

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

## Greater Efficiency and Performance from the Industry Leaders

Citrix XenDesktop with Microsoft Private Cloud on FlexPod provides a tightly coupled, highly efficient virtual desktop solution with simplified server, network, and virtualized machine deployment. Built on industry-leading technologies, this solution offers excellent virtual desktop user experience with greater performance, scalability, and manageability.

## Streamlined Virtual Infrastructure Management

Functional integration between hypervisor (Microsoft Hyper-V Server 2008 R2 SP1) and Cisco Unified Computing System™ (Cisco UCS™), through Cisco UCS Manager and Microsoft System Center 2012 Virtual Machine Manager (VMM), provides for a highly streamlined, scalable infrastructure.

## High-Performance Cisco UCS Blade Servers

Cisco UCS B230 M2 Blade Servers with Intel® Xeon® E7-2800 Series processors deliver a best-in-class, next-generation platform that can be quickly deployed and can support very large numbers of virtual desktops.

## Tested and Validated Virtual Desktop Infrastructure Based on FlexPod

Focused on the needs of the enterprise, Cisco, Citrix, Microsoft, and NetApp provide scalable, tested, and validated desktop virtualization capacity built on FlexPod, taking the guesswork of deploying virtual desktop infrastructure (VDI).

Offering choice and flexibility without sacrificing performance, Cisco and its partners deliver more than 2000 virtual desktops using Citrix XenDesktop with Microsoft Private Cloud on FlexPod, a scalable virtual infrastructure built on Cisco Unified Computing System, Microsoft Hyper-V, Citrix XenDesktop, and NetApp FAS storage.

## The Evolving Workplace

Today's IT departments are facing a rapidly evolving workplace environment. The workforce is becoming increasingly diverse and geographically dispersed, including offshore contractors, distributed call center operations, knowledge and task workers, partners, consultants, and executives connecting from locations around the world at all times.

This workforce demands access to a growing variety of client computing and mobile devices that workers can choose based on personal preference. These trends are increasing pressure on IT to help ensure protection of corporate data and prevent data leakage or loss through any combination of user, endpoint device, and desktop access scenarios. These challenges are compounded by desktop refresh cycles to accommodate aging PCs and the migration to newer operating systems, such as Microsoft Windows 7 and 8.

## Desktop Virtualization and the Role of the Data Center

Fortunately for IT, end users, and the business itself, desktop virtualization now offers a near-native end-user experience on almost any device, while at the same time providing increased control and security and lower total cost of ownership (TCO) to IT and the business. An agile and robust data center infrastructure is required to support desktop virtualization. Challenges related to performance, capacity, and security must be addressed within the data center for desktop virtualization to deliver on its promises of simplified operations, secure data, and reduced desktop TCO. Cisco provides an optimized data center infrastructure for desktop virtualization and a platform for desktop virtualization.

## Optimized Infrastructure for Virtual Desktops: Cisco Unified Data Center with Microsoft, Citrix, and NetApp

Cisco® Unified Data Center is a holistic data center infrastructure architecture that delivers a network and computing fabric with a comprehensive feature set with better scalability and consistently high performance. It combines computing, storage, networking, security, and management resources into a single fabric architecture to create an optimal environment for desktop virtualization. The Cisco unified management framework offers an open design that integrates transparently, boosting the power of Microsoft management tools. Cisco Unified Data Center combined with Microsoft System Center 2012 Virtual Machine Manager (VMM), provides automated, streamlined operations and management capabilities that extend beyond the software and into the infrastructure, avoiding the challenges and costs of uncontrolled operations. Coupled with Citrix XenDesktop 5.6, Citrix Provisioning Server 6.1, and NetApp FAS storage, this virtualized infrastructure platform takes the guesswork out of choosing the right architecture for virtual desktop workloads, providing linear scalability as users are added.

### Consistently fast performance from 145 users on a single blade to more than 2000 users using Citrix XenDesktop with Microsoft Private Cloud on FlexPod.

