware vCenter Server provides a scalable and extensible platform for proactive virtualization management. The VMware vCenter Server platform includes components that work together to give the enterprise a scalable virtualization management hub. Management servers provide central management points for hosts and VMs. Inventory and performance information is stored in a database, and agents provide connectivity between the host and management server.

A Cloud-Ready Infrastructure

Fast-growing volumes of information and increasing data center complexity are spurring many organizations to look for flexible, scalable and reliable ways to deliver IT services on demand. Cloud solutions are an enticing option, with characteristics that include self-service, pay-per-use and the ability to scale resources dynamically, as needed.

Implementing a fully virtualized architecture is an important 1st step. It moves organizations toward deploying private clouds within the company data center, public clouds that provide general access to data in a publicly hosted facility, or hybrid clouds with the capabilities of both public and private.

Hitachi Unified Compute Platform Select for VMware vSphere with Cisco Unified Computing System is the ultimate foundation for cloud computing. A validated reference architecture, it supports predictable, low-risk cloud deployment and abstracts the underlying infrastructure from applications and information. Cloud solutions built on UCP Select for VMware vSphere with Cisco UCS offer improved agility, increased efficiency and reduced cost of delivery.

Accelerate Data Center Transformation

As the data center transitions from a cost center to a business-enablement resource, IT organizations require technologies that respond quickly to business needs while reducing costs and increasing efficiencies. They also need vendors, who provide the assurance that their products work together, so new technologies can be integrated into the data center quickly and safely. UCP Select for VMware vSphere with Cisco UCS offers a collaborative, tested, comprehensive, cloud-ready solution framework. This solution demonstrates a long-term commitment to helping you design and build the flexible data center that satisfies your organization's needs today and scales to meet its challenges tomorrow.

Learn More

Cisco and Hitachi Data Systems continue to develop design guidelines to help organizations efficiently and smoothly deploy solutions from both companies, together. These guidelines include Cisco Validated Designs and Hitachi Data Systems Reference Architectures. The documents cover various topics, including basic data center design and virtualization using Cisco Unified Fabric Switching, Cisco Unified Computing System and Hitachi storage with VMware. In addition, optimized application deployment guides, for applications such as Oracle RAC, are available. Look to the following links for the latest design guidelines from Cisco and Hitachi Data Systems:

- Hitachi storage platforms, visit: www.HDS.com.
- Cisco UCS, visit: http://www.cisco.com/go/ucs.
- Cisco Nexus Switches, visit: http://www.cisco.com/go/nexus.
- Cisco MDS Family, visit: http://www.cisco.com/go/mds.
- Cisco CVDs, visit: http://www.cisco.com/en/US/docs/unified_computing/ucs/UCS_CVDs/ucs_hds.html.
- VMware products, visit: www.VMware.com/products.