Reference Architectures for Cisco Desktop Virtualization

Solution Benefits

- Linearly scalable desktop performance as deployments grow from hundreds to tens of thousands of users
- Simplified, stateless provisioning and operating model that can deliver virtual desktops and applications in a fraction of the time required by traditional approaches
- Uncompromised user experience, consistent across user devices and locations, delivered across a quality-of-service (QoS)-enabled data center and network infrastructure
- Single unified system that goes beyond convergence by providing a massively scalable, distributed virtual blade chassis with a single integrated point of connectivity and management
- Portfolio of reference architectures to address specific IT challenges, environments, and desktop and application delivery approaches with high performance and optimized costs

What You Will Learn

- The four major acquisition costs for desktop virtualization solutions are endpoints and associated software, desktop broker software, storage resources, and data center infrastructure.
- Cisco and its technology ecosystem partners have developed a spectrum of solutions that synthesize best-in-class data center computing and storage technologies into consumable reference architectures for desktop virtualization.
- New reference architectures are available for virtual desktop infrastructure (VDI): On-Board, Simplified, and Scalable Architecture for Desktop Virtualization, and Converged Infrastructure for Desktop Virtualization for ready-to-deploy systems.
- Each architecture addresses specific IT challenges, environments, and desktop delivery approaches with high performance and optimized costs.

Background

Desktop and application virtualization constitutes an increasingly popular way for enterprises to reduce capital expenditures (CapEx) and operating expenses (OpEx), improve efficiency, increase control, and expand connectivity. With virtual desktops, users now access their desktop images hosted on a data center server as virtual machines, which can be accessed from laptops, thin clients, smartphones, and other devices.

Although desktop virtualization has existed for many years, many implementers of the technology have discovered that significant hurdles need to be overcome to fully reap its benefits.

Challenges of Transforming the Desktop

The CapEx Hurdle

First, many customers immediately encounter a significant CapEx hurdle when sizing their infrastructure to handle this new workload. Significant investment is often required in the data center shared storage infrastructure, as well as costs for scaling server capacity and networking. These hardware costs can easily represent over 50 percent of the total solution cost in some use cases.

Putting Everything Together

Additionally, desktop virtualization is a multilayered solution, requiring often disparate solution elements spanning virtualized infrastructure, desktop and application virtualization software, connection brokers, display protocols, access and authentication, and user persona management to work together in a cohesive solution. The associated complexity required to integrate a multifaceted solution creates an escalating OpEx equation for customers as they try to manage everything.

The Performance Chasm

Many organizations that manage to deliver a successful pilot or proof-of-concept (PoC) environment are subsequently tasked with expanding that initial success into a full-scale production environment and are then confronted with the challenge of how to optimally size and scale their infrastructure. Crossing the chasm between a successful pilot deployment and a high-performance production deployment at scale involves a balancing act, with the associated risk of either oversizing the environment and wasting CapEx or undersizing the infrastructure and delivering a poor user experience that does not replicate the success experienced in the pilot phase.

The Cisco Desktop Virtualization Solution

Cisco and its technology partners have combined to deliver reference architectures that address these challenges and eliminate the guesswork and risk associated with implementing desktop and application virtualization through a portfolio of reference architectures built with best-in-class technologies.

Cisco Unified Computing System: Optimized Infrastructure for Desktop Virtualization

The foundation of the Cisco® Desktop Virtualization Solution is the Cisco Unified Data Center. The Cisco Unified Data Center provides an open, end-to-end, service-optimized infrastructure for next-generation virtual workspaces, delivered jointly with our primary industry partners.

- Simplify: Accelerate time to productivity by simplifying the data center infrastructure.
- Secure: Improve the protection of data center infrastructure and assets.
- Scale: Support more desktops per server with predictable performance.
- Save: Achieve accelerated ROI, improved deployment speed, and investment protection.

First Unified System for Desktop Virtualization

The Cisco Unified Computing System™ (Cisco UCS®) is the virtualized server foundation of the Cisco Unified Data Center. Cisco UCS goes beyond convergence to bring the benefits of centralized computing to the scale-out nature of many desktop virtualization environments: simplified management, greater deployment flexibility, and easier scalability. A self-integrating, self-aware system, Cisco UCS consists of a single management domain interconnected by a unified I/O infrastructure. The system is designed as a single virtual blade chassis that incorporates and scales across multiple blade chassis, rack servers, and racks (Figure 1).

