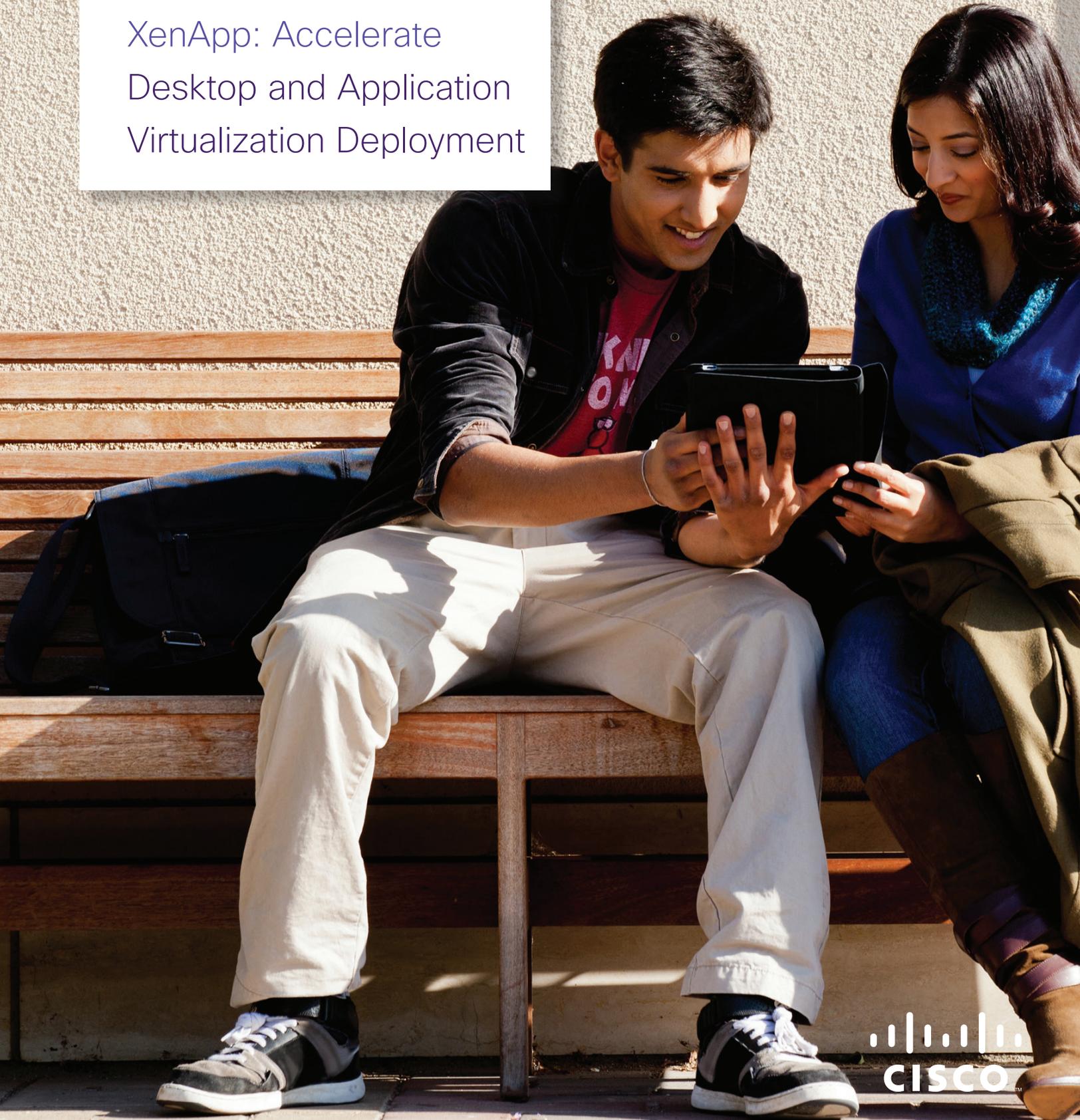


White Paper

Cisco UCS with
Citrix XenDesktop and
XenApp: Accelerate
Desktop and Application
Virtualization Deployment



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Cisco UCS with Citrix XenDesktop and XenApp: Accelerate Desktop Virtualization and Application Virtualization

White Paper
August 2013



Desktop virtualization requires a portfolio of solution architectures to address the full range of business and user needs and effectively deploy virtual desktops and applications.

Cisco offers a suite of solution architectures for desktop virtualization, each optimized for specific constraints and IT delivery models to meet the requirements of environments of all sizes:

- Cisco® On-Board Architecture for nonpersistent virtual desktops with integrated server-resident storage and management
- Cisco Simplified Architecture for persistent and nonpersistent virtual desktops in an appliance-like configuration without the costs associated with a full SAN networking deployment
- Cisco Scalable Architecture for persistent and nonpersistent virtual desktops in a scale-out configuration for environments with thousands of desktops with existing SAN investments
- Cisco Converged Infrastructure with modularized infrastructure packaging that accelerates procurement and simplifies virtual desktop infrastructure (VDI) management, scaling, and support

Cisco unified management capabilities provide simple, consistent, scalable management, lowering operating expenses (OpEx).

What You Will Learn

This white paper summarizes the factors propelling businesses to evaluate new desktop implementation strategies. It reviews the four architectural approaches that we offer for desktop virtualization, and the technology advantage offered by the Cisco Unified Computing System™ (Cisco UCS®) and its tight integration with Citrix XenDesktop and XenApp:

- Cisco On-Board Architecture
- Cisco Simplified Architecture
- Cisco Scalable Architecture
- Cisco Converged Infrastructure

Each architectural discussion demonstrates how the Cisco® solutions scale management and infrastructure together to bring simplified, consistent management to every business organization's virtual desktop environment.

Growing Importance of Desktop Virtualization

Desktop IT managers focus on enabling a mobile, flexible, productive, global workforce with performance and collaboration integration that actually enhances the working experience compared to that with traditional desktops. For a business to succeed, employees need access to all their applications and data from any device, at any time, from any location—and this access must be provided cost-effectively to lower both capital expenditures (CapEx) and OpEx.

To provide this level of user access and efficiency, many organizations are eager to adopt desktop virtualization. However, several major obstacles have impeded successful deployment using traditional systems and architectures. These obstacles include high acquisition costs, management complexity, and improper planning and sizing, which results in poor performance.

There is no one-size-fits-all infrastructure that can meet the needs of every user in every business. For example, the desktop and business requirements for mobile users, call center or training center employees (often categorized as task workers), accountants, marketing, human resources employees (often categorized as knowledge workers), and designers with needs for high-powered graphics are all very different. The business requires a greater level of security for mobile workers because they are predominately accessing the desktop from a network external to the corporate network. Task workers, such as call center employees, interact with the same one or two applications while they work, so desktops that are nonpersistent are cost effective and work well for these users. Knowledge workers, however, tend to use many different applications and work both within the corporate network and from other locations and so need a more flexible and persistent desktop environment. Therefore, optimized configurations and architectures that can address different delivery models, user workloads, scalability, and performance needs are required.

To assist desktop IT managers in their mission and to accelerate desktop virtualization deployments, Cisco and our partners have developed four reference architectures that combine best-in-class data center computing, networking, and storage technologies. The reference architectures help simplify, accelerate, and eliminate the risk associated with desktop virtualization deployments. These Cisco Desktop Virtualization reference architectures include the Cisco On-Board Architecture, Simplified Architecture, Scalable Architecture, and Converged Infrastructure models. These reference architectures address a range of IT challenges, desktop environments, and delivery approaches to enable high-performance, easy-to-manage, and cost-effective solutions.

