White Paper

Cisco Desktop Virtualization Solution with Citrix XenDesktop: Deliver Desktops and Applications as On-Demand Services

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What You Will Learn

Businesses today face new challenges. Users want limitless flexibility in the ways they get their work done, and IT departments are recognizing the need to reestablish control over their desktops and the mission-critical data that is distributed across their global enterprises. This challenge can be addressed by the Cisco® Desktop Virtualization Solution with Citrix XenDesktop, a solution that enables a more mobile, flexible, and productive workforce. Users gain an uncompromised user experience with access to their applications and data on any supported device, anywhere, and at any time. IT departments transform their operations by securing and centralizing their desktop infrastructure and implementing their virtual desktop solutions with a high-performance, scalable, and agile infrastructure.

The Challenge

As organizations everywhere reassess their end-user computing strategies, they recognize the need to balance the competing requirements of IT departments and users. While users are demanding ever more flexibility, mobility, and choice, IT departments need to reduce cost and complexity; increase security and compliance; establish a high-performance, scalable infrastructure; and choose an agile approach that they can quickly put to work to better meet business needs.

IT departments are recognizing that the cost and risks of maintaining a traditional desktop infrastructure have become untenable. Today's globally distributed, application-laden desktops and laptops are cumbersome and difficult to manage. Over time, each PC in an organization develops its own unique operating system and application image, which leads to problems that must be solved one system at a time. Mission-critical data is distributed across a global pool of resources and cannot be adequately controlled, leading to challenges in complying with governmental and industry regulations. Unforeseen events that limit workplace access threaten business continuity when users depend on their dedicated desktops to be productive. IT departments must respond to business events such as mergers, acquisitions, and expansions, but they are burdened with the task of

integrating or deploying new desktops one PC at a time. To help alleviate the burden of frequent desktop operating system updates, IT departments are seeking an approach to make the transition as swift and cost-effective as possible.

Meanwhile, the challenges of operating in a global economy demand the utmost productivity. To be more effective, users are demanding access to applications anywhere, at any time, and on their choice of devices. User expectations are no longer set by the sophistication of desktop PCs at the office, but instead by a range of new consumer devices including highly featured mobile phones, tablets, and laptop computers that can access wireless networks almost anywhere. Users expect that if their personal devices can load new applications from online stores with click-of-the-mouse simplicity, they should have that same level of choice and empowerment from the IT departments that they believe are there to help make them more effective.

A desktop virtualization approach can solve these problems, but IT departments understand that they must choose the right solution among those available. The solution must be as cost effective as possible. The solution must be simple and easy to deploy. It must scale incrementally as users transition to the solution. Most important of all, the solution must achieve a balance between the needs of users and the needs of the IT department.

The Solution

The Solution Delivers Virtual Desktops and Applications as On-Demand Services to Users Anywhere, at Any Time, and on Their Choice of Devices.

The Cisco Desktop Virtualization Solution with Citrix XenDesktop delivers desktops and applications as on-demand services to users anywhere, at any time, and on their choice of devices. The solution increases mobility and flexibility, resulting in greater productivity across a global workforce. Deployed on a platform built from the start to support virtualized environments, the solution delivers an uncompromised user experience, helps IT departments centralize their desktop operations, secures mission-critical data, and better supports the foundation of any business: its people.

The solution helps IT departments achieve an optimal balance between the needs of users for more mobility, flexibility, and choice and the needs of IT departments to centralize desktop infrastructure, secure mission-critical data, and respond quickly to rapidly changing business requirements. It does all this in a way that is simpler, easier to deploy, more scalable, and more cost effective than many competing solutions.

The Cisco Desktop Virtualization Solution with Citrix XenDesktop combines the industry-leading Cisco Unified Computing System™ (Cisco UCS®) with Citrix XenDesktop and delivers desktops and applications as on-demand services. The more centralized that desktops are, the more important that attributes such as performance and reliability become. The solution is powered by high-performance, reliable Intel® Xeon® processors, and its reach can be extended through the performance and security of Cisco's end-to-end networking technology. The result is an uncompromised user experience for every user in the enterprise.

Cisco UCS: Excellent Platform for Desktop Virtualization

Cisco UCS offers several compelling advantages for desktop virtualization, including scalability, simplicity, and end-to-end security. The Cisco Desktop Virtualization Solution with Citrix XenDesktop is a fully integrated solution that is open and validated from end to end with Citrix technologies.

- **Scalability:** The solution is highly scalable, with the capability to host a large number of virtual desktops per server and the capability to add new servers with little infrastructure cost.
- **Simplicity:** The service profiles feature in Cisco UCS Manager enables fast, accurate provisioning of bare-metal Cisco UCS blade and rack servers, compatible modularity between Cisco UCS and Citrix software components, and simplified unified management that spans multiple virtual machines.
- **Security:** The solution's security is optimized through segmentation and firewalling of desktops and virtual machines. This isolation is implemented using the Cisco Nexus® 1000V Switch, the Cisco Virtual Security Gateway for the Cisco Nexus 1000V Switch, role-based access control (RBAC), and comprehensive desktop-aware policies and administration.
- **Lower cost:** The solution's lower TCO results from the Cisco UCS architecture with its unified fabric and unified management. The solution also achieves cost benefits from simplified redundancy domains and reduced spare-pool requirements for large deployments.

The Cisco Desktop Virtualization Solution with Citrix XenDesktop includes reference architectures and Cisco Validated Designs that describe how to configure the Cisco UCS, Cisco Nexus switching, and Citrix XenDesktop software. The solution has an open architecture that allows customers to choose the hypervisor that best suits their needs, including Citrix XenServer, Microsoft Windows 2008 Release 2 (R2) Hyper-V, and VMware vSphere. The Cisco Validated Designs and reference architectures help accelerate deployment and reduce risk for a broad portfolio of Cisco's newest desktop virtualization solutions, including simplified and scalable architectures. Cisco Validated Designs also help accelerate deployment for pooled (nonpersistent), persistent (virtual disk [vDisk]), and graphics-intensive application use cases.