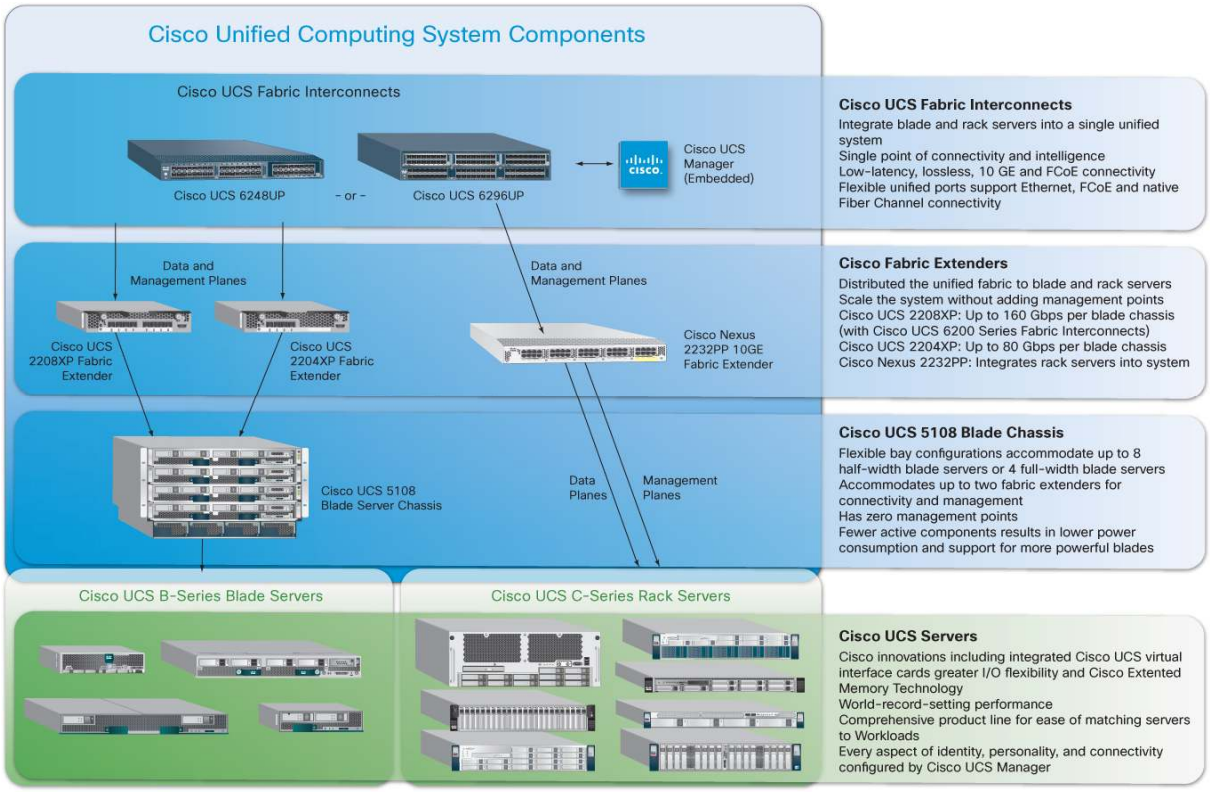
Radically Simplified Architecture

The system implements a radically simplified architecture that eliminates the multiple redundant devices that populate traditional blade server chassis and result in layers of complexity: Ethernet switches, Fibre Channel switches, and chassis management modules. Cisco UCS consists of 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 cost and less complexity. 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-consuming 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, including the cost of blade chassis and switching, is as little as half that of typical blade servers.

Figure 1. Cisco UCS Components



The Cisco Desktop Virtualization Solution built on Cisco Unified Data Center delivers:

- Single unified system: Cisco UCS goes beyond convergence by providing a massively scalable, distributed virtual blade chassis with a single integrated point of connectivity and management.
- Programmable infrastructure: Every aspect of the system's configuration is programmable through an intuitive GUI, third-party management tools, or an open-standard XML API, bringing automation to server configuration.
- Integrated, model-based management: The system's model-based management amplifies the knowledge of subject-matter experts by enabling consistent, error-free alignment of policy, server personality, and workloads.
- Unified fabric: The system's high-speed, low-latency unified fabric brings the data and management planes, Ethernet, and Fibre Channel over Ethernet (FCoE) to each blade server, reducing the number of components needed and delivering uniform connectivity to each server.

