



SOLUTION BENEFITS

- Delivers linear, virtual desktop storage scalability with consistent, predictable performance
- Reduces the need for expensive networked storage
- Simplifies solution manageability with fewer architectural components required
- Improves TCO with reduced costs for storage, servers, power, cooling, rack space, and operations
- Dramatically improves application response time
- Reduces the marginal cost of virtual desktops

Optimizing Desktop Virtualization Solutions with the Cisco UCS Storage Accelerator

A cost-effective, high-performance, scalable solution for nonpersistent VMware® Horizon View™ virtual desktops deployed on the Cisco Unified Computing System

For virtual desktop infrastructure (VDI) applications, offloading a portion of storage to the Cisco UCS Storage Accelerator in the server can result in a lower per-desktop cost for storage, lower overall costs, predictable performance for scaling VDI, lower power and cooling costs, a smaller datacenter footprint, and simplified manageability as compared to traditional shared-storage approaches. The Cisco UCS B200 M3 Blade Server with Cisco UCS Storage Accelerator and VMware Horizon View delivers these important performance and cost benefits for organizations seeking to implement VDI.

Challenge: Desktop Virtualization and the Storage I/O Bottleneck

Desktop and application virtualization are increasingly popular ways for enterprises to reduce capital and operating expenses, improve efficiency, increase control, and expand connectivity. With virtual desktops, users can access their desktop images for laptops, thin-clients, smartphones, or other devices from a hosted, centralized infrastructure in a datacenter.

While many enterprises are increasingly turning to desktop virtualization to provide increased business agility, risk mitigation, and support for bring-your-own-device (BYOD) initiatives, many organizations quickly realize that the newfound success of virtual desktop infrastructure (VDI) as demonstrated in a small pilot or proof-of-concept (POC) does not readily extend to a full-scale production environment.

With hundreds or thousands of users logging onto their virtual desktops at the same time at the start of the workday, “boot storms” that drain network performance can become a regular occurrence. The back-end datacenter infrastructure becomes deluged with storage I/O traffic as desktop operating systems initialize and users log in. An activity that was previously confined to a user’s laptop or desktop (and the embedded hard disk serving the desktop operating image) is now stretched across the network and into the back-end storage infrastructure, which may not have been adequately sized to meet the storage I/O needs of the end-user population.

The Storage I/O Balancing Act

In one study conducted by Cisco Consulting Engineers, for a typical VDI environment with 150 virtual desktops booted within a four-minute window, a peak aggregate demand from all desktops of 39,000 read I/O operations per

second (IOPS) and 2200 write IOPS was observed or approximately 260 read IOPS and 15 write IOPS per virtual desktop booted. Compare these numbers with a steady-state environment, where IOPS have settled down after the boot and login storm. The same study saw approximately 11 read IOPS and 7 write IOPS per virtual desktop. These numbers present an extremely wide variance across which a VDI architect must build a solution for consistent performance and optimized cost.

Many organizations struggle with the task of predicting how to appropriately size their storage I/O performance needs. It's difficult to balance peak loads seen during boot and login storms, antivirus scans, and normal steady-state operations that consume much fewer IOPS. Oversizing for peak demand results in a huge capital expenditure (CapEx) burden and wasted infrastructure resources. Undersizing results in dissatisfied end users who compare the lackluster performance against the more responsive desktops they used before. This situation is likely to result in the early demise of any desktop virtualization initiative or to at least stall its progress in becoming a full-fledged production-ready solution.

A related issue for traditional shared-storage approaches is "lumpiness of scale." Put another way, traditional approaches for VDI storage typically incur a non-linear cost increase as implementers expand their user populations, going from their first 100 users to 1000 users and beyond. Typically, shared-storage array controllers can support a pre-sized number of IOPS. With the growth in the number of virtual desktops, one of two approaches is followed. Either the number of controllers is increased or the scale of the existing controller is increased. With either approach, significant additional capital expenditure is required, increasing the marginal cost of adding virtual desktops for the next tier of users.

An additional concern for VDI implementers is related to management complexity. With traditional shared-storage arrays, manageability of the SAN along with the various virtual and physical control points may overburden desktop virtualization deployments. Each virtual desktop can have four or more logical storage elements (including the image, write cache, profiles, and user data). Mapping and placing these appropriately on the storage array logical unit numbers (LUNs) can create a storage manageability challenge, especially as these elements grow along with an increasing number of desktop users.