The Move to Virtual Desktop Infrastructure

In many cases, the move to desktop virtualization requires the purchase of new hardware and an upgrade of desktop software with new operating system and applications. The magnitude of these changes has IT departments evaluating their desktop strategy to better address user needs and create a scalable, cost-effective infrastructure that meets security and compliance requirements. Most desktop virtualization deployments start small and grow over time. Often a proof of concept (PoC) is deployed for one department, and then, as the IT department becomes more familiar with and confident about using the technology, the initial infrastructure is scaled, and other deployments follow. As deployments grow, businesses should expect the first investments in physical and management infrastructure to be compatible and interoperable with future deployments.

Holistic Management

As with most data center solutions, desktop virtualization is a multilayered solution. Often, desktop virtualization is implemented using disparate solution elements and management software for each component:

- Virtualized infrastructure
- Desktop virtualization software
- Connection brokers
- Display protocols

- Access and authentication methods
- User persona management
- Network, storage, and server management

IT departments should be able to expect this multifaceted solution to have simplified, integrated management that lowers OpEx.

Scalable Performance

After a successful pilot or PoC deployment, the IT department normally expands this initial deployment. An ideal solution easily scales the initial deployment to a production deployment with consistent performance that delivers an excellent desktop experience for users.

Cisco Delivers Flexible Architecture for Desktop Virtualization

Cisco and our technology partners have collaborated to create a portfolio of reference designs based on the foundational Cisco Desktop Virtualization Architectures consisting of best-in-class technologies based on building-block components: Cisco UCS and Citrix XenDesktop and XenApp. These reference architectures reduce risk and complexity and offer a clear path to virtual desktop deployments with:

- Lower initial cost
- Reduced system complexity and simplified management
- Scalable performance for IT environments of all sizes

The reference architectures include Cisco On-Board, Simplified, and Scalable models for desktop virtualization. In addition, Cisco Converged Infrastructure solutions such as NetApp FlexPod data center platforms and the Virtual Computing Environment (VCE) coalition Vblock™ Systems provide modular, ready-to-deploy solutions. These designs are suited to organizations of various sizes, ranging from small and medium-sized businesses (SMBs) to large enterprises and service providers.

Cisco UCS: First Unified System for Desktop Virtualization

Cisco UCS is the virtualized server foundation of all Cisco Desktop Virtualization Architectures. In addition to convergence, the system brings the benefits of unified computing to the scale-out nature of desktop virtualization environments:

- Simplified management
- Greater deployment flexibility
- Easier scalability

A self-integrating, self-aware system, Cisco UCS consists of a single management domain interconnected by a unified I/O infrastructure. The Cisco UCS domain is designed as a single virtual blade chassis that incorporates and scales across multiple blade chassis, rack servers, and racks. Tight integration with VMware vCenter, managing VMware vSphere deployments, and with Microsoft System

Center Operations Manager (SCOM), Virtual Machine Manager, and Orchestrator, managing Microsoft Windows Server 2012 Hyper-V deployments, creates a highly cohesive virtualization cluster that is an excellent foundation for virtual desktop environments (Figure 1). Cisco UCS is also optimized for Citrix XenServer desktop virtualization solutions.

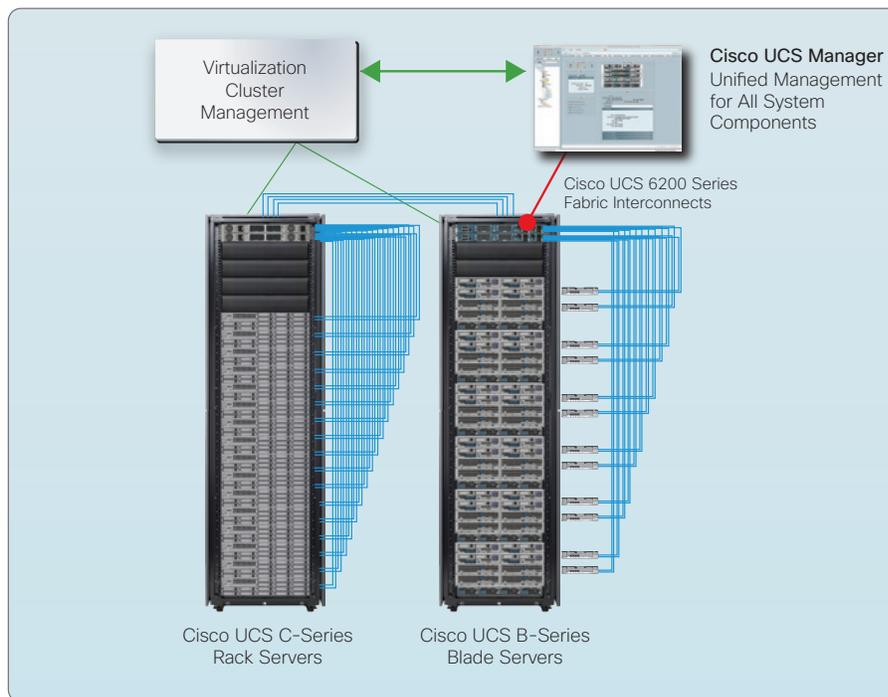


Figure 1. Virtualization Clusters Are Centrally Managed by Cisco UCS Manager Integrated with VMware vCenter and Microsoft System Center

Radically Simplified Architecture

The system implements a radically simplified architecture that eliminates the multiple redundant devices that populate traditional blade server chassis and result in increased costs and layers of complexity: Ethernet switches, Fibre Channel switches, and chassis-management modules. Cisco UCS incorporates a redundant pair of Cisco UCS 6200 Series Fabric Interconnects that provide a single point of management and a single point of control for all I/O traffic.

Lower Cost of Scalability

Cisco UCS scales with less complexity and at lower cost. Instead of requiring the addition of layers of switching in racks, blade servers, and hypervisors to expand the system, Cisco UCS uses low-cost, low-energy-consumption, high-performance fabric extenders to connect the data and management planes directly to blade and rack servers. Cisco fabric extenders bring up to 160 Gbps of network, storage, and management bandwidth to each chassis, and multiple 10-Gbps connections to each rack-mount server. This significant reduction in the number of components enables a lower-cost, more graceful scaling model in which the per-server infrastructure cost,

High Virtual Desktop Density

Cisco UCS supports 182 Microsoft Windows 7 virtual desktops on a single Cisco UCS B200 M3 Blade Server with Citrix XenDesktop 5. For more information, please visit http://www.principledtechnologies.com/clients/reports/Cisco/UCS_B200_M3_Citrix_VDI_03120412.pdf

including the cost of blade chassis and switching, is as little as half that of typical blade servers.

Balanced Approach

Cisco UCS provides the right balance of memory, I/O bandwidth, and processing power to support greater desktop density on each physical server without affecting performance. In fact, Principled Technologies tested Cisco UCS with Citrix XenDesktop and found that a single Cisco UCS B200 M3 Blade Server with 384 GB of memory easily supports 182 virtual knowledge-worker desktops running Microsoft Windows 7.