- Cisco Fabric Extender Technology (FEX Technology): This design condenses three layers of networking into one, providing scalability with less cost and no additional complexity, and it brings visibility and control to virtualized environments.

Cisco Desktop Virtualization Solution Architecture

Cisco and its technology ecosystem partners have developed a comprehensive portfolio of reference architectures that are aligned with specific IT environments, business considerations, and goals, while addressing the traditional challenges associated with deployment of desktop virtualization or VDI, as discussed earlier. These four architectural approaches offer a clear path to deployment of virtual desktops with:

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

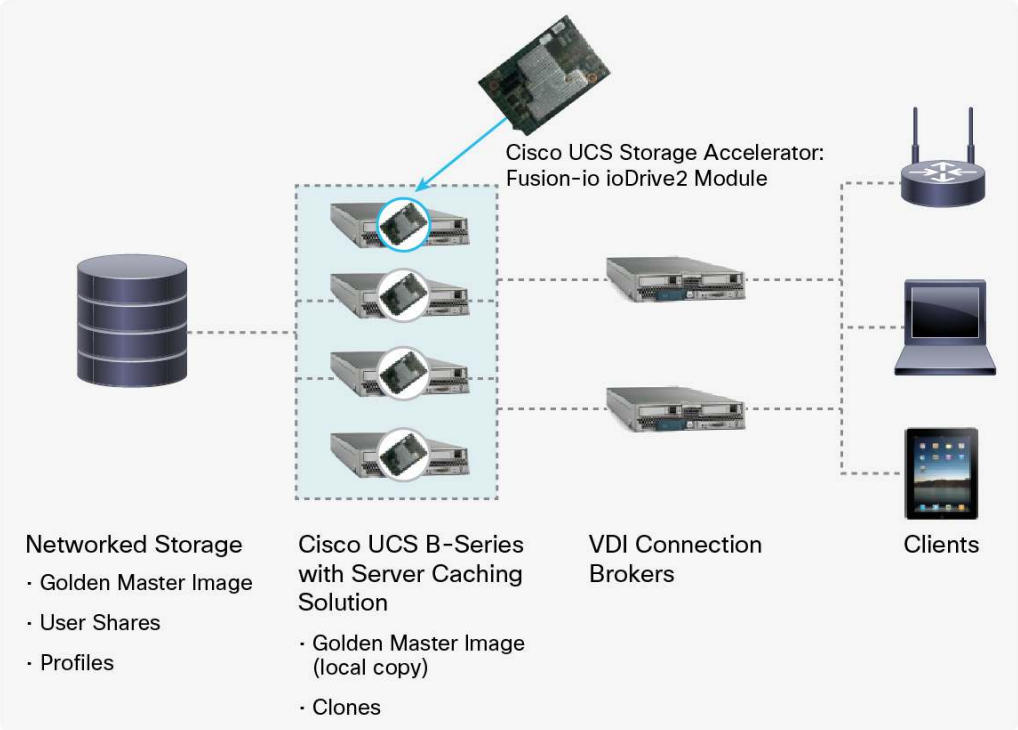
Built on best-in-class technologies, these include On-Board, Simplified, and Scalable architecture models for desktop virtualization. In addition, Converged Infrastructure solutions such as FlexPod and vBlock™ Systems provide modular, ready-to-deploy solutions for the customer. These designs are suited to organizations of various sizes, ranging from small and medium-sized businesses (SMBs) to large enterprises to service providers. Also, larger environments can use an approach that is designed for smaller environments when the immediate need is to establish a pilot or PoC environment and prove success quickly.