The Cisco Unified Computing System: Optimized for Desktop Virtualization

IT organizations seeking to implement desktop virtualization are increasingly turning to the Cisco Unified Computing System™ (Cisco UCS) as their compute platform of choice. The industry's first unified datacenter platform, Cisco UCS delivers a converged, programmable infrastructure that simplifies and speeds enterprise-class application and service deployment in bare metal, virtualized, and cloud-computing environments. Unified, model-based management, end-to-end provisioning, and migration support come together in this next-generation datacenter platform to accelerate and simplify application deployment with greater reliability and security.

Cisco UCS provides these important features:

- Integration of Cisco servers and network and I/O resources into one system
- Improvement of enterprise application availability and performance
- Scalability of service delivery to increase business agility
- Streamlining of datacenter resources to reduce total cost of ownership
- Radical reduction in the number of devices requiring setup, management, power, cooling, and cabling

Cisco UCS B-Series Blade Server: The VDI Workhorse

Cisco UCS is changing the economics and performance curve of server-hosted client computing, delivering a robust, high-performance computing fabric on which desktop virtualization can be deployed. The latest generation of Intel® Xeon® processors in Cisco UCS blade and rack-mount servers is used to host user desktops. The enterprise-class Cisco UCS B200 M3 Blade Server further extends the capabilities of the Cisco UCS portfolio in a half-blade form factor. It harnesses the power of the Intel Xeon E5-2600 processor product family, offering up to 768GB of RAM, up to two SSD/HDD drives, and up to 80Gbps Ethernet server I/O connectivity to deliver exceptional levels of performance, memory expandability, and I/O throughput for nearly all applications.

The Cisco UCS Storage Accelerator Solution: Taking the Guesswork out of Sizing I/O for VDI

The Cisco UCS B200 M3 Blade Server offers new innovations with greater performance and value for VDI workloads based on a large, on-server cache storage footprint (referred to as Tier-0 storage). This capability, known as the Cisco UCS Storage Accelerator, is based on Fusion-io's 785GB Multi-Level Cell (MLC) ioDrive2 Adapter, delivering an expansive IOPS footprint, in an on-blade form. Instead of relying on back-end shared storage to host the golden master image and associated clone images for users, the same image can now be stored locally on the Cisco UCS Storage Accelerator as installed on the B200 M3 Blade Server. A central copy of the golden master image can still be kept on back end-shared storage, along with user shares, profiles, and persona.

As part of the Cisco On-Board Architecture for Desktop Virtualization, the UCS Storage Accelerator solution is an ideal server caching solution to deliver uncompromised IOPS to support a guaranteed number of users at not only lower cost but also with predictable performance compared with a SAN-based infrastructure.

Now VDI administrators can linearly scale the number of supported users and deliver consistent performance for hundreds to tens of thousands of users in a pooled, non-persistent VDI implementation. Because the on-server cache storage approach involves a directly mapped flash storage cache that supports much higher IOPS than conventional disk-based storage, VDI environments can now boot seamlessly without bottlenecks and in a fraction of the time and cost of networked storage solutions.

Implementing VDI on the Cisco UCS B200 M3 Blade Server with the Cisco UCS Storage Accelerator consists of the following steps:

- Direct the hypervisor to store virtual desktop images on the Cisco UCS B200 M3 Blade Server's on-board server cache provided by the on-board Fusion-io flash module.
- Store user data and profile information on back-end networked storage (typically a NAS or SAN environment).
Note: This can include specific persona management solutions that can be layered on top of non-persistent, pooled desktop implementations.
- VMware vSphere® 5.1 (with vMotion® with a unified architecture), supports live migration of virtual desktops, including memory and storage, without the requirement of shared storage. This makes it possible for the vMotion characteristics of virtual desktops in the Cisco UCS Storage Accelerator solution to be similar to that of shared storage.
- For high availability, in the unlikely event that a server fails, users simply reconnect and the VDI broker reinstantiates their desktop on another server. Rebooting takes a fraction of the time consumed by traditional networked storage.