Citrix XenDesktop and XenApp

Citrix XenDesktop is a crucial element in the Cisco desktop virtualization architectures. It enables IT departments to simultaneously deliver flexible end-user computing, exceptional desktop data security, and superior scalability and management while substantially reducing total cost of ownership (TCO). It transforms desktops and applications into secure, on-demand services available to any user, anywhere, on any device. Citrix XenDesktop can deliver individual Microsoft Windows, web, and software-as-a-service (SaaS) applications or full virtual desktops to PCs, Apple Macintosh computers, tablets, smartphones, laptops, and thin clients while also substantially reducing TCO. Both Citrix XenDesktop and Cisco UCS support multiple hypervisor options, giving companies flexibility and choice. This flexibility can be especially helpful when a company has already developed a body of knowledge while implementing server virtualization. Robust features, such as secure mobile workplace and centralized desktop management of branch-office desktops, provide a rich user experience.

Citrix XenApp enables IT departments to simplify and improve application management using virtual application delivery. Virtual application delivery provides centralized management and deployment of any Microsoft Windows application as an on-demand service. This approach greatly improves application manageability by:

- Allowing IT departments to centrally manage and update a single instance of an application rather than hundreds or thousands across the enterprise, greatly reducing complexity and lowering the cost of desktop management by up to 50 percent
- Improving application security through control and encrypted access to data and applications
- Providing instant delivery of applications to users anywhere and on any device
- Allowing IT departments to focus on strategic initiatives by automating the process of delivering and updating applications

Citrix XenDesktop and XenApp software together with Cisco UCS architecture, storage optimization, and simplified management bring a level of cost control to the corporate desktop environment not offered by traditional solutions.

Better Together

Tight integration between Cisco UCS and the management software for the leading hypervisors, such as VMware vSphere and vCenter and Microsoft System Center 2012, drastically simplifies the physical and virtual infrastructure management

associated with desktop deployments. To easily integrate Cisco UCS management into the Microsoft environment using a command-line interface (CLI), Cisco PowerTool, a toolkit of Microsoft PowerShell management capabilities, is available.

Cisco UCS virtual interface cards (VICs) are virtualization-optimized converged network adapters (CNAs). Cisco UCS VICs support up to 256 peripheral component interconnect express (PCIe) standards-compliant interfaces that can operate in parallel to increase performance, especially in virtual environments. These PCIe interfaces can be dynamically configured so that both their interface types (network interface card [NIC] or host bus adapter [HBA]) and identities (MAC address and worldwide name [WWN]) are established using just-in-time provisioning initiated from Cisco UCS Manager, VMware vCenter, or Microsoft System Center. The Cisco solution extends virtual ports in the system fabric interconnects directly to both servers and virtual machines. Through the tight integration between Cisco UCS Manager and VMware vSphere or Microsoft System Center 2012 using the Cisco UCS Integration Pack, when a virtual machine is connected to a NIC on a Cisco VIC, it remains attached when the virtual machine is moved from server to server. Cisco Virtual Machine Fabric Extender (VM-FEX) technology can be used with the VMware ESXi or Microsoft Windows Server 2012 Hyper-V hypervisor to improve performance by supporting a more direct connection between virtual machines.

Cisco On-Board Architecture At-a-Glance:

Cisco On-Board Architecture for desktop virtualization is based on a solid-state drive (SSD) or flash memory (tier-0 storage). It delivers high-performance and cost-effective storage located on the server to host nonpersistent hosted virtual desktops and virtualized application deployments.

Cisco On-Board Architecture

Many environments struggle with virtual desktop and application deployments, particularly when a preexisting, well-designed SAN infrastructure is missing. Deployment of a SAN infrastructure can be a daunting and expensive proposition. Even for organizations with a SAN in place, throughput bottlenecks are common between the virtual desktops and the shared-storage back end that they need to access. These bottlenecks often result from an inability to support disk I/O-operations-per-second (IOPS) requirements and the inherent latency of the flow through the server, switched infrastructure, and shared storage. The IOPS bottleneck is most evident during systemwide events such as boot storms and antivirus scans. This problem is further compounded as the number of users increases and the capacity limit of the storage network and controller is reached. At this point, most businesses incur high incremental costs to expand the SAN. The result is escalating costs as the system continues to grow.

There is always a cost trade-off between performance and capacity, and one way to address I/O bottlenecks is to choose high-performance storage. This solution can be good for the short term, but then when it comes time to scale the storage, each incremental unit is more costly because of the high-performance requirement. A viable alternative to the purchase of high-performance shared storage to meet all desktop needs is to reduce costs by disaggregating the storage into separate high-performance volumes and high-capacity volumes (Figure 2). Storage optimized for capacity can be used to hold user data and profiles, and storage optimized for performance can be used to hold write cache files. This approach balances the need for large amounts of storage for scenarios in which only some of the storage is highly performance sensitive. This approach also reduces the amount of data moving through the network during periods of heavy user login and boot-up.

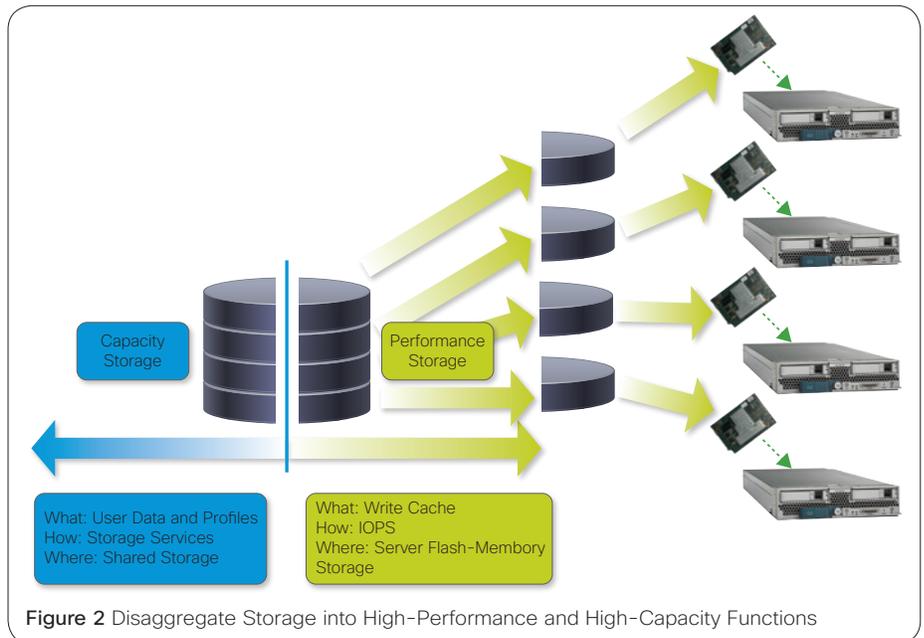


Figure 2 Disaggregate Storage into High-Performance and High-Capacity Functions

Solution Architecture

Cisco On-Board Architecture for virtual desktops gives organizations a cost-effective way to disaggregate their storage into high-performance, on-board storage that is very close to the computing resources and lower-performance, lower-cost storage that is on the network. This approach provides high-speed, low-latency, flash-memory-based storage (SSDs and PCIe flash-memory modules) directly within Cisco UCS blade servers.

