Cisco UCS Storage Accelerator Solution: Optimize Your Desktop Virtualization Infrastructure

Solution Brief
March 2013

Highlights

- 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
- Lowers the total cost of ownership (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

The Cisco UCS® Storage Accelerator is a cost-effective, high-performance, scalable solution for nonpersistent virtual desktops deployed on the Cisco Unified Computing System™ (Cisco UCS).

For virtual desktop infrastructure (VDI) applications, organizations can offload a portion of storage I/O to the Cisco UCS Storage Accelerator on the local server to reduce the per-desktop cost for storage, lower overall costs, and achieve significantly more predictable performance. This solution allows organizations to scale their VDI deployments with lower infrastructure cost, including significantly less power consumption and a smaller data center footprint compared to traditional shared-storage approaches. The Cisco UCS B200 M3 Blade Server with Cisco UCS Storage Accelerator delivers these important benefits along with industry-leading management capabilities for organizations implementing VDI.

Challenge: Desktop Virtualization and the Storage I/O Bottleneck

Desktop and application virtualization are increasingly popular ways for enterprises to reduce capital expenditures (CapEx) and operating expenses (OpEx), 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 data center.

Although many enterprises are increasingly turning to desktop virtualization to gain increased business agility, risk mitigation, and support for bring-your-own-device (BYOD) initiatives, many organizations quickly realize that the success of VDI as demonstrated in a small pilot or proof-of- concept (POC) deployment 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 work day, boot storms that drain network performance can become a regular occurrence. The back-end data center 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

For example, for a typical VDI environment with 150 virtual desktops booted within a 4-minute window, a peak aggregate demand from all desktops of 39,000 read I/O operations per second (IOPS) and 2250 write IOPS, or approximately 260 read IOPS and 15 write IOPS per virtual desktop, were observed. Compare these numbers with those for a steady-state environment in which IOPS have settled down after the initial 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 variation across which a VDI architect must build a solution with consistent performance and optimized costs.

Many organizations struggle to appropriately size their storage I/O performance needs, which include the 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 CapEx burden and wasted infrastructure resources. Undersizing results in dissatisfied end users who compare the lackluster performance to the more responsive desktops they used before. This situation is likely to result in the early demise of any desktop virtualization initiative, or at least stall its progress toward becoming a full-fledged production-ready solution.

A related challenge for traditional shared-storage approaches is "lumpiness of scale." Put another way, traditional approaches for VDI storage typically incur a nonlinear cost increase as implementers expand their user populations, expanding from their first 100 users, to 1000 users, and beyond. Typically, shared-storage array controllers can support a presized 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 CapEx 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 these elements to the storage array logical unit numbers (LUNs) and placing them appropriately can create a storage manageability challenge, especially as the number of these elements increases along with the number of desktop users.

Cisco UCS: Optimized for Desktop Virtualization

IT departments seeking to implement desktop virtualization are increasingly turning to the Cisco Unified Computing System as their computing platform of choice. The industry's first unified data center platform, Cisco UCS delivers a converged, programmable infrastructure that simplifies and accelerates 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 data center platform to accelerate and simplify application deployment with increased reliability and security.

Cisco UCS provides these important features:

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

Cisco UCS B-Series Blade Servers: 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 processor E5-2600 product family, offering up to 768 GB of RAM, up to two SSD and HDD drives, and up to 80 Gbps of Ethernet server I/O connectivity to deliver exceptional levels of performance, memory expandability, and I/O throughput for nearly all applications.

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). 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 a Cisco UCS 785-GB multilevel cell (MLC) Fusion-io ioDrive 2 Adapter installed on the Cisco UCS 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.

The Cisco UCS Storage Accelerator is an excellent server caching solution for delivering uncompromised I/O to support a guaranteed number of users at lower cost and with more predictable performance than a SAN-based infrastructure (Figure 1).