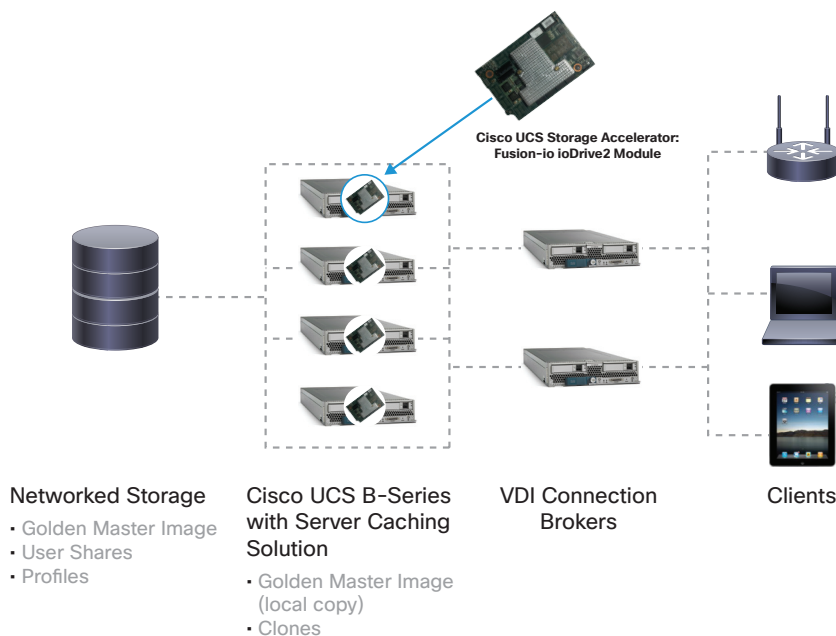


Figure 1: Cisco UCS Storage Accelerator Solution for VDI

VMware Horizon View VDI Solution with Cisco UCS Storage Accelerator

Used with the popular VMware Horizon View desktop virtualization solution, the Cisco UCS Storage Accelerator on the Cisco UCS B200 M3 Blade Server hosts VMware linked clones for faster performance, lower cost, and easier scaling.

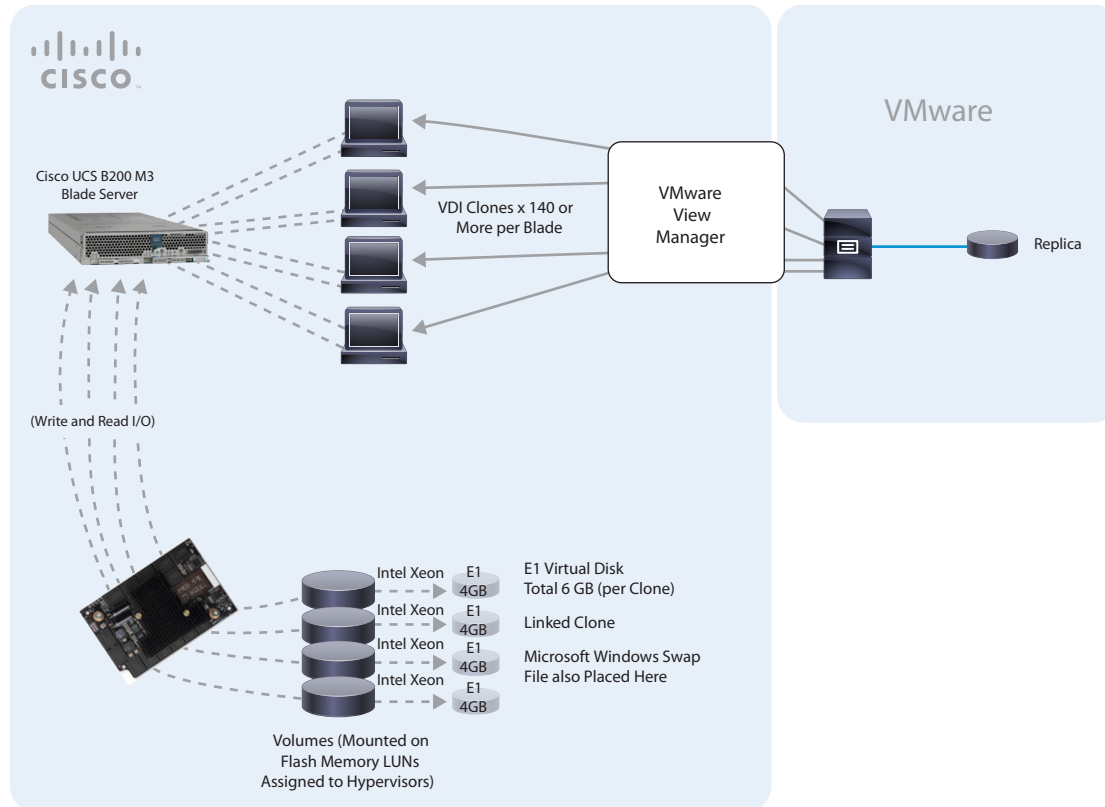
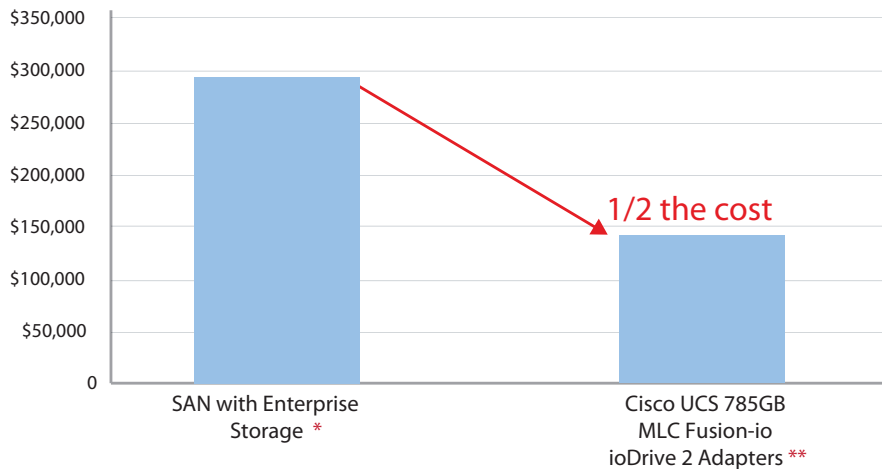