Following this strategy, the virtual desktop virtual disks (vDisks) are placed into the flash-memory-based storage for fast access to the operating system and application components. Existing or otherwise cost-effective network-attached storage (NAS) or even back-end SAN-based storage can be used to maintain desktop master images, user persona data, and other user data that is not sensitive to IOPS performance or latency (Figure 3). This architecture eliminates the latency incurred when the host accesses back-end shared storage across a network fabric, because the desktop image (or the differential) is stored locally on the blade server. IOPS capacity is no longer a concern. The system can take advantage of a simpler, server-installed storage footprint that provides expansive IOPS capacity with negligible latency.

Essential Technology

One successful implementation of Cisco On-Board Architecture is based on Cisco UCS Storage Accelerator technology. The Cisco UCS Storage Accelerator option for Cisco UCS B-Series Blade Servers provides up to 785 GB of server-resident storage that is easily managed as part of the blade configuration and is excellent for placing the write cache and changed blocks (differentials) on the blade. The Cisco UCS Storage Accelerator is faster and requires less power and cooling than traditional storage with spinning disks. In addition, solution acquisition costs are reduced by up to 50 percent compared to a traditional SAN deployment.

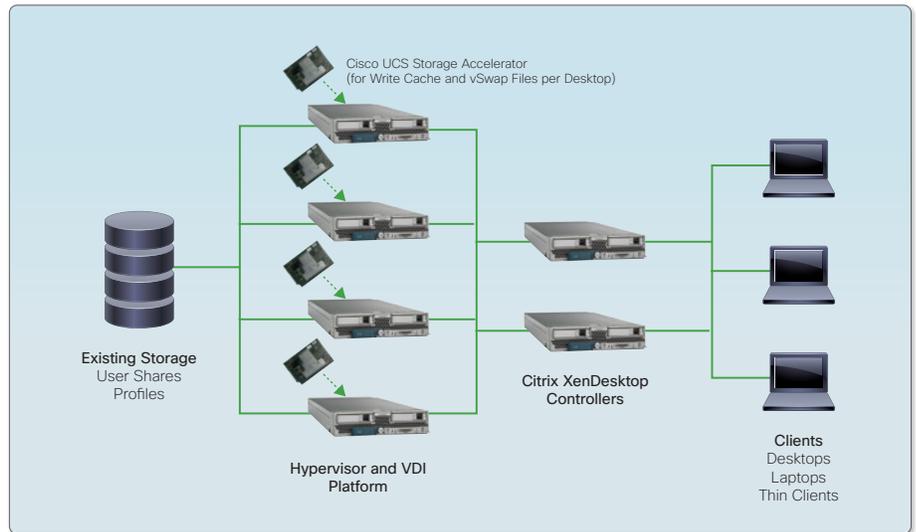


Figure 3. Deployment of Cisco On-Board Architecture Using Nonpersistent Desktops in Conjunction with NAS Storage for Reduced Cost and Complexity

How It Works

When deploying Cisco On-Board Architecture with Citrix XenDesktop (Figure 4) and XenApp, the Cisco UCS server flash-memory cache presents a block device to the hypervisor. Desktop configurations are created using Citrix Provisioning Server (PVS) and Citrix Studio. The virtual desktops have an associated write-cache file placed in the flash-memory storage. The virtual disk contains the write cache for the desktop and the Microsoft Windows swap file. This architecture is excellent for scaling nonpersistent hosted virtual desktops with application layering provided by Citrix XenApp, with each Cisco UCS server supporting approximately 150 desktops. For

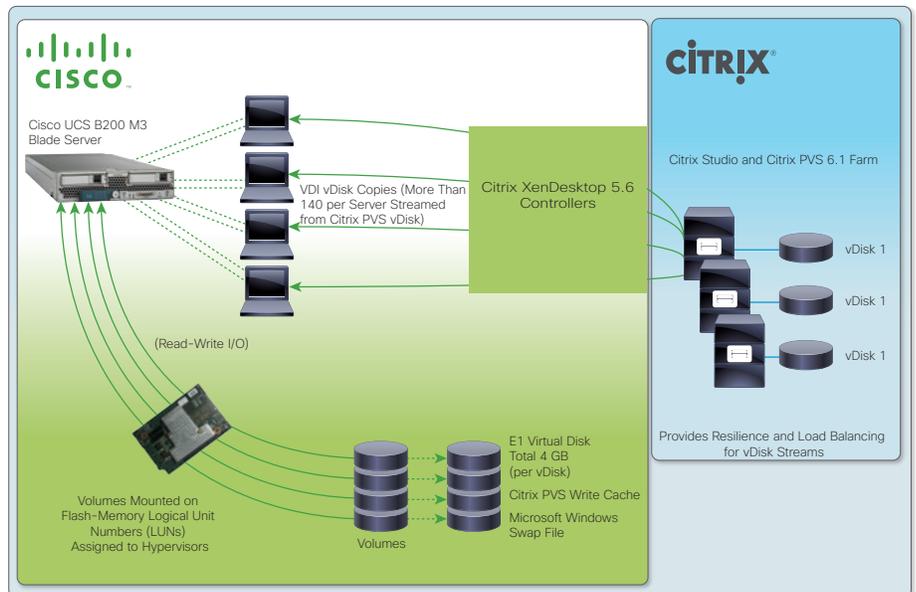


Figure 4. Deployment of Citrix XenDesktop Using Cisco On-Board Architecture

availability reasons, this architecture is well suited to nonpersistent virtual desktop deployments in which the failure domain is limited on the server, and in which when the user logs out, that user's desktop is returned to the pool, ready to be assigned to the next user. Nonpersistent desktops are increasingly used because of the low storage footprint required. They are often used in environments such as call centers, retail, training centers, test configurations, and other task-worker environments. If a server goes down, another server can take over, and the virtual desktops restart in seconds.

Deliver linear, virtual desktop storage scalability with consistent, predictable performance. For more information, refer to *Optimizing Desktop Virtualization Solutions with the Cisco UCS Storage Accelerator* at http://www.cisco.com/en/US/solutions/collateral/ns340/ns517/ns224/ns944/whitepaper_C22-726648.pdf.

SIDEBAR: Cisco Simplified Architecture At-a-Glance

The Cisco Simplified Architecture for desktop virtualization employs a radically simplified approach using appliance-like configurations that support persistent hosted virtual desktops with personal vDisks and nonpersistent hosted virtual desktops with virtual application delivery. Attaching the shared storage directly to the Cisco UCS fabric interconnect reduces cost and complexity.

Verified Support for Up to 1500 Virtual Desktops

The combination of Cisco UCS and Nimble Storage hardware running Citrix XenDesktop 5.6 on VMware ESXi 5 software delivers a high virtual machine density of more than 120 desktops per blade and up to 1500 virtual desktops in two Cisco UCS server chassis, satisfactorily meeting boot and login storm service-level agreements (SLAs). For more information, please visit http://www.cisco.com/en/US/solutions/collateral/ns340/ns517/ns224/ns836/ns978/ns1135/whitepaper_c11-727694.pdf.

Architecture Benefits

The on-board architectural approach offers many advantages, including a dramatic reduction in desktop boot and login times and lower IOPS burden on the back-end shared storage and storage network. Perhaps most important is the low incremental cost per additional desktop. The on-board architecture does not require the escalating CapEx of traditional SAN-based designs when the storage network or controller capacity is reached. As the user base expands, the Cisco On-Board Architecture scales linearly and easily to accommodate the growth. Reduced power consumption, along with system-based management that radically simplifies the ongoing management and deployment of additional servers to support additional desktops, reduces OpEx. For organizations not ready to invest in a SAN infrastructure and use nonpersistent desktops, the Cisco On-Board Architecture for desktop virtualization is an excellent, cost-effective, and high-performance option.