Mobile, Flexible, Productive Workforce

The Cisco Desktop Virtualization Solution with Citrix XenDesktop provides Microsoft Windows desktops and applications as on-demand services that can be accessed from traditional PCs, Macs, thin clients, smartphones, and tablets. The solution increases workplace flexibility, business continuity, user mobility, and productivity.

The solution delivers desktops and applications as on-demand services. Powered by Cisco UCS and delivered end to end by Cisco networking, Citrix FlexCast delivery technology provides a range of options that can be tailored to meet the needs of specific users or groups of users. Different types of users across the enterprise have different performance and personalization requirements. Some require simplicity and standardization, and others need high performance or a fully personalized desktop. With Citrix FlexCast technology, IT departments can deliver every type of virtual desktop and application, hosted or local, physical or virtual, each specifically tailored to meet the performance, security, and flexibility requirements of individual users.

This on-demand application delivery is supported by the stateless architecture of Cisco UCS, which allows IT departments to deploy new desktop and application virtualization infrastructure in minutes, rather than the days or weeks required to deploy traditional infrastructure. So while the solution's desktop and application-delivery mechanisms make users more productive, the solution's foundation helps IT departments be more productive as well.

Uncompromised User Experience

The Cisco Desktop Virtualization Solution with Citrix XenDesktop delivers a customized user experience that rivals that of a local PC. Citrix HDX technology delivers a high-definition user experience that offers greater reliability and higher availability than traditional PCs, regardless of location, even when using multimedia, real-time collaboration, USB peripherals, and 3D graphics. Users are empowered to select and deploy the applications they need, and they are also freed from the problems that plague traditional PC environments. Centralized management of desktops and applications reduces susceptibility to viruses and conflicts between dynamic linked libraries, increasing availability and user productivity.

The solution, based on Intel Xeon processor–powered servers, delivers higher performance for virtualized applications and desktops by accelerating the processing of virtual desktop infrastructure (VDI) and session-based desktops, and it does so with a higher virtual machine density than other solutions can provide, lowering capital costs.

The solution excels because of its integrated, 10-Gbps unified fabric, which accelerates application responsiveness and performance by providing a low-latency network infrastructure. The unified fabric accelerates the streaming of desktops and applications to users. It improves virtual desktop performance by delivering improved storage throughput and increasing the number of I/O operations per second (IOPS) that the infrastructure can provide. It provides an intelligent and scalable foundation for LAN and SAN convergence, and it reduces costs because only one network, instead of two parallel networks, needs to be deployed. Beyond the data center, Cisco and Citrix WAN optimization technologies optimize virtual desktop delivery over the WAN, helping maintain a superior user experience for a global, mobile workforce.

High-Performance, Scalable, and Agile Infrastructure

Virtual desktop environments require a high-performance, flexible, and reliable infrastructure. Cisco UCS incorporates a unique set of innovations that makes it an excellent platform for desktop virtualization.

Virtual desktop environments must be able to be deployed rapidly and scale linearly as more users transition from traditional PCs. Cisco UCS is designed as a cohesive, stateless system whose entire end-to-end server and networking infrastructure is wired once and then configured through software. The solution includes predefined, downloadable Cisco service profiles that help make Citrix XenDesktop deployment and scaling fast and error free.

Microsoft Windows updates and a new generation of applications demand a new balance between a server's memory capacity and its processing power. Cisco UCS provides an economical memory footprint in its blade and rack servers, and when

used in combination with the Intel Virtualization Technology built into every Intel Xeon processor, the platform brings higher performance, scalability, and agility at a lower cost than comparable incumbent systems.

High network bandwidth and low latency enhances the user experience by making data center–hosted virtual desktops respond as if they were running locally. The 10-Gbps unified fabric of Cisco UCS helps the solution provide high-performance desktop and data access to users by accelerating the streaming of desktops and applications to users and by reducing latency and increasing the bandwidth for server storage access. Based on 10 Gigabit Ethernet and Fibre Channel over Ethernet (FCoE), the system dramatically simplifies rack-level cabling by eliminating the need for a redundant set of adapters, cables, and switch ports to support storage access separately from network traffic. This simplicity reduces cost and complexity, increases scalability, and decreases power consumption.

Virtual desktop environments use large numbers of virtual machines. In traditional virtualized environments, least-common-denominator security is often applied to the networks that support virtualization pools, to facilitate virtual machine mobility. Cisco UCS supports virtualization-aware networking that allows virtual links connected to virtual machines to be secured and managed just like physical links, ending the need to compromise security and control to support virtualization. The solution incorporates Cisco virtual interface cards (VICs), which support all the hypervisor and virtual machine networking requirements with a single PCI interface. It also incorporates the Cisco Nexus 1000V Switch, a full-featured Cisco switch that increases security and control while implementing virtualization-aware networking.

Secure IT Operations and Increased Compliance

One of the most significant challenges that an IT department must address is how to regain control of thousands of unique and vulnerable desktop images scattered across the world. With the Cisco Desktop Virtualization Solution with Citrix XenDesktop, IT departments can choose to never allow data to leave the data center. Citrix XenDesktop protects mission-critical data with secure connectivity and multifactor authentication that helps ensure that only authorized users connect to specified applications and data. In this way, intellectual property is protected according to organizational policies, and IT departments are empowered with the tools they need to meet government and industry regulations.