Figure 2: Cisco UCS Storage Accelerator Solution for VDI Used with VMware Horizon View

Benefits of Employing VDI Solutions Based on Cisco UCS Storage Accelerator

Lower cost of storage through lower cost of IOPS – The Cisco UCS Storage Accelerator-based VDI solution delivers a dramatically lower-cost storage solution, with predictable, consistent storage IOPS performance, as compared to shared enterprise storage solutions. As VDI deployments scale to larger user populations, the cost of storage scales more affordably with a server-based cache solution such as the Cisco UCS Storage Accelerator. For example, as shown in Figure 3, in a deployment of 2000 virtual desktops, comparing SAN storage with the server-based Cisco UCS Storage Accelerator, storage costs were reduced by 50 percent.



*Includes industry standard enterprise storage to support up to 2000 desktops with one year support (\$286,000), four ports of Cisco Nexus® 5000 Series, and four storage port licenses for Cisco UCS Fabric Interconnect, all at Average Selling Price prices.

**Includes Cisco UCS Storage Accelerator at ASP

***Does not include support and maintenance costs

Figure 3: Cisco UCS Storage Accelerator Solution for VDI: Storage Cost Estimates for 2000 Virtual Desktops

Cisco UCS Storage Accelerators for Fusion-io 785GB cards can provide up to 500,000 writes (512KB) or approximately 10 times more write IOPS and 100,000 reads (512KB) or approximately three times more read IOPS than a typical shared storage solution (sized for 2000 desktops).

Improved performance – With SAN-based storage solutions for VDI, reads and writes are serviced by the storage array, requiring communications across the server, storage network, storage controller, and storage media. There is latency associated with each of these elements, as illustrated in Figure 4. Additionally, for IOPS-intensive workloads, backlogs occur at the access fabric, storage controller, and storage media layers due to the serialization of IOPS, further slowing the VDI application.