On-Board Architecture

Many environments struggle with VDI deployment, especially in the absence of a well-designed SAN infrastructure and sufficient storage capacity to host user desktops. For those with a SAN in place, a throughput bottleneck can potentially exist between virtual desktops hosted on a server and the shared storage back end that they need to access. This bottleneck is the result of the combined effect of insufficient capability to handle the disk I/O operations per second (IOPS) and the inherent latency of the flow through the server, switched infrastructure, and shared storage. This problem is compounded as the number of users increases and the capacity limit of the storage controller is reached. At this point, additional cost is incurred to expand storage capacity. The result is escalating cost increases as the system continues to grow.

The On-Board Architecture for Desktop Virtualization addresses these challenges. This approach provides high-speed, low-latency flash-memory-based storage (solid-state drives [SSDs] and PCI Express [PCIe] flash-memory modules) on the Cisco UCS servers and is well suited to customers who prefer to deliver stateless or floating, non-persistent desktops. It eliminates the roundtrip latency incurred when the host accesses back-end shared storage across a network fabric, because the desktop image (or replica) is now stored locally on the blade. IOPS capacity is no longer an issue because the system can take advantage of a simpler, server-installed storage footprint that provides expansive IOPS capacity with negligible latency, while reducing the SAN burden and associated costs by up to 50 percent. For example, the On-Board architecture based on the Fusion-io ioDrive2 Module, as part of the Cisco UCS Storage Accelerator option for the Cisco UCS B-Series Blade Servers, can provide 785 GB of server-resident storage that is easily managed as part of the blade configuration, which is excellent for linked clones or replicas images. The desktop master image and user persona data is maintained on back-end shared storage (Figure 2).

Figure 2. On-Board Architecture for Desktop Virtualization



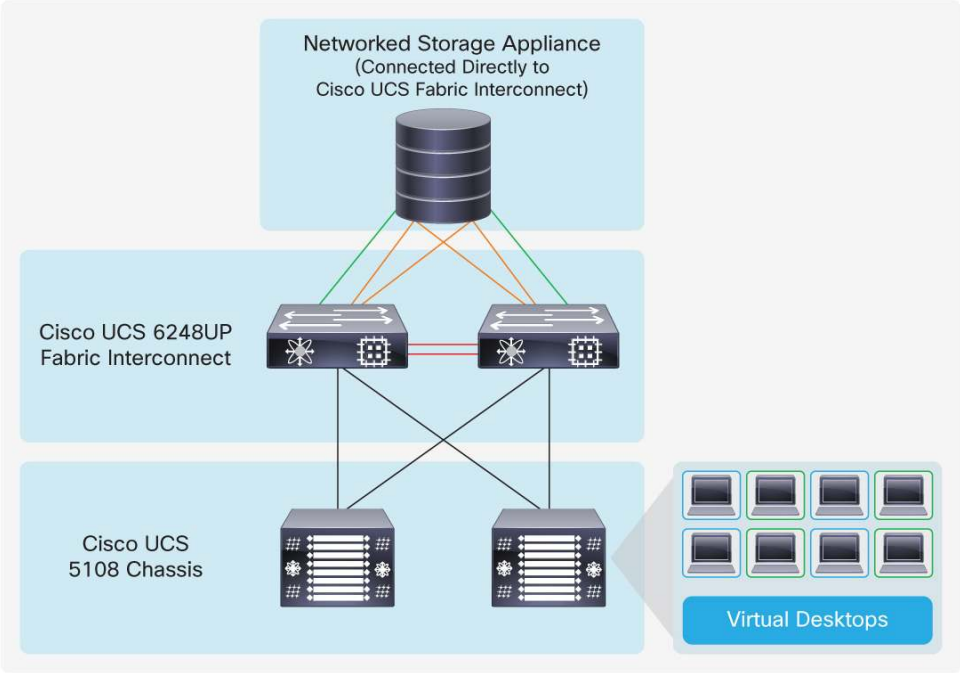
This solution can support full VMware vMotion migration when VDI workloads need to be moved between hosts. The added benefit of stateless (or floating) desktops is that if the host fails, new desktops can be provisioned on another host in seconds. This architectural approach offers a dramatic reduction in desktop boot and login times, reduced IOPS burden on the back-end shared storage, reduced power consumption, and most important, a low incremental cost per additional desktop because there is no longer an escalating CapEx increase as is the case in a traditional design when the storage controller capacity is reached. The On-Board architecture for Cisco Desktop Virtualization offers a lower-cost and more predictable and manageable way to scale floating non-persistent desktops with high performance.