The solution's single-instance management enables IT departments to separate devices, operating systems, applications, and user personalization to maintain a single master image of each. Instead of juggling thousands of static, unique, and vulnerable desktop images, IT departments can manage everything from a central location. This capability dramatically reduces the need for ongoing patching and maintenance efforts, with users running approved application and operating system images that have centrally approved patches and security settings.

For hosted virtual desktops (HVDs), Cisco Data Center Virtual Machine Fabric Extender (VM-FEX), a critical Cisco UCS technology, provides network visibility and control all the way to individual virtual machines, making the management of virtual links (including VLANs, quality of service [QoS], and security) equivalent to the management of physical links. This greater level of security helps IT departments centralize their network security policies, tightly control and isolate communication

paths from virtual machines, and enhance virtual machine mobility by maintaining network profiles regardless of virtual machine location.

Citrix XenDesktop

Citrix XenDesktop is a desktop virtualization solution that delivers Microsoft Windows desktops as an on-demand service to any user anywhere. With Citrix FlexCast delivery technology, XenDesktop can quickly and securely deliver individual applications or complete desktops to users across the entire enterprise, whether they are task workers, knowledge workers, or mobile workers. Users now have the flexibility to access their desktops on any device, at any time, with a high-definition user experience. With Citrix XenDesktop, IT departments can manage single instances of each operating system, application, and user profile and then dynamically assemble them to increase business agility and greatly simplify desktop management. Citrix XenDesktop's open architecture enables customers to easily adopt desktop virtualization using any hypervisor, storage, or management infrastructure.

Any Device, Any Time, Anywhere

Today's digital workforce demands the flexibility to work from anywhere at any time using the worker's choice of devices. Using Citrix Receiver as a lightweight universal client, Citrix XenDesktop users can access their desktops and corporate applications from any PC, Mac, thin client, or smartphone. This solution enables complete workplace flexibility, business continuity, and user mobility.

Citrix HDX User Experience

Citrix XenDesktop 4 delivers a Citrix HDX user experience on any device, over any network, with greater reliability and higher availability than with a traditional PC. Citrix HDX technology uses adaptive orchestration to seek a balance between server, network, and client capabilities to deliver the best possible user experience. With Citrix HDX technology, users get an experience that rivals that of a local PC, even when using multimedia, real-time collaboration, USB peripheral devices, and 3D graphics. New webcam and voice-over-IP (VoIP) support, improved audio, 3D graphics support, and support for Cisco Wide Area Application Services (WAAS) help ensure that users can get a high-definition user experience regardless of their location.

Citrix FlexCast Delivery Technology

Different types of workers across the enterprise have different performance and personalization requirements. Some require simplicity and standardization, and others need high performance or a fully personalized desktop. Citrix XenDesktop can meet all these requirements with a single solution with the unique Citrix FlexCast delivery technology. Citrix FlexCast helps IT departments deliver every type of virtual desktop, hosted or local, physical or virtual, each specifically tailored to meet the performance, security, and flexibility requirements of the individual user.

On-Demand Applications with Citrix XenApp

To reduce desktop management costs and complexity, Citrix XenApp virtualizes applications through integrated application streaming and isolation technology. Citrix XenApp is unique in that it is a complete system for application delivery, offering both online and offline application access through a combination of application

hosting and application streaming directly to user devices . Citrix XenApp can help IT departments control data access, reduce the number of desktop images that need to be managed, eliminate system conflicts, and reduce application regression testing, making Citrix XenApp an important element of successful desktop virtualization. The addition, updating, and removal of applications become simple tasks because users can make use of a self-service application store that enables them to access applications instantly from anywhere.

Open Architecture

Citrix XenDesktop works with the industry-leading hypervisors, storage systems, and Microsoft software, enabling IT departments to use their current investments while giving them the flexibility to add or change components in the future. Whether you are using Citrix XenServer, Microsoft Hyper-V, or VMware vSphere, Citrix XenDesktop provides support, and it simplifies management of networked storage using Citrix StorageLink technology. Citrix XenDesktop also closely integrates with Microsoft App-V and System Center for application management.

Cisco Unified Computing System

Cisco UCS is a single unified system with configuration automated through integrated, model-based management to simplify and accelerate deployment of enterprise-class applications and services running in bare-metal, virtualized, and cloud-computing environments. When used as the foundation for the Cisco Desktop Virtualization Solution with Citrix XenDesktop, the system brings lower TCO, greater performance, improved scalability, increased business agility, and investment protection.

Cisco UCS represents a major evolutionary step away from the current state of the art, which relies on systems in which individual components must be configured, provisioned, and assembled to form a solution. Instead, Cisco UCS is designed to be stateless. It is installed and wired once, with its entire configuration, from RAID controller settings and firmware revisions to network configurations, determined in software by its integrated, embedded management function.

The system is designed to radically simplify the way in which the Cisco Desktop Virtualization Solution with Citrix XenDesktop is deployed. The system integrates servers with intelligent Intel Xeon processors with a 10-Gbps unified fabric that carries all IP networking and storage traffic, eliminating the need to configure multiple parallel IP and storage networks at the rack level. The solution dramatically reduces the number of components compared to other implementations, reducing TCO, simplifying and accelerating deployment, and reducing the complexity that can be the source of errors that can cause downtime.

As described in the architectural discussion that follows, the system eliminates switching in blade server chassis and at the top of individual racks, and it reduces by a factor of three the number of switching and management devices needed. This approach decreases the number of cables and upstream switching devices needed by half and eliminates the need for costly and fragile fiber connections within racks, and the integrated, embedded management function gives the system a single point of management. Compare this to traditional blade server approaches, which

use dual Ethernet switches, dual Fibre Channel switches, and dual management modules in each chassis (Figure 1).