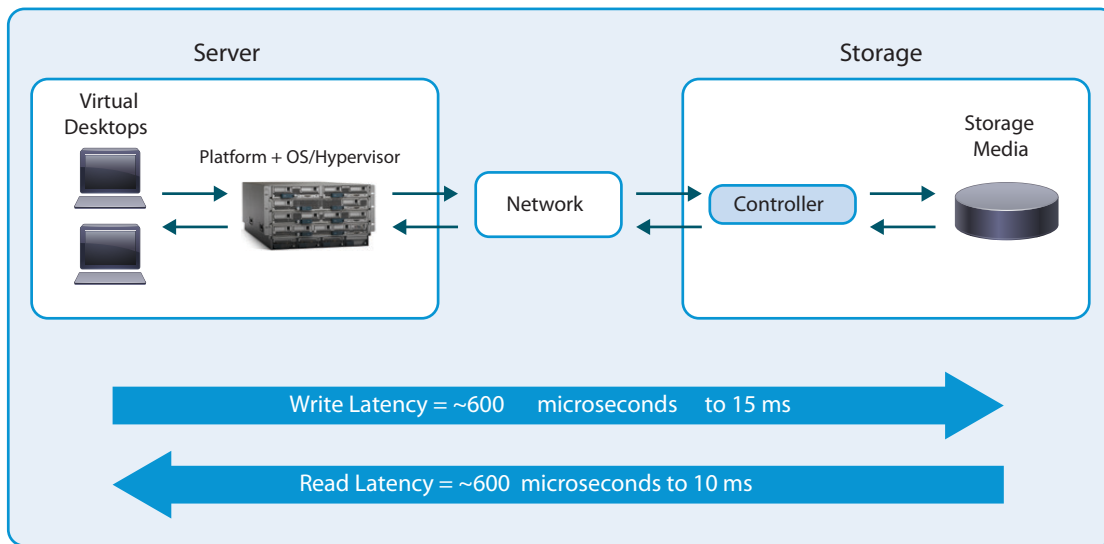


Figure 4: Performance of Traditional SAN-Based Storage Solution for VDI

The Cisco UCS Storage Accelerator solution provides the disaggregation of the storage environment by removing the need to traverse the network, storage controller, and media, and secondly by containing the I/O requests for each server within the server. As Figure 5 shows, performance of a VDI solution using the Cisco UCS Storage Accelerator results in reduced latency because reads and writes occur on the adapter.

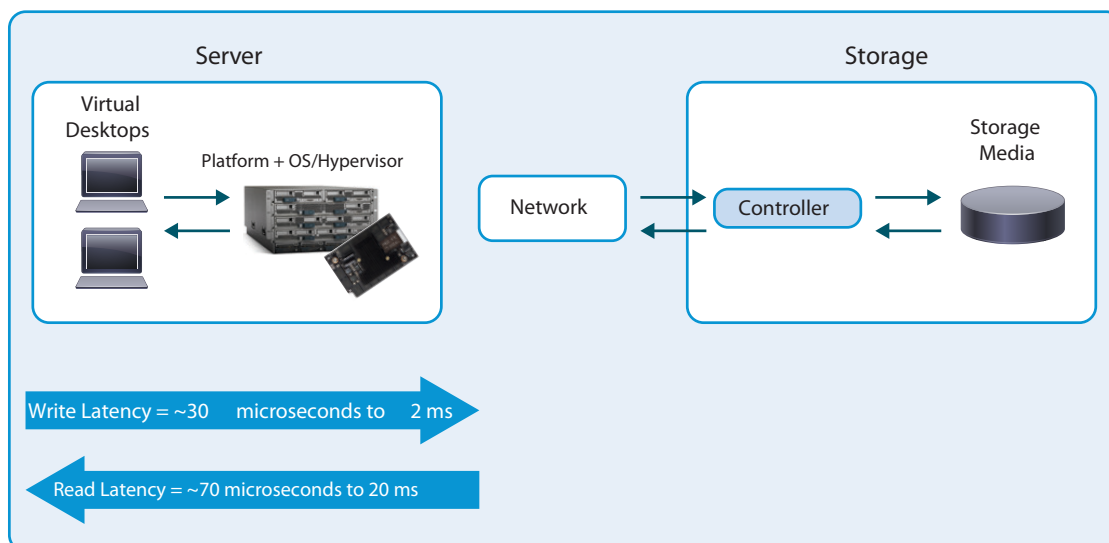


Figure 5: Cisco UCS Storage Accelerator Solution Architecture for VDI

The Cisco UCS Storage Accelerator architecture delivers in 10 times more IOPS (as compared to 20 solid state drives behind a RAID controller) and consistent performance of random reads/writes. Traditional queue depths and others forms of I/O serialization are avoided. The Cisco UCS Storage Accelerator solution for VDI complements SAN investments and provides investment protection, consistent performance, and a high degree of scalability because the IOPS workload is distributed across multiple servers as VDI solutions scale.