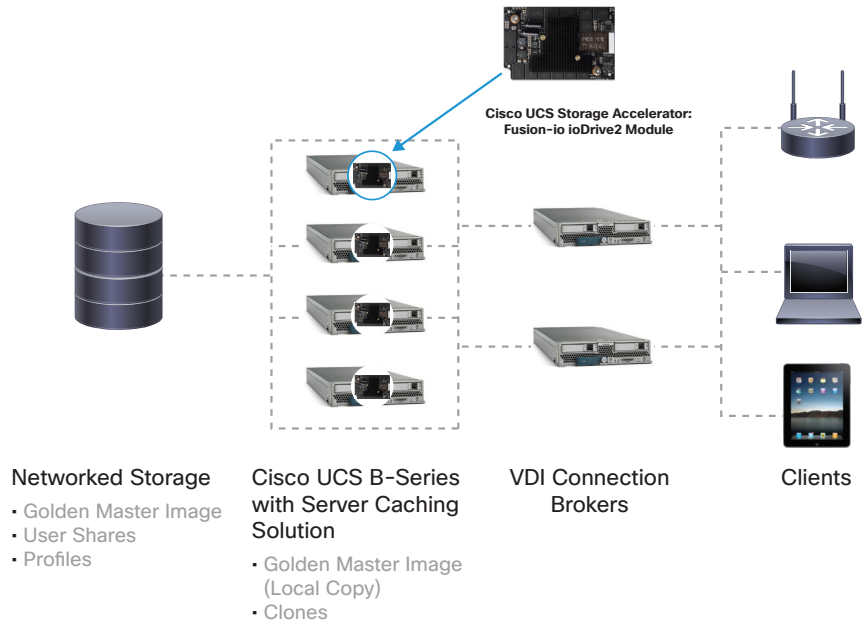
Now VDI administrators can linearly scale the number of supported users and deliver consistent performance for hundreds or tens of thousands of users in a pooled, nonpersistent VDI implementation. Because the on-server cache storage approach uses a directly mapped flash storage cache that supports many more IOPS than conventional disk-based storage, VDI environments can boot transparently without bottlenecks and in a fraction of the time and cost required for networked storage solutions.

Organizations can implement VDI on the Cisco UCS B200 M3 Blade Server with the Cisco UCS Storage Accelerator as follows:

- Organizations can 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 memory module.
- Organizations can store user data and profile information on back-end networked storage (typically a network-attached storage [NAS] or SAN environment).

  Note: This process can include specific persona management solutions layered on top of nonpersistent, pooled desktop implementations
- With VMware vSphere 5.1 (with VMware vMotion and a unified architecture), live migration of virtual desktops, including memory and storage, is supported without the requirement of shared storage. With this support, the VMware vMotion characteristics of virtual desktops using the Cisco UCS Storage Accelerator solution are similar to those for shared storage.
- For high availability, in the unlikely event that a server fails, users simply reconnect, and the VDI broker reinstantiates the desktops 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 View VDI Solution with Cisco UCS Storage Accelerator

Used with the popular VMware View VDI 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).

Citrix VDI Solution with Cisco UCS Storage Accelerator

For those organizations implementing a Citrix VDI solution, the Cisco UCS Storage Accelerator solution can provide significant benefits. In a Citrix XenDestkop solution, the Cisco UCS Storage Accelerator hosts the write cache (and optionally the virtual disk [vDisk]) for optimal performance and scalability (Figure 3).