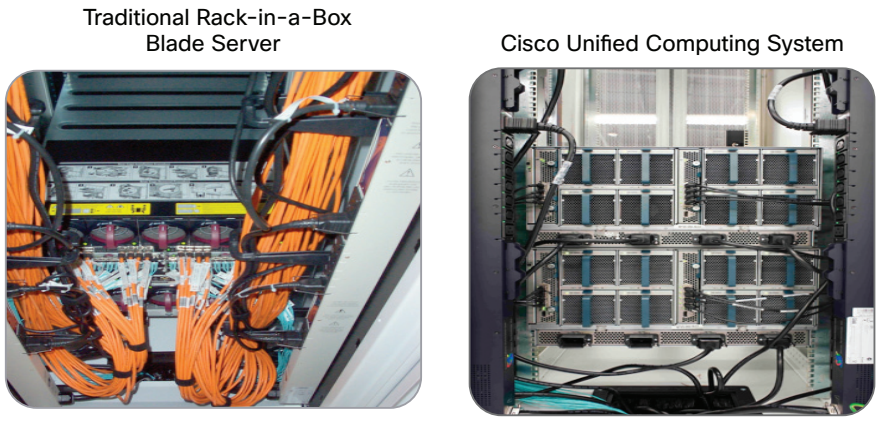

Figure 1. The Radical Simplicity of Cisco UCS Is Demonstrated by the Dramatic Reduction in Rack-Level Cabling Compared to Traditional Architecture

The system is designed to be form-factor neutral. The core of the system is a pair of fabric interconnects that link all the computing resources together and integrate all system components to a single point of management. Today, blade server chassis and rack servers are integrated into the system through fabric extenders that bring the system's 10-Gbps unified fabric into each chassis or rack (Figure 2). Cisco UCS Manager integrates all servers into a single cohesive system, enabling a blade or rack server deployment approach that best suits each organization's needs.

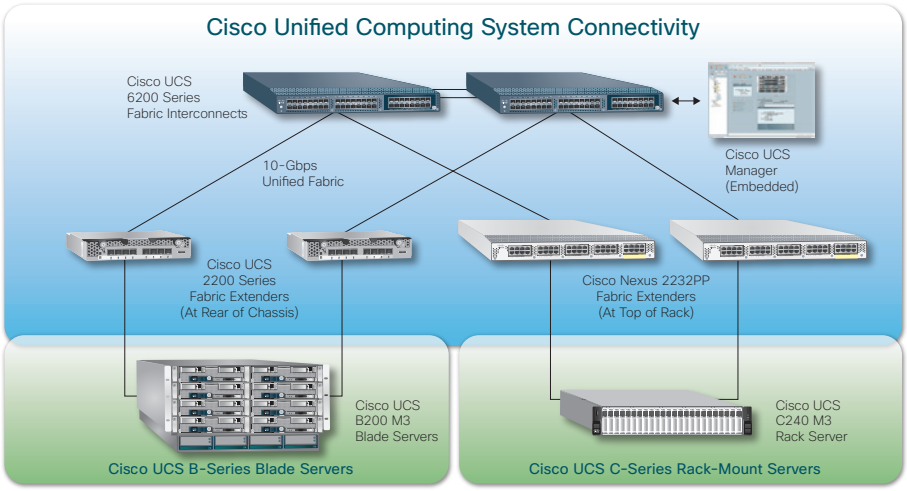

Figure 2. Cisco UCS Integrates Blade and Rack Servers with a 10-Gbps Unified Fabric Through a Single Point of Management

Cisco UCS is built from the foundation to accommodate future technologies without requiring major equipment upgrades. The blade server chassis is built with the power and cooling capacity to accommodate future generations of processors. The Cisco UCS blade chassis midplane is equipped to provide scalable networking capacity to each of the chassis' eight half-width slots so that I/O capacity can be increased in the future without the need to change the blade server chassis.

Integrated, Embedded Management and Cisco Service Profiles

Traditional solution designs involve the manual assembly of components, with management capability added as an afterthought. Management servers and networks must be assembled, configured, and maintained. Blade chassis contain multiple management systems that must be wired and configured, and firmware that must be kept up to date. Individual element managers must be used to configure system components, including RAID controller settings and firmware; BIOS firmware and settings; and firmware revisions and settings for network components such as network interface cards (NICs), host-bus adapters (HBAs), and blade-server-resident switches. Although some vendors claim that this type of solution constitutes integrated management, if it requires a management server and manual configuration, the solution is not integrated.

Cisco UCS offers true integrated, centralized, embedded management. Cisco UCS Manager resides on the Cisco UCS 6200 Series Fabric Interconnects and operates with high availability when two fabric interconnects are used, as they are in the Cisco Desktop Virtualization Solution with Citrix XenDesktop. Logically, every system component is aggregated into the system and managed as if it were part of the fabric interconnects. Physically, components are distributed among data center racks and blade server chassis. Cisco UCS Manager acts as an element manager that allows every component to be configured from a single pane. For organizations that want to integrate Cisco UCS with higher-level management tools, Cisco UCS Manager can export configuration information for use by ITIL processes (including configuration-management databases). It also offers a robust XML API to facilitate deep integration with broader systems management tools.

Cisco UCS Manager offers flexible, role-based management that helps organizations make more efficient use of their limited administrative resources by allowing administrators to focus on the definition of policies to provision computing infrastructure and network connectivity, and automating the actual provisioning. Cisco UCS Manager uses Cisco service profiles to provision servers and their I/O properties.

The system and its resources are stateless, and Cisco service profiles contain all the information needed to fully define and provision a server (Figure 3), including RAID levels, BIOS settings, firmware revisions and settings, adapter identities and settings, VLAN and VSAN network settings, network QoS, and data center connectivity.

The Cisco Desktop Virtualization Solution with Citrix XenDesktop uses predefined, downloadable service profiles that provision each of the solution's server components, allowing the solution to be deployed rapidly and accurately in minutes, rather than the days or weeks required when each data center subject-matter expert must use an individual element manager to configure each component in the expert's domain.