Cisco Simplified Architecture

IT departments may prefer to deploy persistent desktops for their end users. Using Citrix XenDesktop and XenApp, a growing number of businesses are exploring the virtual desktop approach using personal vDisks together with application layering to provide an excellent persistent desktop experience. This approach to virtual desktops helps ensure that each worker has a dedicated workspace that can be customized, similar to the physical desktop model. Additionally, many environments prefer the operation model of shared storage. In such situations, a shared-storage infrastructure is recommended to help ensure user acceptance, ensure desktop availability, and reduce service interruption. Small to medium-sized IT departments may prefer to use such an approach, which does not require the investment needed to move to a full SAN fabric infrastructure.

Solution Architecture

For environments such as those just described, we offer the Cisco Simplified Architecture for desktop virtualization, which employs an appliance-based model for virtual desktop deployments. This architecture simplifies the shared-storage implementation by eliminating the need for an intermediate switch layer between the storage and the server. Instead, shared storage connects directly to the Cisco UCS fabric interconnect (Figure 5). Cisco Simplified Architecture supports storage solutions from various Cisco ecosystem partners and offers a lower initial cost, making it well suited to organizations that do not have an existing investment in enterprise-class SAN infrastructure.

Essential Technology

Cisco Simplified Architecture allows the storage appliance to connect directly to the Cisco UCS fabric interconnect. This approach eliminates the need for upstream Fibre

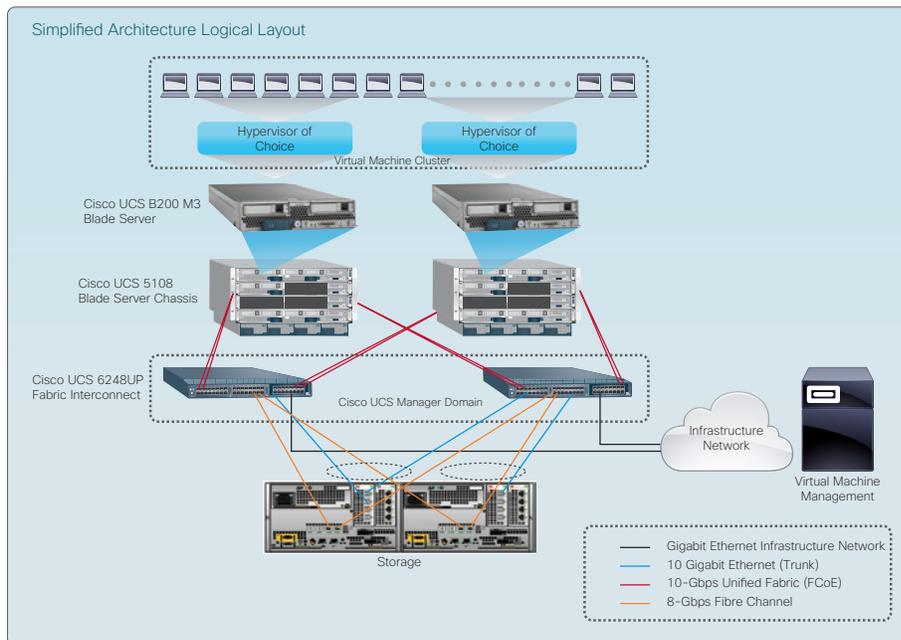


Figure 5. Cisco Simplified Architecture for Desktop Virtualization

Channel or Ethernet switches and associated management. Instead, Cisco UCS servers use direct-connect storage connections to the appliance ports for Ethernet-based Small Computer System Interface over IP (iSCSI) or NAS, and Fibre Channel ports for Fibre Channel and Fibre Channel over Ethernet (FCoE) connections for Fibre Channel storage. For the Ethernet ports connected to the storage appliance, Cisco UCS can concurrently support block and file protocols on the same port. This approach is excellent for deployments that use block-level access for bootup and file shares for data. The fabric interconnect provides radically simplified management for the entire infrastructure, including implicit Fibre Channel zoning and other zoning services. As needed, storage multipathing can be implemented on the servers to help ensure that the system does not have a single point of failure. This architecture provides the benefits of a shared-storage model with lower initial CapEx and lower OpEx because it has fewer components and management points. Note that the number of virtual desktops that this architecture can support, and its capability to scale, is limited to one Cisco UCS domain and the number of storage ports that can be directly attached to the system. Consequently, this architecture makes an excellent starting point for a move to a SAN, which provides greater scalability.

How It Works

When the Cisco Simplified Architecture with Citrix XenDesktop (Figure 6) is deployed, desktop configurations are created using Citrix PVS and Citrix Studio. The virtual disk space, located on the shared storage, contains the write cache. This architecture is excellent for supporting hosted virtual desktops with personal vDisks and nonpersistent hosted virtual desktops that need to scale up to approximately 10,000 virtual desktops. The number of desktops this architecture can support depends on the desktop workload characteristics, the size of the write cache, and the deployed storage capacity limits. As is expected with a shared-storage

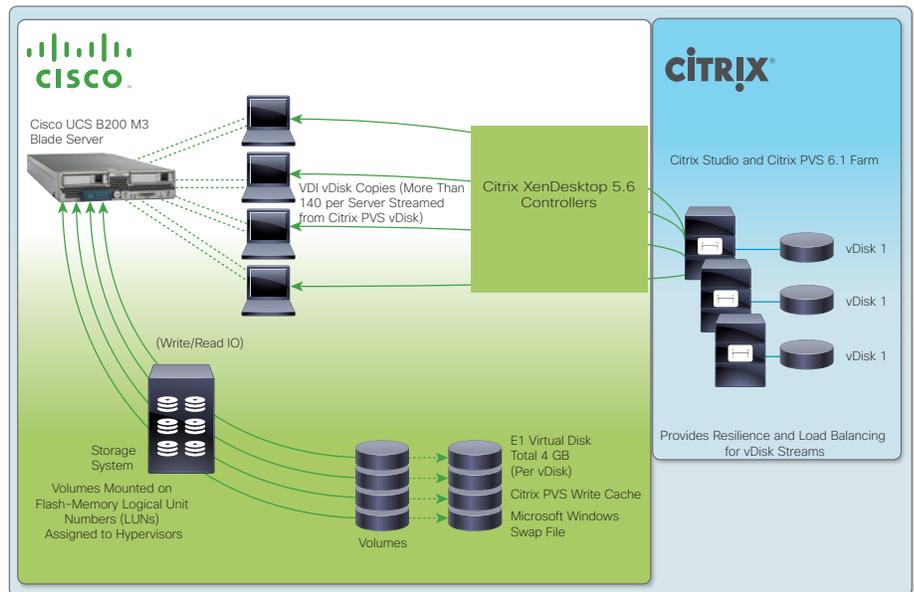


Figure 6. Deployment of Citrix XenDesktop Using Cisco Simplified Architecture or Cisco Scalable Architecture

implementation, the Cisco Simplified Architecture fully supports virtual desktop migration to balance workloads, perform server maintenance, and keep desktops active during a hardware failure.