Figure 2. Cisco UCS Storage Accelerator Solution for VDI used with VMware View

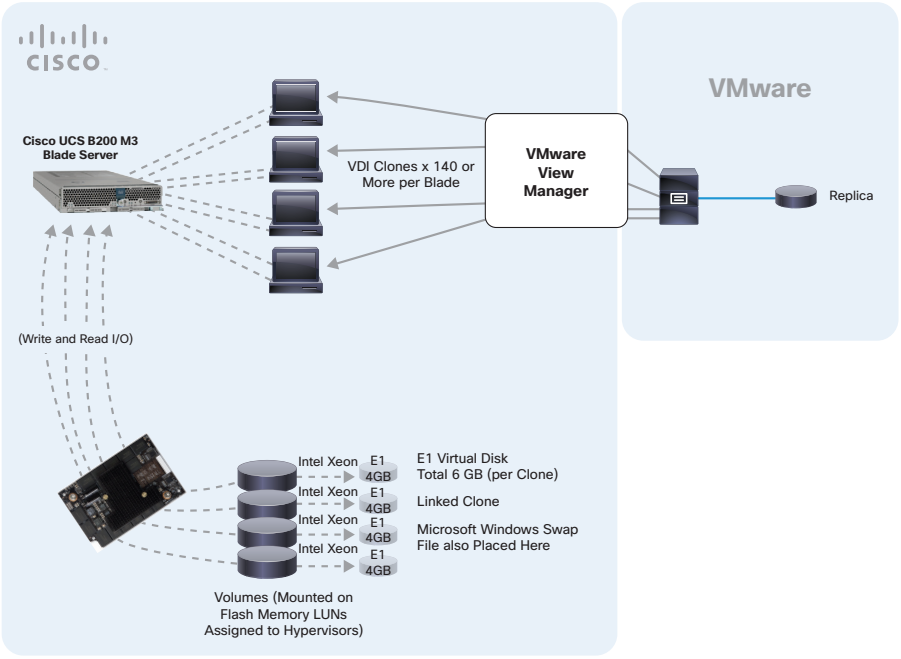
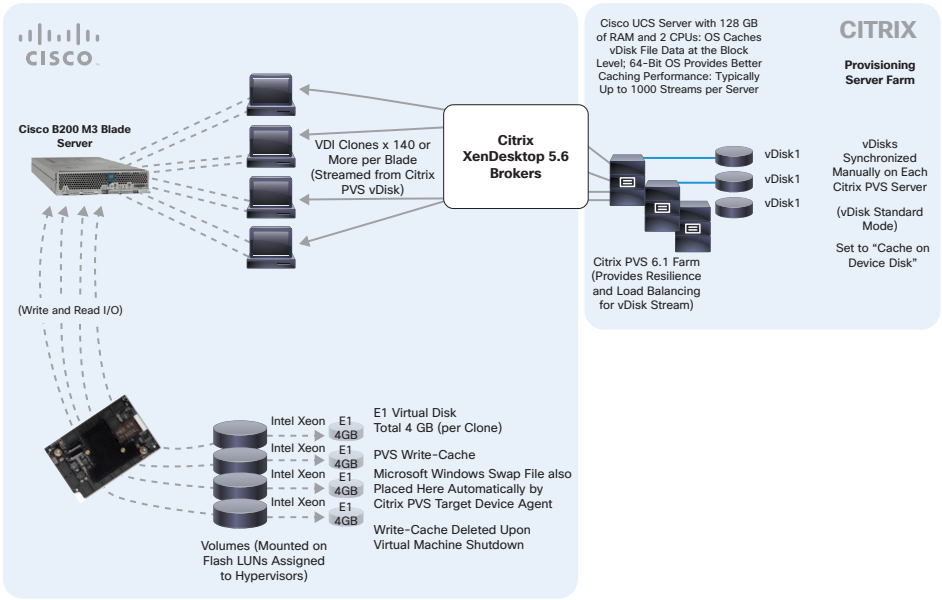


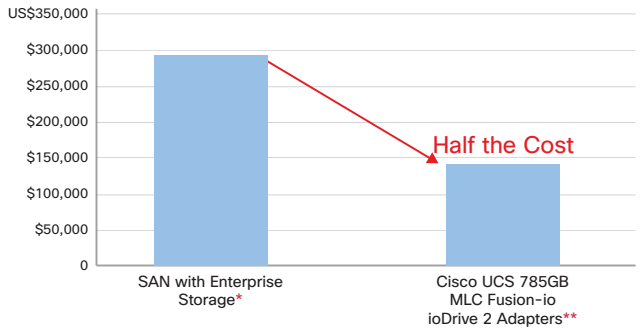
Figure 3. Cisco UCS Storage Accelerator Solution for VDI Used with Citrix VDI Solution



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 VDI solution delivers a dramatically lower-cost storage solution, with more predictable, consistent storage IOPS performance than shared enterprise storage solutions. As VDI deployments scale to support 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, in a deployment of 2000 virtual desktops, the server-based Cisco UCS Storage Accelerator reduced storage costs by 50 percent compared to a SAN storage solution (Figure 4).

Figure 4. Cisco UCS Storage Accelerator Solution for VDI: Storage Cost Estimates for 2000 Virtual Desktops



* Includes industry standard enterprise storage to support up to 2000 desktops with licenses for 1-year support (US$286,000), four ports of Cisco Nexus® 5000 Series Servers, and four storage ports licenses for Cisco UCS fabric interconnect, all at average selling price (ASP) prices.