Organizations need dependable scalability with uncompromised performance as increasing numbers of virtual desktop users are added. The infrastructure packaging and modularity provided by FlexPod supporting Citrix XenDesktop with Microsoft Private Cloud provides an excellent platform for scalability with high performance delivered in a low-risk, validated configuration that takes the guesswork out of implementing a solution that grows with an organization's expanding needs.

Citrix XenDesktop with Microsoft Private Cloud on FlexPod is a validated configuration that delivers a virtualized data center in a rack composed of leading computing, networking, storage infrastructure, and virtual desktop software components. It differs from other virtualization offerings by providing:

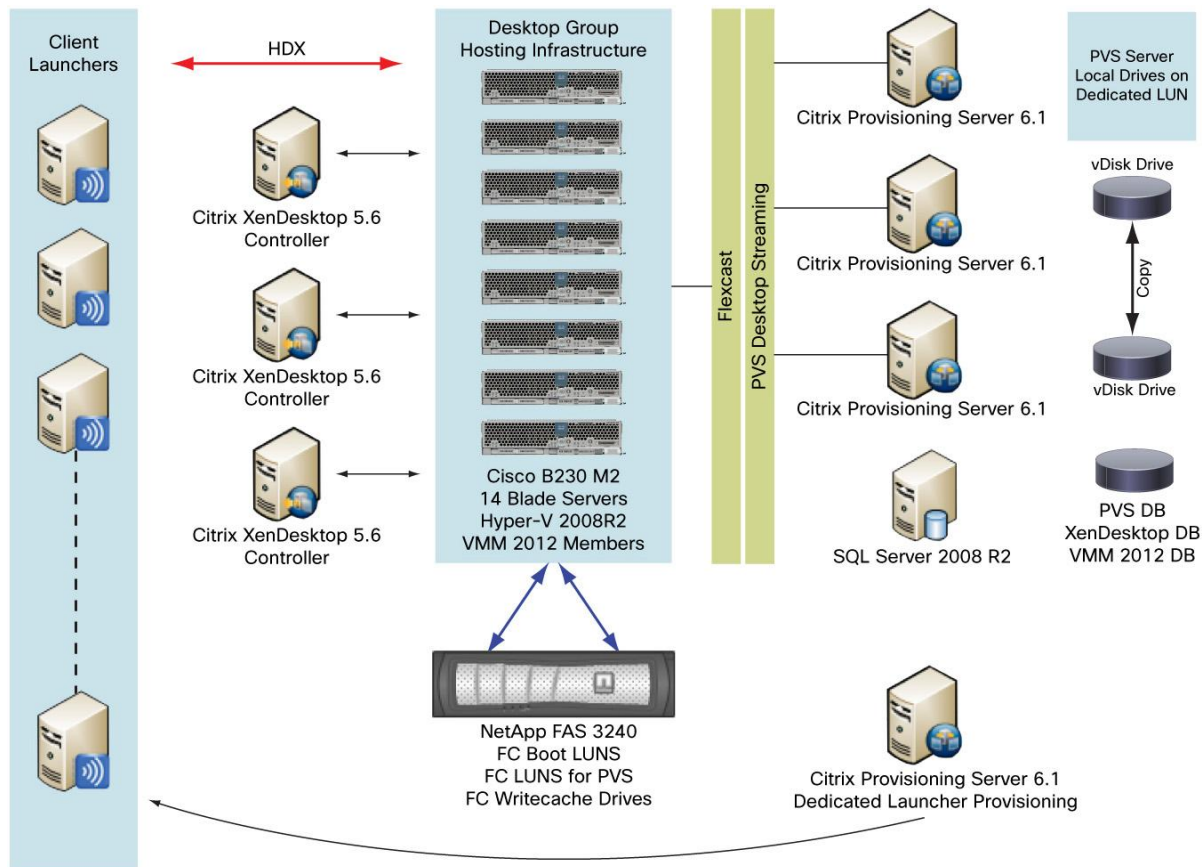
- Validated technologies from industry leaders in computing, storage, networking, virtual desktop, and server virtualization
- A single data center platform that lets you scale to meet the largest virtual desktop infrastructure requirements without disruption or architectural changes in the future
- Integrated components that enable you to centrally manage all your infrastructure pools
- An open-design management framework that integrates with your existing third-party infrastructure management solutions