Architecture Benefits

The Cisco Simplified Architecture supports a high density of persistent desktops, virtual desktops with personal vDisks, and nonpersistent virtual desktops without the costs associated with the purchase and support of an entire SAN infrastructure. The entire hardware infrastructure is managed from a single point, with integration points for VMware vCenter and Microsoft System Center management. This architecture accelerates server deployments, helps ensure continued data security, and greatly reduces complexity and the time and staff needed to manage the infrastructure. It is an excellent starting point for organizations that want to deliver the entire desktop experience that users have come to know and appreciate.

Cisco Scalable Architecture At-a-Glance

Cisco Scalable Architecture for desktop virtualization is a prevalidated, flexible, enterprise-class desktop virtualization architecture that scales from 100 to many tens of thousands of persistent, virtual desktops with personal vDisks and nonpersistent desktops and application delivery.

Cisco Scalable Architecture

Many organizations implement desktop virtualization in phases, deploying perhaps a hundred desktops at a time. These environments require a single architecture that can easily scale with their deployments and with ongoing growth. Such environments require the flexibility to accommodate both persistent, hosted virtual desktops with personal vDisks and nonpersistent hosted virtual desktops using Citrix XenDesktop, supporting multiple different worker types with the utmost resiliency and scalability using a completely shared-storage approach. Applications can be layered on these desktops using Citrix XenApp virtual application delivery. The Cisco Scalable Architecture is excellent for organizations with an existing enterprise SAN investment to which the VDI workload can be added.

This architecture is excellent for:

- Organizations with exiting SAN storage
- New, large-scale desktop virtualization deployments
- Businesses that employ a cloud or shared infrastructure approach in which VDI is one of the workloads

Solution Architecture

The Cisco Scalable Architecture for desktop virtualization (Figure 7) has successfully demonstrated high performance in dense, large-scale environments. This resilient, scalable architecture uses a switched, shared fabric-based approach with a shared-storage infrastructure and scalable domains with many Cisco UCS servers. Organizations can start with a small pilot or PoC deployment and add servers and storage to scale to tens of thousands of persistent and nonpersistent virtual desktops. Businesses can use any combination of storage protocols to implement the shared-storage infrastructure, including Fibre Channel, FCoE, iSCSI, and NAS. In addition, scalable management can be provided using Cisco UCS Manager and Cisco UCS Central Software. Organizations can manage up to 160 Cisco UCS servers and associated networking and storage interconnects using a single Cisco UCS Manager domain, and multiple Cisco UCS deployments, including geographically distributed multisite Citrix XenDesktop and XenApp deployments, with Cisco UCS Central Software. Both Cisco UCS Manager and Cisco UCS Central Software are discussed in greater detail in the section “Scale Management as Virtual Desktop Deployments Grow” on page 17.

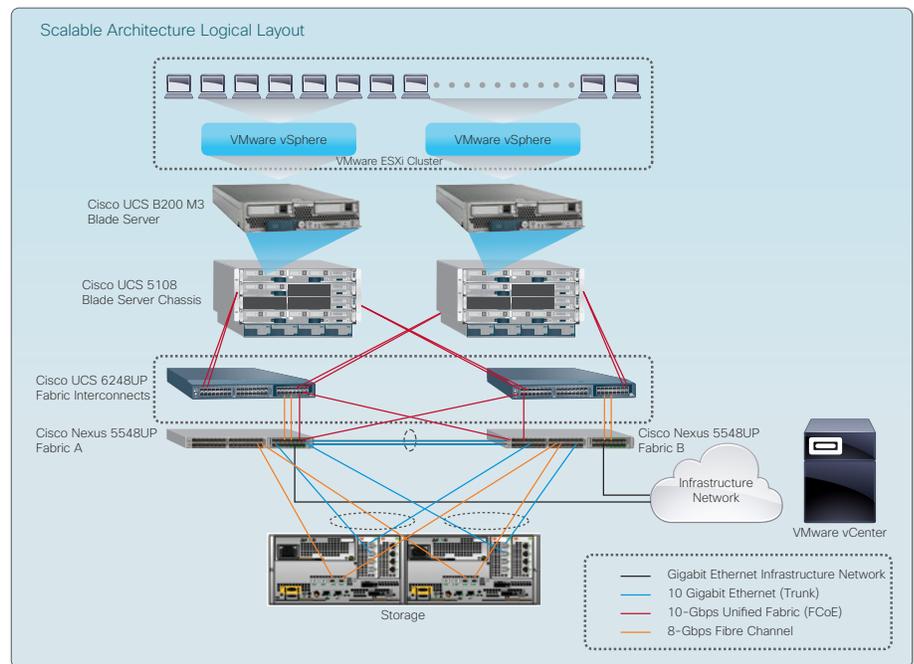


Figure 7. Cisco Scalable Architecture for Desktop Virtualization

Fast Deployment: 5000 Citrix XenDesktop Virtual Desktops Deployed in 30 Minutes

When validating the Cisco Scalable Architecture Cisco Validated Design, the team was able to deploy and configure Cisco UCS, EMC VNX storage, and 5000 Citrix XenDesktop virtual desktops in 30 minutes. See <https://communities.cisco.com/docs/DOC-33330>.

Essential Technology

The Cisco Scalable Architecture offers enterprise-class capabilities to support large numbers of virtual desktops, including no single point of failure with N+1 components, path redundancy for desktop workloads, and N+N redundancy for management components. The redundant fabric interconnects in Cisco UCS provide server aggregation and management with Cisco UCS Manager. Governance domains, or a separation of server, network, and storage administrative roles, can easily be defined in Cisco UCS Manager and Cisco UCS Central Software, allowing consistent configuration and management processes to be propagated throughout the infrastructure.

Storage access support is provided by 10-Gbps Ethernet ports and 8-Gbps Fibre Channel ports out to the storage network. The servers support active-active network virtual PortChannels (vPCs) on the access layer and storage multipathing. Best practices recommend dual links for all peer links, for redundancy.

How It Works

As with the Cisco Simplified Architecture, when the Cisco Scalable Architecture is deployed with Citrix XenDesktop (Figure 8) and XenApp, desktop configurations are created using Citrix PVS and Citrix Studio, propagated to the Cisco server, and placed in the write cache on the shared storage.

When an entire Cisco UCS domain is deployed with Citrix desktop virtualization, numerous Cisco UCS servers are dedicated to a particular virtual machine or virtual desktop-management domain as a building block, each hosting approximately 2500 virtual desktops. For example, with 10 building blocks, a single Cisco UCS domain can support up to 25,000 virtual desktops, with all associated infrastructure managed from a single point. As is expected with a shared-storage implementation,