Server-based manageability – In traditional application architectures, there are multiple management tools for network, storage, and compute environments. With Cisco UCS, Cisco UCS Manager provides unified, embedded management of all software and hardware components of the Cisco UCS across multiple blade chassis, rack servers, LAN connectivity, SAN networking, systems identity management, monitoring and troubleshooting. With the Cisco UCS Storage Accelerator in the server, the UCS Management capabilities are extended to cover Tier 0 storage as well. This dramatically simplifies storage management for VDI deployments.

Figure 6 shows that the same Cisco UCS environment for a single chassis and a single blade can scale to 20 chassis and 160 blades through dynamic provisioning. And now, through the addition of the Cisco UCS Storage Accelerator, the Cisco UCS Manager manages the Tier 0 storage on the server in addition to all the many other components it manages.

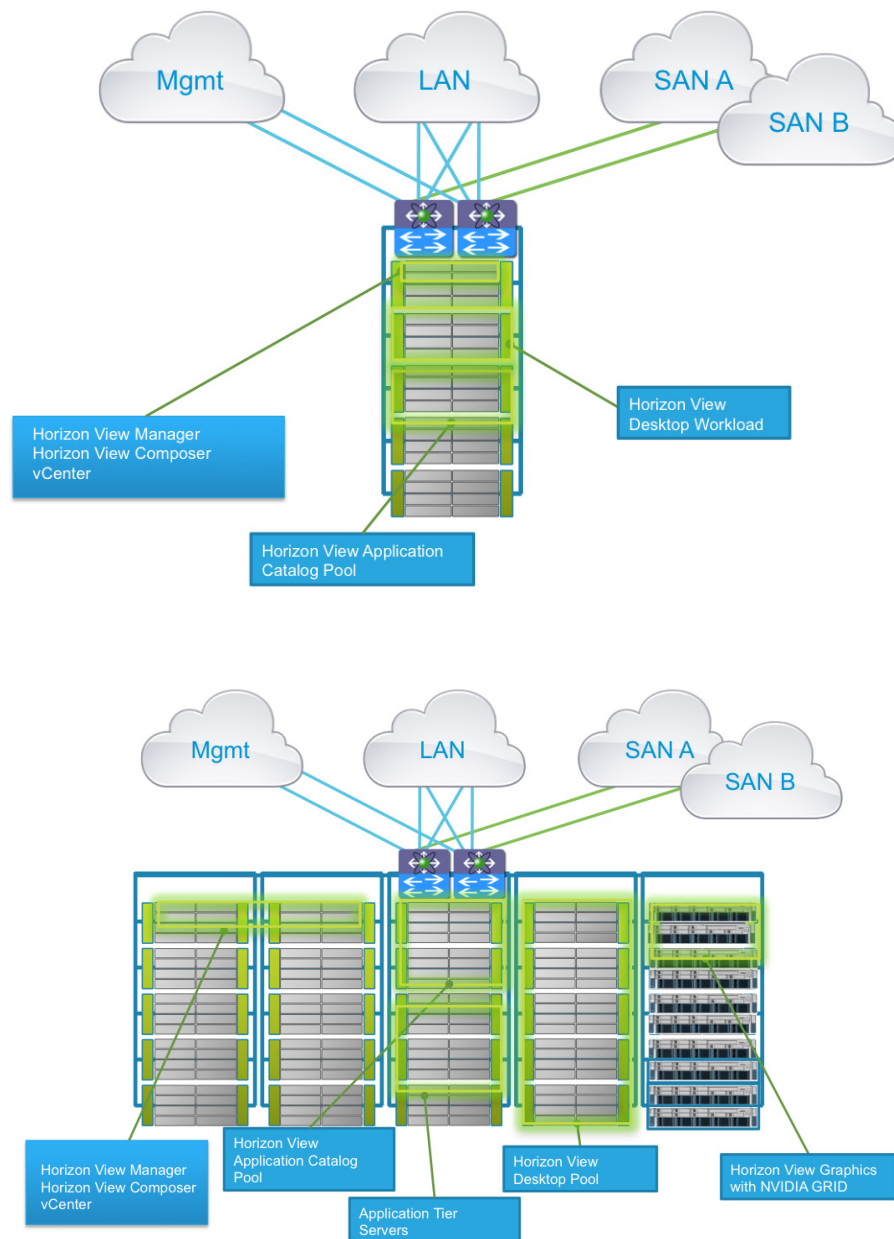


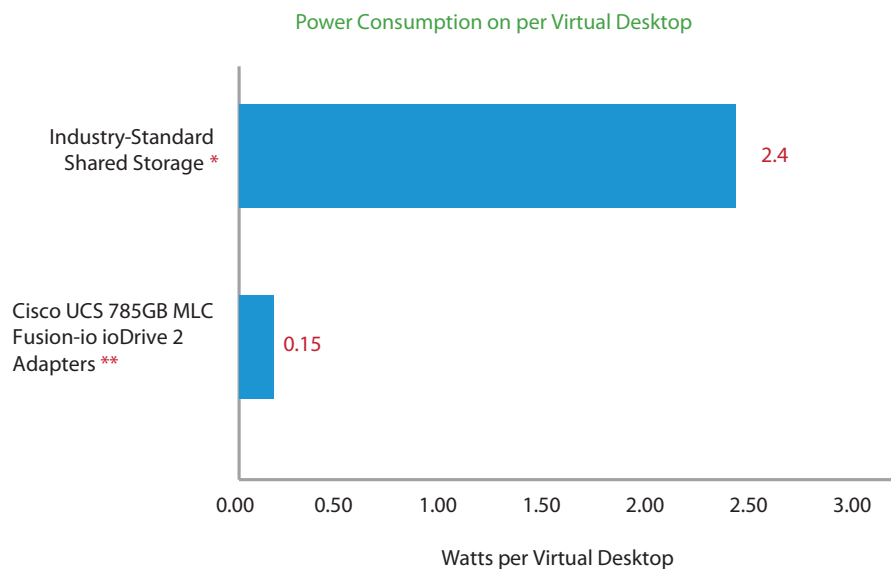
Figure 6: Cisco UCS Storage Accelerator Solution Architecture for VDI

Predictable Performance as the VDI Solution Scales

By disaggregating the monolithic storage and placing the storage close to the virtual desktop workload in smaller blocks, the scalability of the VDI solution dramatically improves. With the smaller block of storage on the server (which can support up to ten times more IOPS requirements) satisfying the desktop workload requirement, this VDI block approach scales linearly without external dependencies. As a VDI solution scales from hundreds to thousands of virtual desktops, each server with a Cisco UCS Storage Accelerator becomes a building block, enabling more cost-effective scalability with predictable performance.

Lower Power Consumption and Floor Space