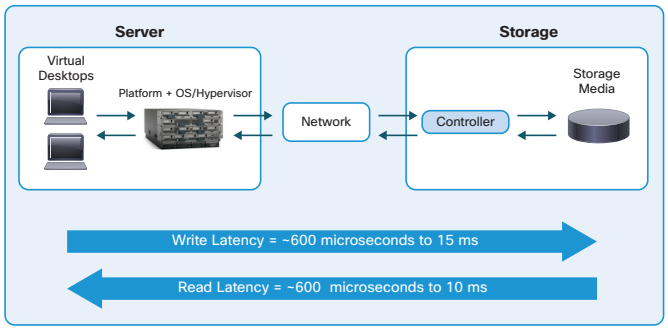
** Includes Cisco UCS Storage Accelerator at ASP

*** Does not include support and maintenance costs

Cisco UCS 785-GB MLC Fusion-io ioDrive 2 Adapters can provide up to 500,000 write operations (512 B), or approximately 10 times more write IOPS, and 100,000 read operations (512 B), or approximately three times more read IOPS, than a typical shared storage solution (sized for 2000 desktops).

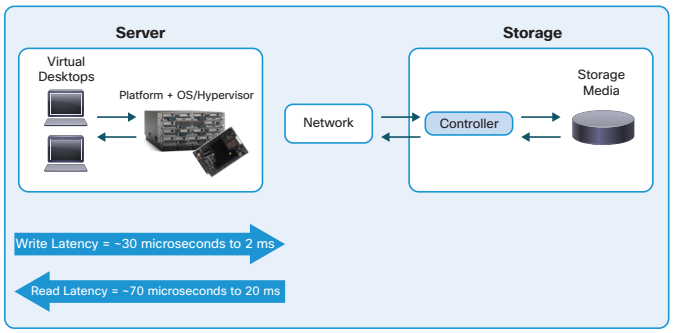
Improved performance Improved performance: With SAN-based storage solutions for VDI, read and write operations are serviced by the storage array, requiring communication across the server, storage network, storage controller, and storage media. Latency is associated with each of these elements (Figure 5). 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 5. Performance of Traditional SAN-Based Storage Solution for VDI



The Cisco UCS Storage Accelerator solution enables the disaggregation of the storage environment by removing the need to traverse the network, storage controller, and media, and by containing the I/O requests for each server within the server. Performance of a VDI solution using the Cisco UCS 785-GB MLC Fusion-io ioDrive 2 Adapter results in reduced latency because read and write operations occur on the adapter (Figure 6).