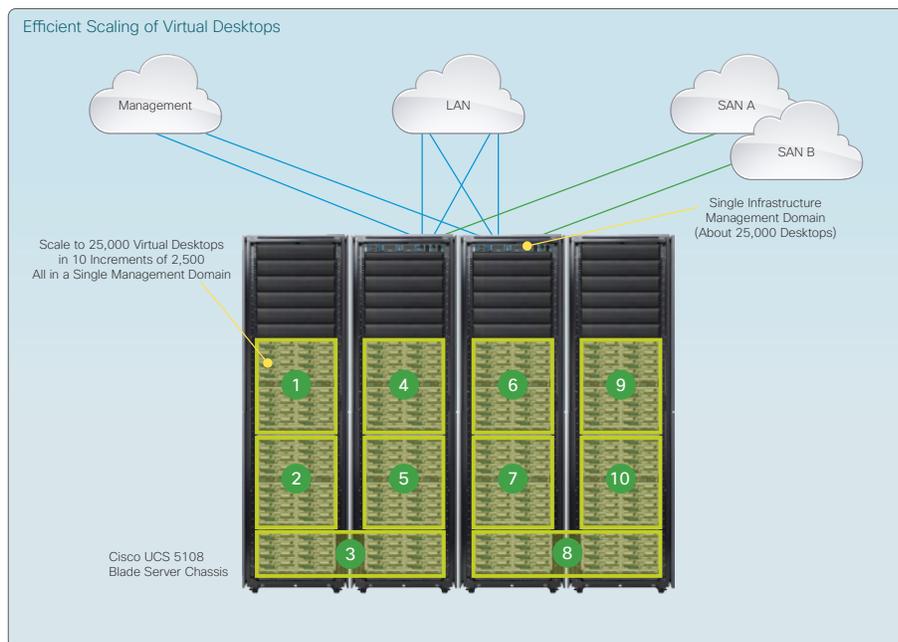


Figure 8. Deployment of Cisco Scalable Architecture Integrated with Citrix XenDesktop

Validated 5000-Seat VDI with Rapid Deployment and Uncompromised Performance

Cisco Scalable Architecture scales linearly to support up to 5000 Citrix XenDesktop users on 39 blades with N+1 fault tolerance at the cluster level. Starting from zero users, 5000 Citrix XenDesktop users were logged in and working in 30 minutes using Cisco Nexus® Family switches, Cisco UCS, EMC VNX storage, and VMware vSphere software. For more information, please visit http://www.cisco.com/en/US/solutions/collateral/ns340/ns517/ns224/ns944/solution_overview_c22-726263.pdf.

Cisco Converged Infrastructure At-a-Glance

Cisco Converged Infrastructure for desktop virtualization is a prevalidated, flexible, enterprise-class VDI built on NetApp FlexPod and VCE coalition Vblock solutions.

Cisco, Citrix, Microsoft, and NetApp Deliver High-Performance Infrastructure for Virtual Desktops

Cisco and its partners deliver more than 2000 virtual desktops using Citrix XenDesktop with Microsoft Private Cloud on NetApp FlexPod. For more information, please visit http://www.cisco.com/en/US/solutions/collateral/ns340/ns517/ns224/ns836/ns978/ns1135/solution_overview_c22-704547.pdf.

the Cisco Scalable Architecture fully supports desktop migration to balance workloads, perform server maintenance, and keep desktops active during a hardware failure.

Architecture Benefits

The Cisco Scalable Architecture enables deployment of a high density of persistent, hosted virtual desktops with personal vDisks and nonpersistent virtual desktops in an enterprise-class, highly available environment. The entire hardware infrastructure can be managed locally with Cisco UCS Manager or scaled for global management with Cisco UCS Central Software, with support for more than a million virtual desktops worldwide. The consistency of management and policy, performed through role-based experts, reduces the complexity of large deployments and accelerates local server deployments for outstanding service. The integration between Cisco UCS Manager and hypervisor management helps ensure continued data security and quality of service (QoS), even when a desktop is moved to another server. These capabilities reduce the time and staff needed for management of this flexible, scalable infrastructure. As a result, the Cisco Scalable Architecture with Citrix XenDesktop and XenApp is an excellent choice for businesses that want to start small, implement desktop virtualization in phases, and scale over time to support thousands of highly available desktops. Businesses can deliver an entire, familiar desktop experience using a building-block approach.

Converged Infrastructure

Businesses seeking to implement virtual desktops often struggle with the amount of time needed to size, test, deploy, and manage the infrastructure, and they tend to have preferred storage vendors. They express many concerns, such as “We do not have several months for a PoC deployment,” “We need VDI now,” and “We cannot deal with the complexity that results from the use of multiple vendors.”

Solutions

For organizations with such requirements, the Cisco Converged Infrastructure for desktop virtualization is available. Built on the technologies of ecosystem partners NetApp and the VCE coalition, these solutions use the VCE coalition Vblock Systems and NetApp FlexPod. The result is a conveniently packaged, prevalidated infrastructure that modularizes data center components into easily consumable building blocks that can be added for scalability. Each unit of infrastructure offers self-contained computing, storage, and network fabric resources coupled with virtualization software. Support converged, to provide support with just one number to call.

Deployment with NetApp FlexPod

Citrix XenDesktop built on NetApp FlexPod is a prevalidated, best-in-class VDI design that accelerates virtual desktop deployments with predefined configurations that scale from 500 to many thousands of virtual desktops. This highly modular solution reduces deployment time and associated risk and cost while boosting IT and end-user agility. Gone are the days when virtual desktops took hours to boot. With NetApp FAS Storage Systems with FlashCache, you can boot and log in to your desktop quickly and effortlessly. To help ensure that service levels are maintained, a consistent QoS is set and monitored at each layer of the infrastructure, even at scale.

Hunter Fan Company, a global manufacturer of ceiling fans and air-quality products, was seeking to enable business growth with an agile infrastructure that would enhance all aspects of the business. As part of this initiative, the company rolled out Citrix XenDesktop and XenApp for desktop virtualization. The result was improved application performance and business continuity with a reduced data center footprint and simplified support. For details, see <http://www.vce.com/asset/documents/hunter-fan-casestudy.pdf>.

Deployment with VCE Coalition Vblock Systems

VCE coalition Vblock Systems are complete, preintegrated, and optimized solutions. The VCE coalition integrates and tests each system before it is delivered to accelerate deployment and help ensure predictable performance. These powerful VDI solutions provide integrated management for the rapid provisioning and decommissioning of virtual desktops, modular scalability, and a resilient and validated architecture. VCE coalition Vblock Systems with Citrix XenDesktop tightly integrate Cisco UCS, EMC storage, and Citrix XenDesktop components and optimize the solution for efficient and effective virtual desktop deployments.

Cisco Converged Infrastructure Benefits

Businesses that take advantage of converged infrastructure designs benefit from:

- Reduced risk through prevalidation
- Ordering simplicity
- Rapid deployment
- Simplified support
- Modular scalability
- Integration of enterprise-class components

Along with these benefits, businesses gain simplified, smooth support through a single support number.

Scale Management as Virtual Desktop Deployments Grow

Simplified management is essential to successful desktop virtualization initiatives. It can greatly reduce the number of service calls and overall TCO of the desktop ecosystem. Cisco UCS is known for the simplified management offered by Cisco UCS Manager and Cisco UCS Central Software.

Cisco UCS Manager

Cisco UCS Manager manages all Cisco UCS components as a single logical chassis with complete visibility across the entire infrastructure, including the onboard storage used by virtual desktops. This role-based management system is embedded in the system fabric interconnects to provide the same simple and consistent configuration for a system of any size: from a single server to 160 servers, blades, or rack form factors. The Cisco UCS Manager GUI enables point-and-click provisioning of new servers in minutes, and it allows IT departments to rapidly meet user demands as the environment grows.

Having a single management domain enables organizations to have a single cohesive view into their virtual desktop systems, application servers, management servers, and even high-end design systems, all within a single management plane (Figure 9).