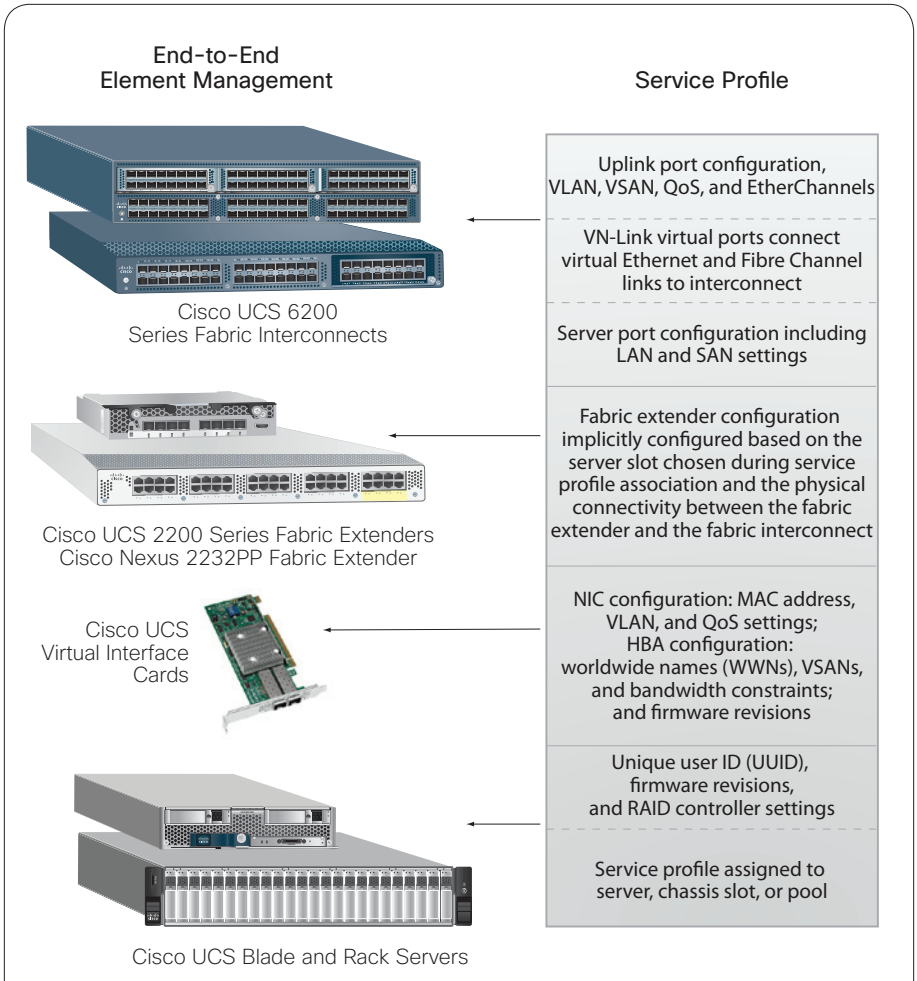

Figure 3. Cisco UCS Service Profiles Provide Automatic, End-to-End Configuration of the Entire Hardware Stack

Cisco UCS Manager service profiles provide immense benefit to the solution. They transform the time-consuming, error-prone, manual assembly of components into a policy-based click-of-the-mouse operation. They accelerate infrastructure scaling by allowing organizations to add incremental resources and put them to work more quickly and accurately. Servers can be pooled, and service profiles can be assigned to specific slots, so that any server inserted into the slot is provisioned and put to work automatically. Service profiles enable true workload portability, so that if a server upgrade is required, an existing service profile can be applied to the upgraded server and put into service within minutes. Service profiles also reduce the number of spares that an organization needs to maintain, because a single spare can be put to any use rapidly simply by invoking the applicable service profile.

Unified Fabric and Fabric Extenders

A major building block of Cisco UCS is the dual 10-Gbps unified fabric, which accelerates both IP and storage traffic. This unified fabric enhances the solution's capability to deliver a high-definition user experience and increase server performance and allows the infrastructure to scale without the network's limiting

performance. The unified fabric supports all the I/O requirements of today's hypervisors, including network isolation for specific functions such as hypervisor storage access, console use, and virtual machine movement.

The fabric is based on 10 Gigabit Ethernet with standards-based extensions including FCoE and IEEE Data Center Bridging (DCB). These enhancements contribute to the system's simplicity because a single network fabric meets all server I/O needs and requires only a small number of adapters, cables, and switches to install or scale the infrastructure. Ethernet extensions, including Priority Flow Control (PFC), allow FCoE traffic to be managed as a separate, lossless traffic class so that the implementation of FCoE is completely consistent with Fibre Channel networking requirements. PFC also allows storage traffic to be shaped and managed independently of IP traffic. In total, the unified fabric provides access to IP-based storage (including Network File System [NFS] and Small Computer System Interface over IP [iSCSI]), native Fibre Channel SANs, and FCoE-ready devices such as the NetApp FAS3140 and FAS3170 storage systems included as part of the solution's reference architecture.

Cisco UCS 6200 Series Fabric Interconnects

The unified fabric is implemented by a pair of Cisco UCS 6200 Series Fabric Interconnects, with fixed unified ports and expansion module slots. This low-latency, line-rate series of interconnects provides all the necessary downstream bandwidth to the solution's blade server chassis. It can connect upstream to standard Ethernet switches and storage systems. The fabric interconnects' cut-through architecture and jumbo-frame capacity reduce latency and increase bandwidth to 10 Gigabit Ethernet–equipped storage systems from vendors, including NetApp and EMC. The fabric interconnects' unified ports enable organizations to directly connect to native Fibre Channel networks simply by populating a port with the proper transceiver. Fabric interconnect port capacity can be extended with expansion modules that increase the number of unified ports.