Cisco, Microsoft, NetApp, and Citrix tested this architecture using the latest technology throughout the stack, including:

- Two Cisco UCS 5108 Blade Chassis, each with two Cisco 2104XP Fabric Extender I/O modules
- Fourteen Cisco B230 M2 Blade Servers using Intel Xeon processors E7-2870 with 256 GB of RAM and Cisco UCS M81KR Virtual Interface Cards (VICs)
- Two Cisco B200 M2 Blade Servers supporting solution infrastructure and management components
- Microsoft Hyper-V 2008 R2 SP1 hypervisor with installed Cisco UCS M81KR (Palo) VIC drivers for Microsoft Hyper-V, integrated with Microsoft System Center 2012 VMM
- NetApp FAS3240 dual controllers, with 600-GB 10,000-RPM SAS drives for Fibre Channel boot, Infrastructure, Small Computer System Interface over IP (iSCSI) for clustered shared volumes, and virtual desktop write cache logical unit numbers (LUNs), and 256-GB flash memory cache
- Citrix XenDesktop 5.6 with redundant desktop controllers
- Three Citrix Provisioning Server 6.1 instances with a local copy of the pooled virtual desktop virtual disk (vDisk)
- Login VSI software for evaluating the performance of the test environment

Figure 1 shows the test configuration.