Cisco UCS Central Software

Cisco UCS Central Software allows IT departments to manage multiple Cisco UCS deployments locally or in multiple locations for global management scalability. The software creates a unified management domain for IT administrators, spanning

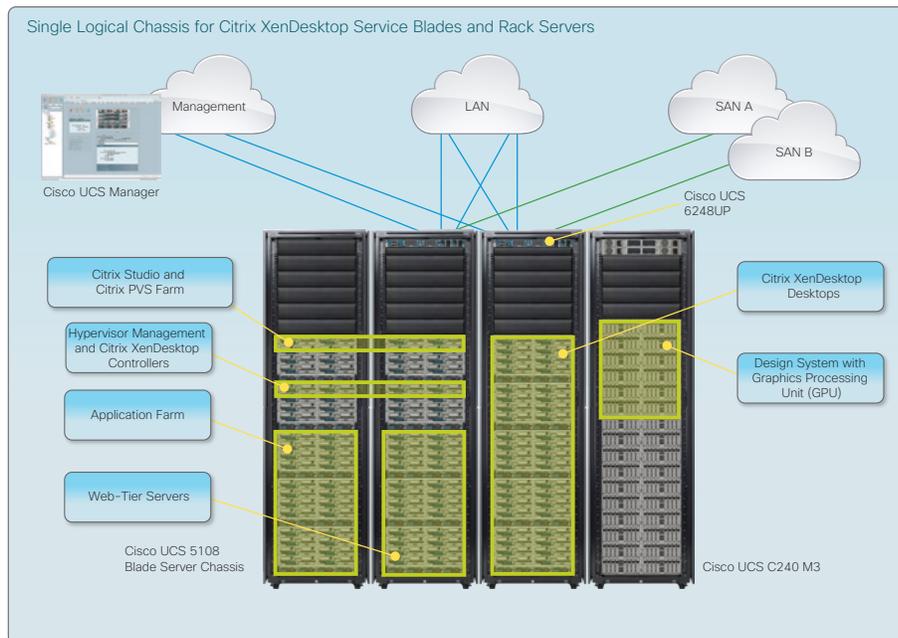


Figure 9. Cisco UCS Manager Integrated with Citrix XenDesktop to Provide Simplified and Consistent Management of the Entire Virtual Desktop Environment

thousands of servers in a single data center, multiple data centers, and data centers deployed around the world. Offering the same model-based architectural framework as Cisco UCS Manager, Cisco UCS Central Software provides a familiar design across all domains (Figure 10). In addition, Cisco has extended the XML API to enable global automation for Cisco UCS domains.

Cisco UCS Central Software globalizes the underlying policy-based management philosophy of Cisco UCS Manager. Multiple Cisco UCS domains can be managed centrally, whether they are in a single data center or spread across multiple data centers. All core management tasks are centralized, such as activities to create, edit, and delete policies and profiles; track inventory; discover faults; update firmware; and refresh consoles. Cisco UCS Central Software also provides the foundation for high availability, disaster recovery, and workload mobility. Whether an organization wants to see the attributes of globally distributed Cisco UCS domains or centrally configure various aspects of a single domain, Cisco UCS Central Software provides a single-pane view to achieve the objective. As a result, IT departments can consistently and easily manage growing infrastructure and continue to save OpEx.

Cisco Desktop Virtualization Solutions Portfolio Solves Traditional VDI Problems

Cisco Desktop Virtualization Architectures help desktop IT managers by providing blueprints for infrastructure that enables a mobile, flexible, productive, global workforce and that enhances the work experience compared to that with traditional desktops. This approach is accomplished with simple, resilient architectures that meet your business size and budgetary needs now and into the future. With the

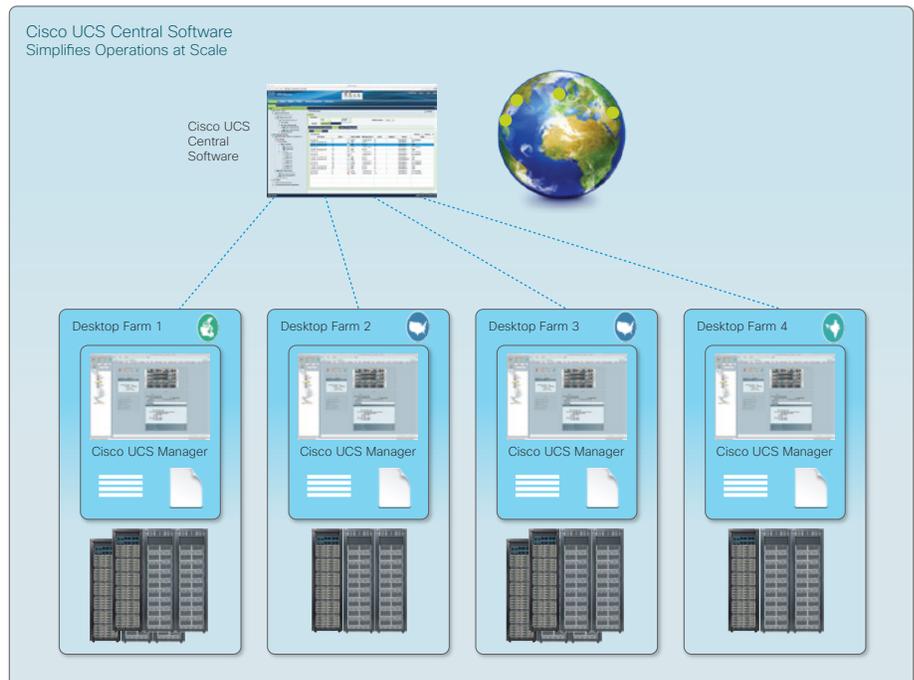


Figure 10. Cisco UCS Central Software Uses Cisco UCS Manager to Simplify Global Operations for Larger Deployments, Locally or in Multiple Locations

linear scalability of both the infrastructure and the management systems, your organization can grow from 10 to tens of thousands of desktops using the same model and taking advantage of administrative knowledge and experience.

Our approach provides the right balance of memory, I/O, and CPU resources for high-performance, cost-effective virtual desktops that deliver effective and efficient end-user support. The radical simplicity of the design enables rapid provisioning of both virtual and physical servers with integration between VMware vCenter or Microsoft System Center and Cisco UCS Manager. With these validated and converged infrastructure solutions, IT departments can accelerate virtual desktop deployment, reduce complexity, simplify management, and reduce call-center activity—all leading to lower acquisition costs and lower TCO.

For More Information

For more information, please visit:

- Cisco Desktop Virtualization solutions with Citrix XenDesktop: <http://www.cisco.com/go/citrix>
- Cisco Validated Designs with Citrix XenDesktop: http://www.cisco.com/en/US/solutions/ns340/ns414/ns742/ns743/ns993/landing_vdi_citrix.html
- Cisco 5000-seat VDI reference architecture for Cisco UCS and Cisco Nexus 1000V Series Switches, Citrix XenDesktop, and EMC VNX: <https://communities.cisco.com/docs/DOC-33330>
- Citrix XenDesktop: www.citrix.com/xendesktop

- Citrix and Cisco alliance: <http://www.citrix.com/cisco>
- Cisco Converged Infrastructure solutions:
 - NetApp FlexPod: <http://www.cisco.com/go/flexpod>
 - VCE coalition Vblock solutions: <http://www.vce.com>
- Cisco UCS Manager: <http://www.cisco.com/en/US/products/ps10281/index.html>
- Cisco UCS Central Software: <http://www.cisco.com/en/US/products/ps12502/index.html>



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