Traditional rack-in-a-box blade server implementations fragment the network access layer and add two more points of management per chassis by requiring chassis-resident Ethernet switches for connectivity. Cisco's approach is to use Cisco UCS 2200 Series Fabric Extenders to bring the unified fabric and management capability to each blade server chassis. The fabric extenders are logically part of the fabric interconnects, with their configuration and firmware managed implicitly by the parent fabric interconnect. The fabric extenders are physically part of the blade server chassis, and thus they distribute the system's network, storage, and management connectivity needs without adding another device that needs to be managed. This approach enables scalability without adding complexity, an essential characteristic for meeting the infrastructure-on-demand requirements of desktop virtualization.

Virtualization-Optimized Computing Resources

Achieving the best price-to-performance ratio in a virtual desktop environment requires an efficient, scalable, infrastructure that is optimized for the unique workload requirements of virtualized environments. The Cisco Desktop Virtualization Solution with Citrix XenDesktop can be optimally implemented using Cisco UCS B-Series Blade Servers housed in Cisco UCS 5108 Blade Server Chassis, or on Cisco UCS C-Series Rack Servers. The Cisco UCS B-Series Blade Servers use the Cisco VIC 1280 and 1240, which provide access to up to 80 Gbps of I/O

bandwidth. Cisco UCS C-Series Rack Servers use the PCI Express (PCIe) form-factor Cisco UCS VIC 1225, which scales up to 20 Gbps of I/O bandwidth.

Cisco UCS 5100 Series Blade Chassis

The blade chassis are six-rack-unit (6RU) devices that have removable partitions to allow them to contain up to eight half-width blade servers or up to four full-width blade servers. Every component except the midplane is customer replaceable. Efficient power supplies are configurable as nonredundant, N+1 redundant, or grid redundant. The chassis' eight fans are hot swappable, all cables enter from the rear of the chassis, and all blade servers are front-panel accessible.

Cisco UCS B200 M3 Blade Server

The Cisco UCS B200 M3 Blade Server is used to populate the solution's virtual desktop server farm. The server is a half-width, 2-socket server designed to increase performance, energy efficiency, and flexibility for demanding virtualized applications.

The Cisco UCS B200 M3 harnesses the power of the Intel Xeon processor E5-2600 product family, with up to 768 GB of RAM, two hard drives, and up to eight 10 Gigabit Ethernet ports to deliver exceptional levels of performance, memory expandability, and I/O throughput for nearly all applications. In addition, Cisco UCS has the architectural advantage of not having to power and cool switches in each blade chassis. Having a larger power budget available for blades enables Cisco to design uncompromised expandability and capabilities in its blade servers, as evidenced by the new Cisco UCS B200 M3 and its leading memory and drive capacities, which result in outstanding performance.

Cisco UCS B200 M3 Blade Server

The server's memory capacity, combined with 16 powerful processor cores, establishes a new balance between the large memory requirements of environments such as Microsoft Windows and the processing power required to support a large number of virtual desktops. This balance is crucial to the solution's cost effectiveness. Cisco's measurements show that the Cisco UCS B200 M3 Blade Server can support up to 182 Microsoft Windows 7 virtual desktops per server, with 384 GB of memory, based on a knowledge-worker profile. The solution has an open architecture that can run on the IT department's choice of hypervisor, including Citrix XenServer, Microsoft Windows 2008 R2 Hyper-V, and VMware vSphere. The Cisco UCS B200 M3 Blade Server's memory capacity, supporting up to 768 GB, is used by all three hypervisors to increase virtual machine density and reduce capital costs per virtual desktop.

Cisco Virtual Interface Cards

The Cisco Desktop Virtualization Solution with Citrix XenDesktop uses the Cisco UCS VIC best suited for the customer's choice of hypervisor. The solution uses Cisco VICs for two different server types:

- **Cisco UCS B-Series Blade Servers:** The Cisco UCS VIC 1240 and 1280 are optimized for virtualization and provide up to 256 virtual devices, including any combination of NICs and HBAs. The Cisco UCS B200 M3 can accommodate a modular LAN-on-motherboard (mLOM) form-factor Cisco UCS VIC 1240 and an additional Cisco VIC 1280 or a port-expander card in the mezzanine slot to provide access to up to 80 Gbps of I/O bandwidth. In addition, the Cisco UCS VIC 1240 and 1280 support the Cisco Data Center VM-FEX technology, which

extends the fabric interconnect ports to virtual machines, simplifying server virtualization deployment.

- **Cisco UCS C-Series Rack Servers:** The Cisco UCS VIC 1225 is a dual-port PCIe card that supports a policy-based, stateless, agile server infrastructure that can present up to 256 PCIe standards-compliant interfaces to the host that can be dynamically configured as either NICs or HBAs. In addition, the Cisco UCS VIC 1225 supports Cisco Data Center VM-FEX technology, which extends the Cisco UCS fabric interconnect ports to virtual machines, simplifying server virtualization deployment.

Virtualized I/O and Cisco Data Center VM-FEX Technology

Virtualized environments are I/O intensive, and best practices for software such as the VMware vSphere hypervisor require the use of separate, redundant NICs and HBAs for functions including VMware vmconsole, vmkernel, and vMotion and virtual machine traffic and storage access functions. In traditional server environments, each server needs to be equipped with the appropriate number of interfaces, with each interface cabled to upstream Ethernet and Fibre Channel switches. At this point, the server is for all practical purposes dedicated to a single function for its entire lifecycle due to the time and complexity of equipping it to run different applications.