Simplified Architecture

IT departments often prefer persistent (non-floating) desktops for their end users, to help ensure that each worker has a dedicated workspace that the worker can customize, similar to the physical desktop model with which users are familiar. Additionally, IT may prefer to use a shared storage approach, but without the investment in a SAN fabric infrastructure. IT may require a flattened architecture that offers the benefits of support for both persistent and non-persistent desktops and the scalability afforded by shared storage but without the expense and complexity of a traditional hierarchical back-end architecture.

For such environments, Cisco offers the Simplified Architecture for Desktop Virtualization, which employs an appliance-based model for virtual desktop storage. This architecture does not require an intermediate switch layer between storage and server. This architecture includes solutions from various Cisco ecosystem partners and offers a lower initial front cost, making it an well suited to customers who do not have an existing investment in an enterprise-class SAN infrastructure.

Figure 3. Simplified Architecture for Desktop Virtualization

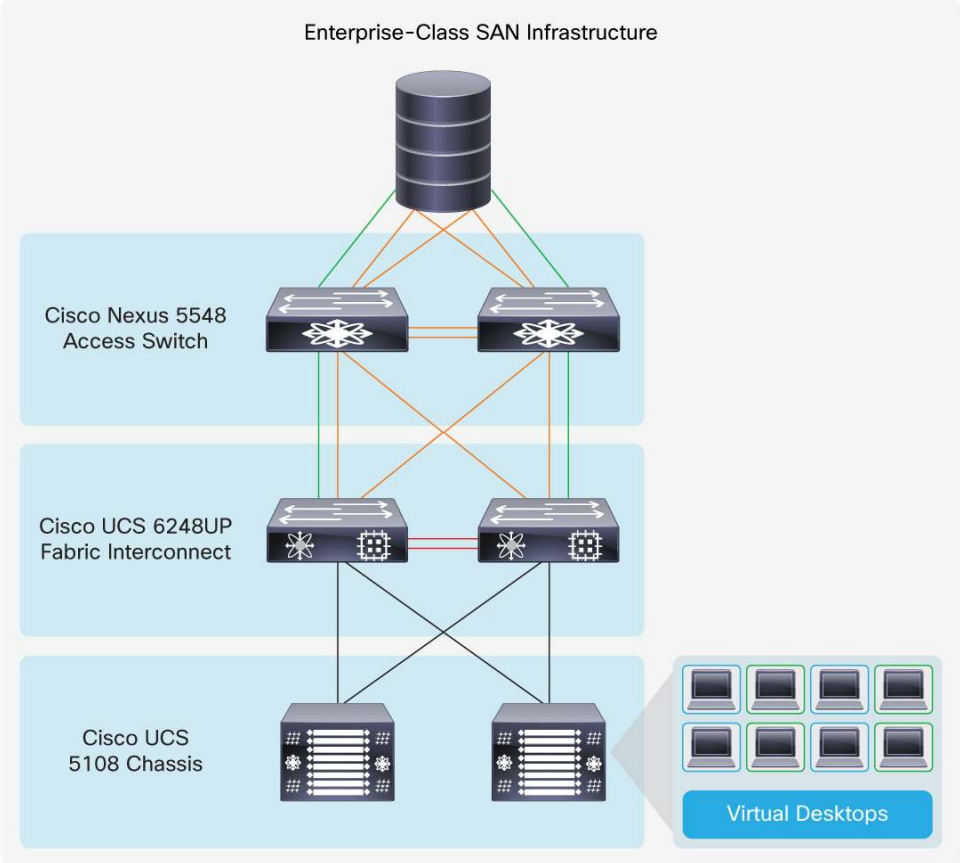


The Simplified architecture allows the storage appliance to connect directly to the Cisco UCS fabric interconnect (Figure 3). This approach eliminates the need for an upstream Fibre Channel and Ethernet switches and associated management, with the system instead using direct-connect-based storage connections to the appliance ports for Ethernet storage, and Fibre Channel and FCoE connections for block storage. This architecture provides the benefits of a shared storage model and low initial CapEx.