Figure 6. Cisco UCS Storage Accelerator Solution Architecture for VDI

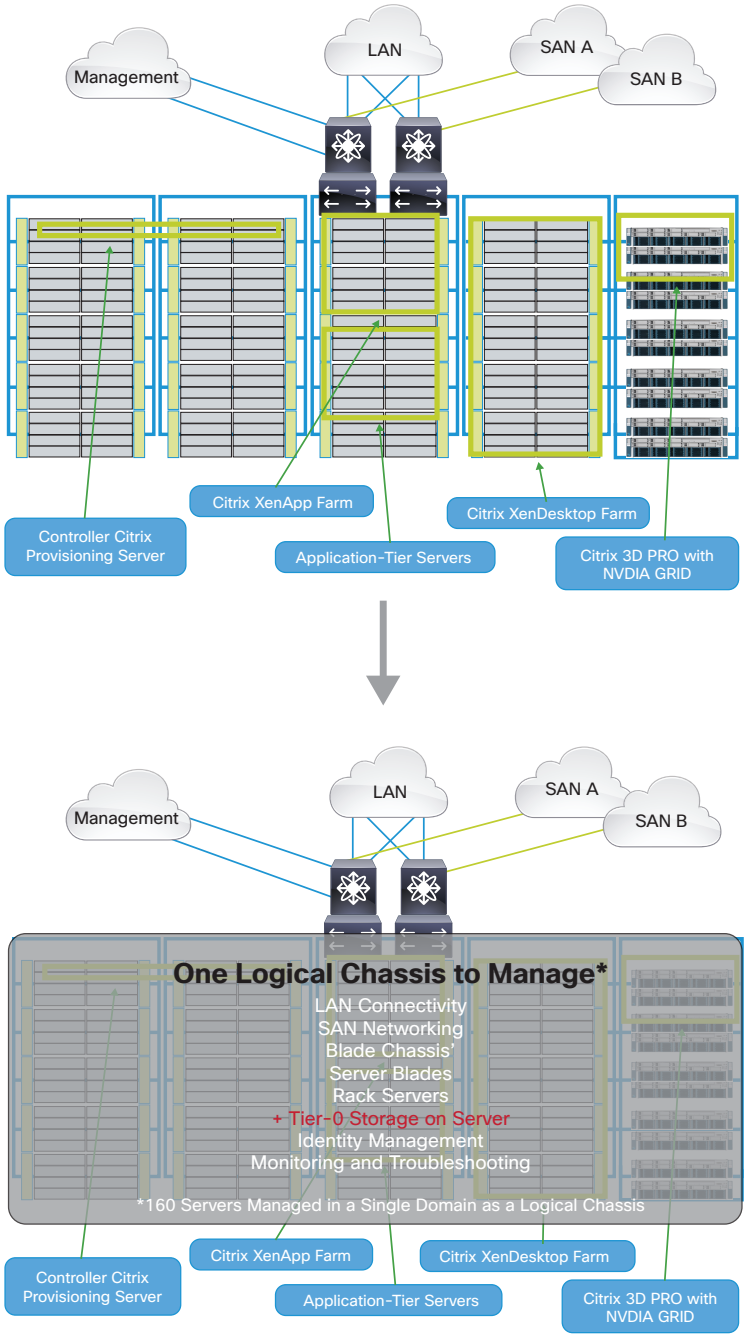


The Cisco UCS Storage Accelerator architecture delivers 10 times more IOPS (compared to 20 SSDs behind a RAID controller) and consistent performance of random read and write operations. Traditional queue depths and other forms of I/O serialization are avoided. The Cisco UCS Storage Accelerator solution 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 the VDI solution scales.

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

Figure 7 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. With the addition of the Cisco UCS Storage Accelerator, Cisco UCS Manager manages the Tier-0 storage on the server as well as all the many other components of the system.

Figure 7. 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 is dramatically improved. With the smaller block of storage on the server (which can support up to 10 times more IOPS, 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 Cisco UCS Storage Accelerator becomes a building block, enabling more cost-effective scalability with predictable performance.

Less 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 data center footprint than traditional SAN-based storage solutions (Figure 8).

Conclusion

As organizations seek the expected benefits of VDI, they need to understand the importance of correctly sizing storage IOPS capacity. 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 compromises 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, increase performance, and optimize their CapEx and OpEx, resulting in a quicker path to VDI return on investment (ROI).

For More Information

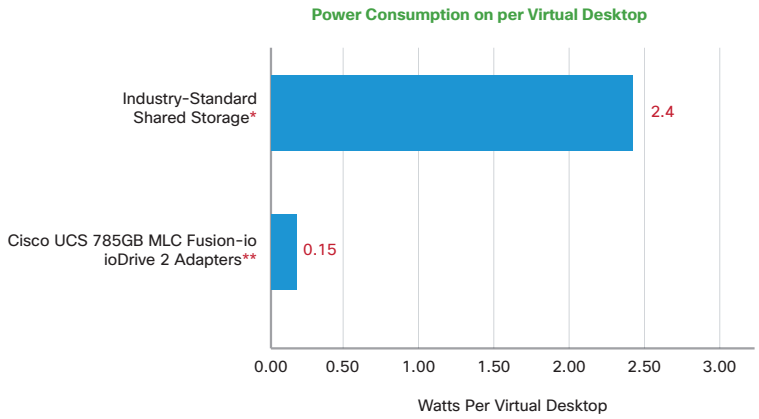
Cisco Desktop Virtualization Solutions:
http://www.cisco.com/go/vdi

Cisco UCS programmable infrastructure:
http://www.cisco.com/en/US/netsol/ns1166/index.html

Unified model-based management:
http://www.cisco.com/en/US/netsol/ns1169/index.html

Cisco UCS servers:
http://www.cisco.com/en/US/prod/ps10265/cisco_servers_for_ucs.html

Figure 8. Cisco UCS Storage Accelerator Solution for VDI Compared to SAN-Based Storage: Power Consumption



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

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

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