**Figure 1:** Test Configuration

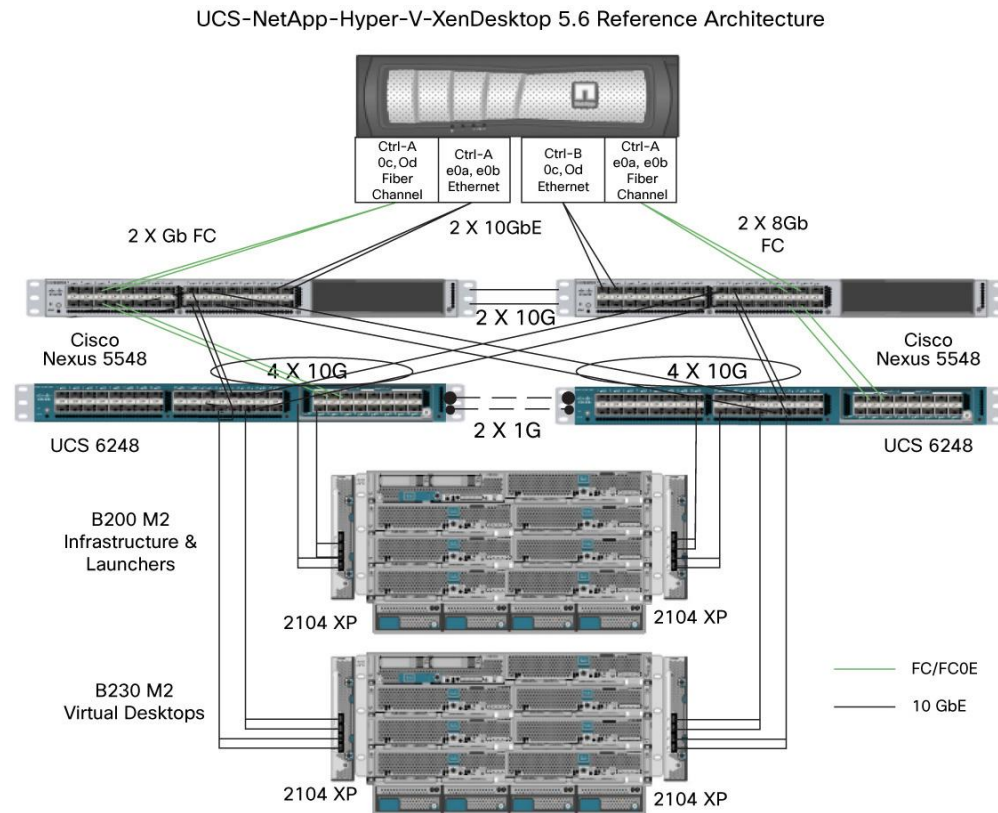


In addition to testing new technology through the latest hardware and software components, Cisco also wanted to increase the testing workload in concert with current demand for increasing use of multimedia. For this purpose, a high-stress workload was applied (profiled in the Login VSI tool) making heavy use of Adobe Flash video to simulate use by demanding knowledge workers. Even with more demanding virtual workloads driven by Login VSI software, the tested configuration demonstrated dramatic scalability over what was possible only a short time ago. A single FlexPod hosted more than 2000 virtual desktops. More important, the configuration showed linear scalability as larger numbers of blade servers were added.

## Reference Architecture

In the reference architecture (Figure 2), all traffic is kept local to the Cisco Nexus 5548P and 5548UP Switches, Cisco UCS 6248UP 48-Port Fabric Interconnects, and the blade servers. This approach can eliminate the typical top-of-rack (ToR) Layer 3 switch, which often proves a VDI bandwidth bottleneck. Importantly, the blade servers are all configured diskless, with all boot images and VDI images centralized on the NetApp FAS storage system for manageability and to provide Cisco's stateless data center environment.

**Figure 2: Reference Architecture**



## Cisco Nexus 5548 Switch and Cisco UCS 6248UP Fabric Interconnects

The Cisco Nexus 5548 switch and Cisco UCS 6248UP fabric interconnects provide all the connectivity for block and iSCSI storage networking, reducing latency and greatly simplifying configuration. The Cisco Nexus 5548 switch provides Fibre Channel access (and zoning) to the NetApp FAS storage array while providing standard iSCSI access over 10 Gigabit Ethernet.

## Infrastructure and Launcher Blades

Figure 2 illustrates the necessary VDI infrastructure that was used in testing to launch VDI sessions running Microsoft Windows 7 virtual desktops. The blade configuration includes:

- Two Cisco UCS 2104XP Fabric Extenders to bring the system's unified fabric to the blade chassis
- Two Cisco UCS B200 M2 Blade Servers (one in each chassis, equipped with two Intel Xeon processors 5600 and 96 GB of RAM and a Cisco UCS M81KR (Palo) VIC) running necessary infrastructure software

The infrastructure software running on the two blade servers includes:

- Two Microsoft Active Directory domain controllers for redundancy
- Two-node clustered file server that handles file storage for roaming user profiles
- Two-node clustered SQL server that handles database tasks for provisioning and broker services
- Citrix Licensing Server that provides the web interface required for logging into the virtual desktops
- Three Citrix Provisioning Server 6.1 servers that provide a single disk image to be provisioned on many clients

- Two Citrix XenDesktop 5.6 controllers (one on each blade) to manage virtual desktops in conjunction with Microsoft System Center 2012 VMM throughout the virtual desktop life cycle

## Launcher Blades

Four Launcher blades were contained in a third chassis, not shown in Figure 2. The launchers are responsible for launching multiple virtual desktop sessions, running the Login VSI medium-sized knowledge-worker workload with Adobe Flash, and logging out the sessions cleanly, returning all virtual machines to an available state on the Citrix XenDesktop controllers.

## Virtual Desktop Blades

The virtual desktop blades ran the Microsoft Windows 7 virtual desktops and contain the following components:

- Fourteen Cisco UCS B230 M2 Blade Servers, each with dual Intel Xeon processor E7- 2870 10-core CPUs, 256 GB of RAM, and a Cisco UCS M81KR (Palo) VIC

## NetApp FAS Storage

The NetApp FAS3240 dual-controller storage system provides advanced capabilities in a midrange storage system that easily responds to future expansion. It offers multiprotocol support, integrated data protection, and heterogeneous disk array support (NetApp V-Series), supported by NetApp's unified architecture running the NetApp Data ONTAP storage operating system.

Block-based storage is provided for boot volumes (SAN access using TFTP) and write-cache drives, and iSCSI storage is used for clustered shared volumes for SQL and profile clustered servers. The NetApp FAS3240 test configuration used 600-GB 10,000-RPM SAS drives for Fibre Channel LUNs and iSCSI volumes and 256 GB of intelligent flash memory cache, improving performance by increasing read rates and reducing average latency for frequently accessed data, essential to VDI performance when a single master image serves a large pool of virtual desktop clients.