A VDI solution using the Cisco UCS Blade Server with Cisco UCS Storage Accelerator uses dramatically less power (about 16 times less power per virtual desktop) and has a much smaller datacenter footprint than traditional SAN-based storage solutions, as shown in Figure 7.



*Typical 15,000 RPM SAS drive on industry-standard enterprise storage consumes 8W, assuming 20 percent additional overheads for controller, shelves, and management nodes.

**Cisco UCS 785GB MLC Fusion-io ioDrive 2 Adapters typically consume 20W and on average support 130 virtual desktops on the Cisco UCS B200 M3 Blade Server.

Figure 7: Cisco UCS Storage Accelerator Solution for VDI Compared to SAN-based Storage: Power Consumption and Floor Space

Summary

As organizations seek to embrace the expected benefits of VDI, it is critical for them to understand the importance of correctly sizing storage IOPS. Oversizing leads to wasted CapEx and underutilized infrastructure. Undersizing IOPS capacity leads to a disappointing end-user experience.

The Cisco UCS Storage Accelerator Solution for VDI eliminates the guesswork and balancing act associated with correctly sizing a VDI implementation by delivering an on-server SSD-based storage footprint that provides expansive local storage IOPS capacity. The result is linearly scalable and predictable performance at a fraction of the cost of high-performance networked storage.

VDI architects can now successfully eliminate storage I/O storms, maximize performance, and optimize their capital and operating expenses, resulting in a quicker path to VDI return on investment.

For More Information

For additional information about desktop virtualization solutions, please visit

[VMware Horizon View](#)

[Fusion-io, Inc.](#)

[Cisco Desktop Virtualization Solution with VMware Horizon View](#)

[Cisco Unified Computing System – Programmable Infrastructure](#)

[Unified Model-based Management](#)

[Cisco Servers for the Cisco Unified Computing System](#)