Cisco UCS is stateless down to the type and number of I/O devices installed in a server, allowing just-in-time provisioning of such fundamental characteristics as I/O interfaces. This approach accelerates virtual infrastructure deployment, supports true workload portability, and extends the lifecycle of servers because they can be repurposed simply by applying a different Cisco service profile to them. This virtualized I/O capability is enabled by the Cisco UCS VIC, which can be configured to provide up to 256 virtual devices per server. These are standard PCIe devices that appear on the server's PCIe bus. The actual number of available interfaces is determined by upstream switch resources. A single Cisco VIC can thus support all of a hypervisor's I/O requirements with a single interface. It also can provide superior network throughput through its support for a separate I/O queue for each device (Figure 4).

The Cisco Desktop Virtualization Solution with Citrix XenDesktop uses Cisco Data Center VM-FEX technology to provide exceptional visibility into and control over network links connected to hypervisors and virtual machines. Cisco Data Center VM-FEX technology makes virtual links visible and manageable just as physical links are. Now network security, QoS, and network settings can be applied on a per–virtual machine basis, and these settings will remain constant regardless of the virtual machine location. This capability overcomes the limitations of the least-common-denominator security that is often applied in virtualized environments to facilitate virtual machine movement.

Cisco Data Center VM-FEX technology is implemented in both hardware and software. The Cisco UCS VIC implements Cisco Data Center VM-FEX in hardware, and as Figure 4 illustrates, each NIC and HBA that provides connectivity for the hypervisor and virtual machines is connected to a virtual link that terminates in the parent fabric interconnect. To support the virtual desktop server farm, Cisco Data Center VM-FEX is also implemented in software by the Cisco Nexus 1000V

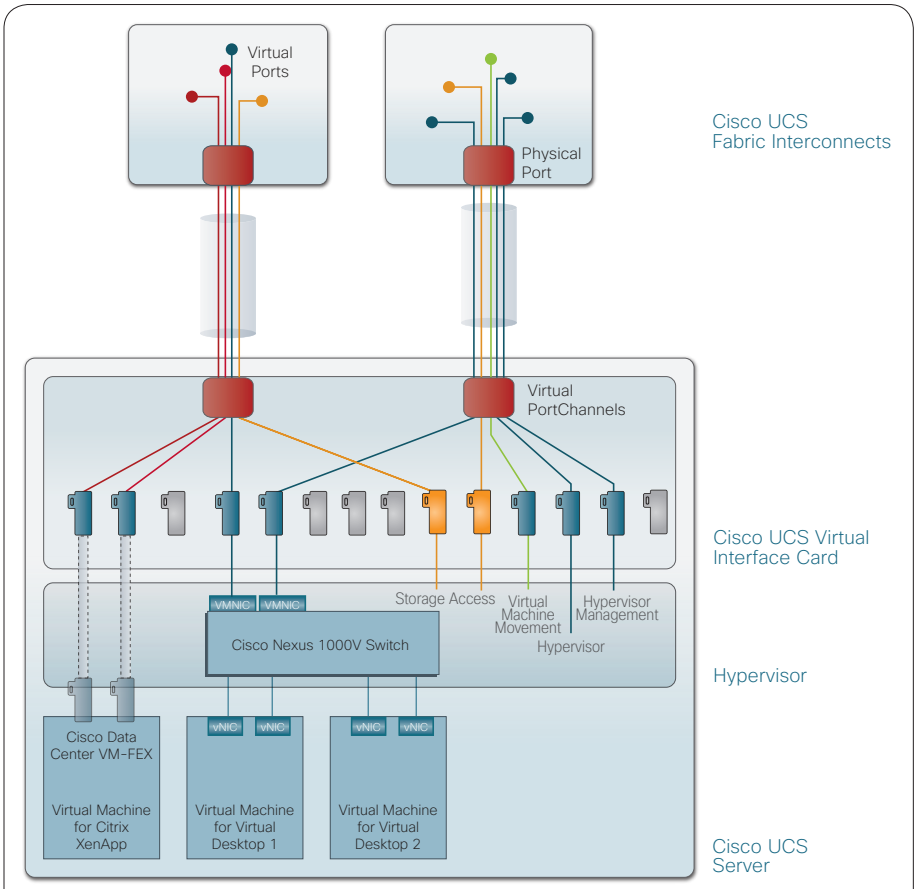

Figure 4. Cisco VICs Can Meet the Needs of the Hypervisor, Citrix XenDesktop, and Citrix XenApp in a Single PCIe-Compliant Interface Card

Switch. This full-featured Cisco switch can be embedded in the VMware vSphere or Microsoft Windows hypervisors, as shown in Figure 4. The Cisco Nexus 1000V establishes a virtual link to each virtual desktop and allows that virtual link to move automatically when a virtual desktop is moved between servers to balance the workload.

Solution Architecture

Cisco packages the Cisco Desktop Virtualization Solution for Citrix XenDesktop as a set of modular building blocks that are used to build the larger reference architecture defined by a Cisco Validated Design. Packaging the solution as a set of building blocks accelerates solution deployment while providing a straightforward, incremental path to accommodate growth. The solution's packaging is designed to give organizations a way to implement a proof-of-concept design or establish an initial desktop virtualization infrastructure for production use. Refer to www.cisco.com/go/quickcatalog for details.

- **Cisco UCS Starter Bundle 1 for Desktop Virtualization:** This bundle supports up to 300 Citrix XenDesktop users or up to 350 Citrix XenApp users. Based on four Cisco UCS B200 M3 Blade Servers, this package establishes servers optimized

to support Citrix management software and an initial virtualization farm to support virtual desktops.