## Main Results

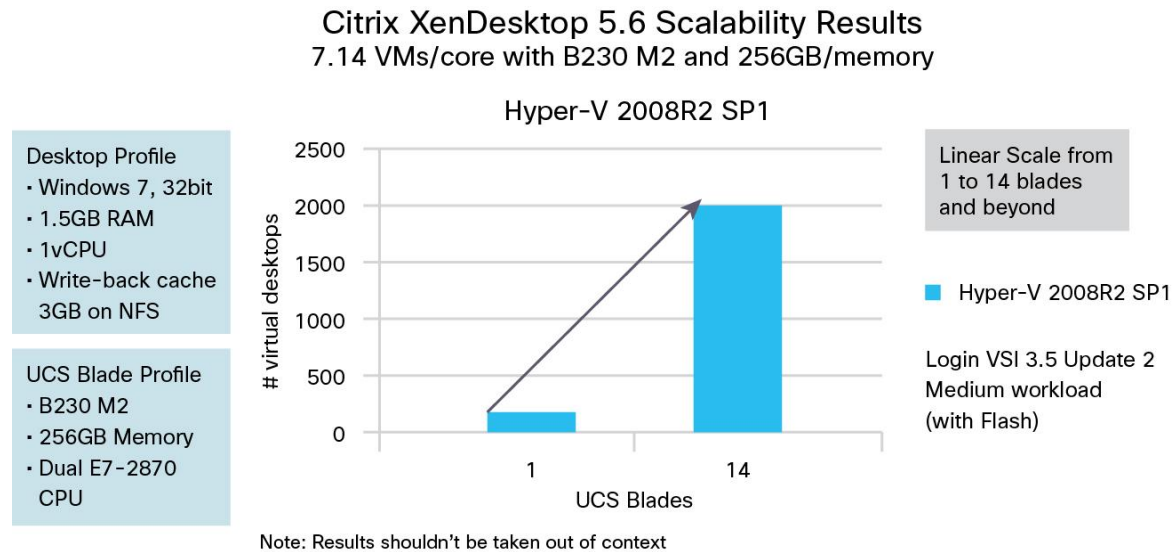
Validation testing revealed the following results based on the Login VSI medium-sized (knowledge worker) workload with Adobe Flash using Microsoft Windows 7 SP1 virtual machines with a single virtual CPU (vCPU) and 1.5 GB of RAM:

- Consistent boot times of 20 minutes (33% faster than prior validated designs)
- User login and workload start within 27 minutes
- Reduced rack space for computing infrastructure, requiring less than half the footprint required in prior benchmarks using Cisco UCS B250 M2 Blade Servers
- Linear scalability as users are added: 145 users on a single blade and more than 2000 users total (Figure 3)



Although the configuration employed supported 2000 active virtual desktop sessions, note that additional chassis and blade servers could be added to the platform to increase capacity.

**Figure 3:** Performance and Scalability



## Conclusion

Cisco and its industry-leading partners Microsoft, Citrix, and NetApp have delivered an optimized data center infrastructure well-suited to the unique demands of virtual desktop workloads, offering greater flexibility and scalability and streamlined operations, with predictable performance and an uncompromised user experience.

With the results achieved and validated for this solution architecture, Cisco and its partners demonstrate considerable investment protection for enterprises by providing greater density of graphics-intensive virtual workloads per blade through a reference architecture that is designed to scale elegantly without arbitrary limitations.

## For More Information

- Cisco Validated Design: Citrix XenDesktop with Microsoft Private Cloud on FlexPod  
[http://www.cisco.com/en/US/docs/unified\\_computing/ucs/UCS\\_CVDs/ucs\\_xd56\\_flexpod.html](http://www.cisco.com/en/US/docs/unified_computing/ucs/UCS_CVDs/ucs_xd56_flexpod.html)
- Cisco desktop virtualization solutions: <http://www.cisco.com/go/vdi>



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