Scalable Architecture

Many IT environments demand expansive scalability and the capability to grow from an initial deployment of hundreds of desktops to tens of thousands of desktops within a single architecture. This architectural approach is optimal for organizations with an existing enterprise SAN investment to which the VDI workload can be added. Such environments also require the flexibility to accommodate all deployment approaches, both persistent and non-persistent, as well as the utmost resiliency and scalability using a completely shared storage approach.

Figure 4. Scalable Architecture for Desktop Virtualization



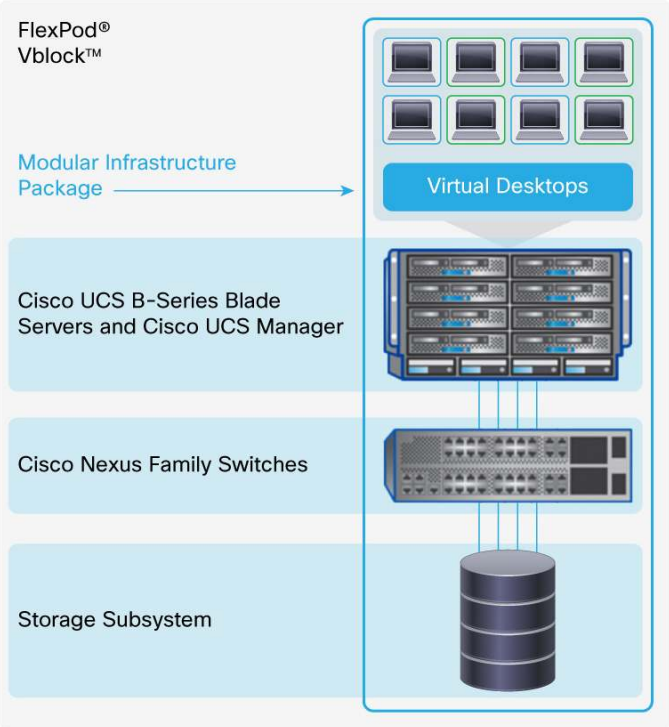
For such requirements, Cisco offers the Scalable Architecture for Desktop Virtualization (Figure 4). As documented through Cisco Validated Designs, this architecture has successfully demonstrated high performance in dense, large-scale environments and benefits such as the capability to boot thousands of desktops in as little as 30 minutes. This architecture is the approach recommended for truly scale-out environments. With this architecture, there are no single points of failure, and it supports both single-domain and multidomain Cisco UCS environments, providing an expandable infrastructure in which an organization can grow its virtual desktop footprint.

Converged Infrastructure

Implementers of VDI, whether for private or service provider environments, often struggle with the cost of managing and supporting the solution, as well as the ensuing complexity associated with a multivendor platform and the need to reduce the amount of time needed for deployment, especially when cloud-based desktop services are being offered. Organizations often express concerns such as these: “For every US$1.00 spent on hardware, we spend US$3.00 to manage it,” and “We do not have several months for a proof-of-concept deployment; we need VDI now,” and “We cannot deal with the complexity of using multiple vendors.”

For organizations with such requirements, Cisco offers the Converged Infrastructure for Desktop Virtualization, built on the technologies of ecosystem partners NetApp and the Virtual Computing Environment (VCE) coalition. This architecture, based on the VCE Vblock Systems and FlexPod, offers a convenient packaged infrastructure approach that modularizes data center components into easily consumable building blocks that can be added as needed for scale. Each unit of infrastructure offers self-contained computing, storage, and network fabric resources coupled with virtualization software (Figure 5).

Figure 5. Converged Infrastructure for Desktop Virtualization



Implementers of this approach benefit from ordering simplicity, rapid deployment, simplified support, and building-block-based scalability.

Conclusion

Cisco and its technology ecosystem partners are addressing the challenges commonly associated with desktop virtualization - cost, complexity, and performance with scalability - and offering a portfolio of architectural approaches built on the Cisco Unified Data Center and best-in-class partner technologies and solutions. These solution architectures can address IT environments ranging from SMBs to large enterprises to service providers, offering a quicker, simpler, and more cost-effective approach to virtual desktop deployment with reduced risk and higher performance with scale.

For More Information

- Reference architectures with VMware
- Reference architectures with Citrix
- http://www.cisco.com/go/vdi
- http://www.cisco.com/go/vdidesigns

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