- **Cisco UCS Starter Bundle 2 for Desktop Virtualization:** This bundle supports up to 400 Citrix XenDesktop users or up to 500 Citrix XenApp users. Based on six Cisco UCS B200 M3 Blade Servers, this package establishes servers optimized to support Citrix management software and an initial virtualization farm to support virtual desktops.
- **Cisco UCS Starter Bundle 3 for Desktop Virtualization:** This bundle supports up to 300 Citrix XenDesktop users or up to 350 Citrix XenApp users using six Cisco UCS C220 M3 Rack Servers.
- **Cisco UCS Small and Medium-Sized Business (SMB) Bundle:** This bundle supports up to 75 Citrix XenDesktop users or 100 Citrix XenApp users. This bundle is a standalone solution that uses a single Cisco UCS C240 Rack Server to support Citrix XenDesktop or Citrix XenApp users.

For details about this design, refer to the Cisco Validated Design at www.cisco.com/go/vdi.

All these solutions can be expanded to support more capacity through the use of expansion packs.

Reference Architecture and Cisco Validated Designs Overview

Cisco Validated Designs and reference architectures reflect the tested, prevalidated designs that Cisco develops for implementing the Cisco Desktop Virtualization Solution with Citrix XenDesktop, and they illustrate how organizations can incorporate the Cisco Desktop Virtualization Solution for Citrix XenDesktop into their own data centers.

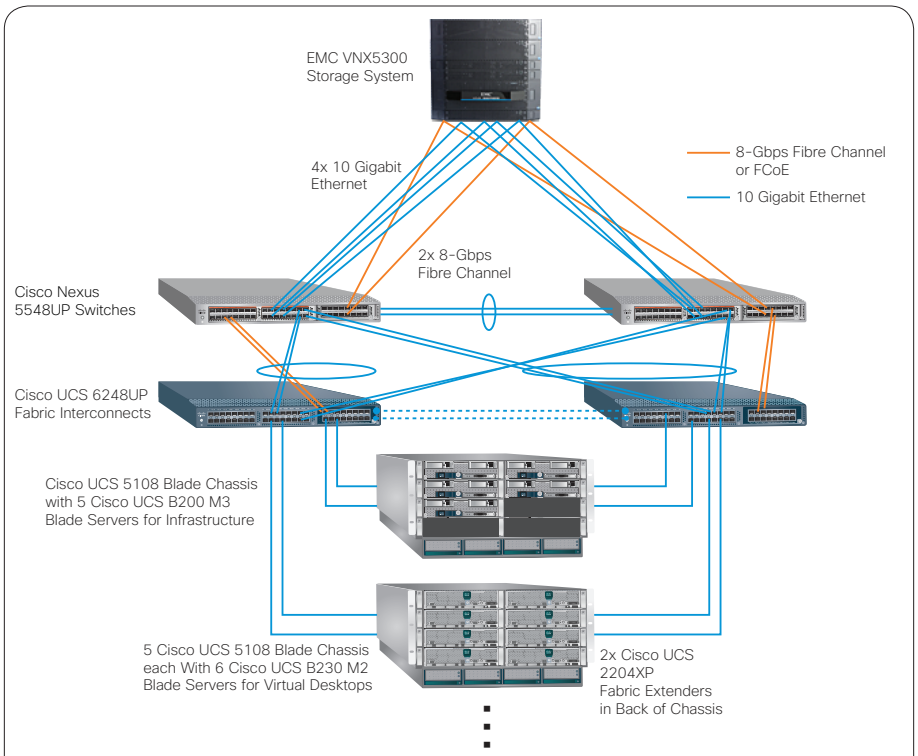

Figure 5. System Configuration Supporting 5000 Users

Proven Scalability

Cisco, Citrix, and EMC jointly validated an enterprise scale-out design that provides linear scalability from zero to 5000 virtual desktops (using Citrix XenDesktop). Recently, the three companies completed a 5000-seat Citrix XenDesktop 5.6 Feature Pack 1 HVD validation using Cisco UCS B230 M2 Blade Servers, Cisco 6200 Series Fabric Interconnects, Cisco Nexus switches, VMware ESXi 5.0 Update 1, and an EMC VNX7500 storage array, as illustrated in Figure 5.

Conclusion

The Cisco Desktop Virtualization Solution with Citrix XenDesktop achieves an optimal balance between the needs of users for more mobility, flexibility, and choice, and the needs of IT departments for centralized desktop infrastructure, security for mission-critical data, and quick response to rapidly changing business requirements. As businesses reassess their end-user computing strategies, they know that they have to move forward with a new approach, yet they also must choose a solution that is as cost effective and risk free as possible.

The Cisco Desktop Virtualization Solution with Citrix XenDesktop is designed for straightforward, rapid deployment with little risk. The solution is backed by a set of complete, tested, and verified Cisco UCS deployment packages with downloadable service profiles that provide on-demand infrastructure to match the solution's on-demand virtual desktops and applications.

The Cisco Desktop Virtualization Solution with Citrix XenDesktop is the first of its kind in the industry. Cisco and Citrix designed the solution to address a common vision of the changing workplace, and both companies are dedicated to delivering the software, end-to-end networking, and solid virtualization platform needed to empower IT departments to successfully navigate today's rapidly changing business environment. With Cisco the leader in enterprise networking and the creator of the industry-leading Cisco Unified Computing System, and with Citrix the leader in desktop virtualization, the joint solution provides the centralized, virtual desktop environment that organizations need. The time to move to such an environment is now.

For More Information

- Cisco Unified Computing System: http://www.cisco.com/go/ucs
- Cisco Desktop Virtualization Solution with Citrix XenDesktop: http://www.cisco.com/go/citrix
- Cisco Validated Designs describing the solutions: www.cisco.com/go/designzone
- Cisco's portfolio of desktop virtualization solutions: www.cisco.com/go/vdi
- VDI solution paks: http://www.cisco.com/en/US/netsol/ns1198/index.html#~Solution_Paks

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