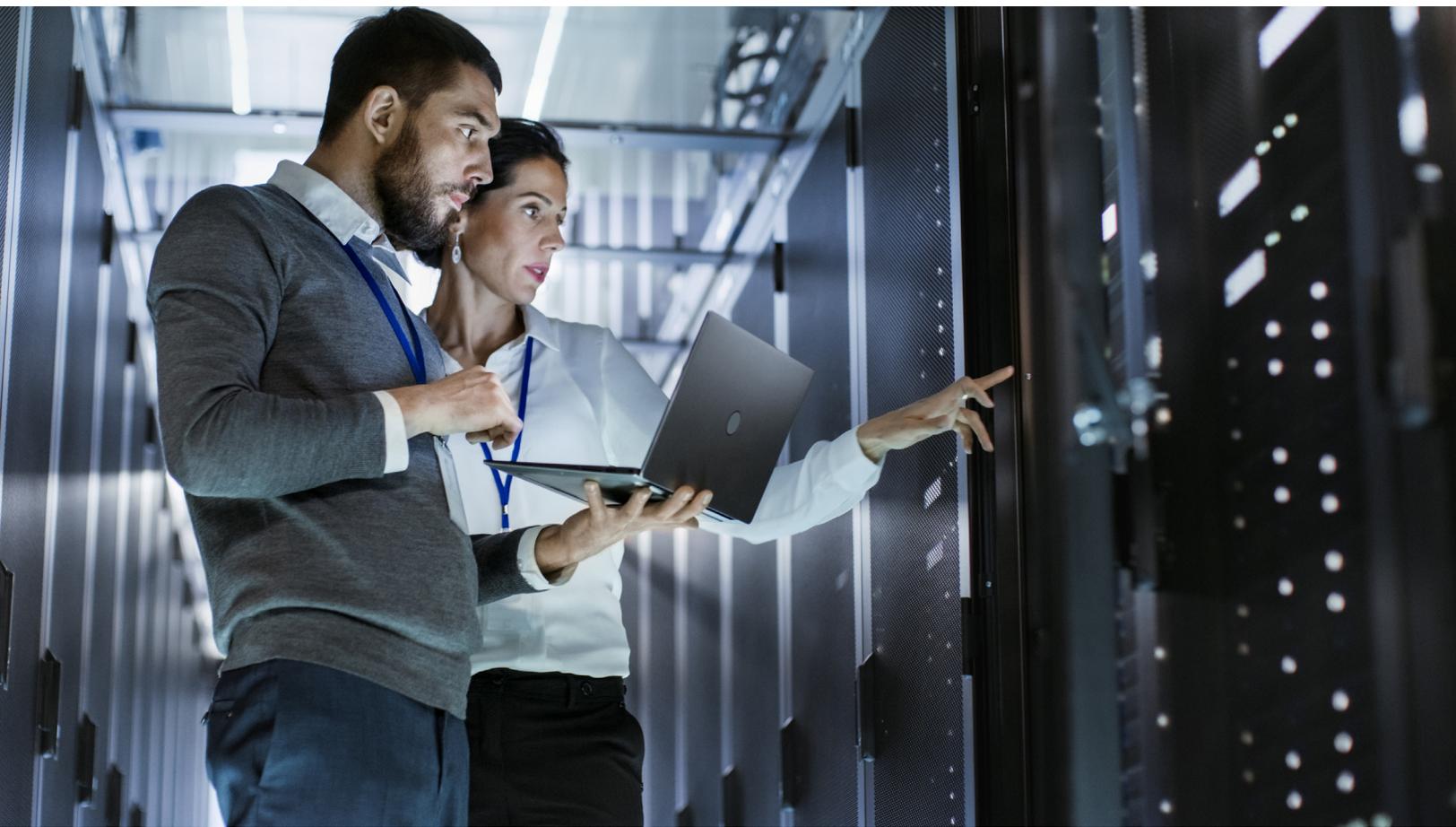# FlashStack for Citrix XenDesktop Solution Guide

Data centers are looking to be more streamlined, flexible and transformative to help deliver the applications and workloads to drive business impact. One method considered is converged infrastructures. This enables enterprises to take advantage of faster time to value, lower overall IT costs, and reduce deployment risk.

However, application availability, management complexity and performance remain an issue for some solutions — particularly for traditional data center architectures with aging systems. It is important to pick the right converged infrastructure for your enterprise.

To address this issue, converged infrastructures can be combined with virtual desktop infrastructure. VDI offers critical benefits to IT, including improved security and centralized desktop management.

Citrix XenDesktop provides benefits beyond standard VDI appliance solutions, delivering fully-functioning virtual Windows or Linux desktops and the apps employees need to remain productive making Citrix XenDesktop the default choice for your company's VDI infrastructure. A virtual desktop delivered by XenDesktop looks and feels the same as a locally installed desktop — even with demanding applications, such as 3D CAD engineering or design apps.

Cisco and Pure Storage have partnered to deliver this converged infrastructure in FlashStack, which uses best of breed storage, server and network components to serve as the foundation for many key mission-critical enterprise applications and provide a robust platform for cloud services.

This solution guide discusses several challenges to VDI adoption and how Cisco, Pure Storage and Citrix together can help companies embrace VDI. It shows how companies can take advantage of highly available, high-performing and cost-effective solutions. Finally, it discusses how to deploy FlashStack.

Business Challenge and Need for Bundled Solution

Organizations that have moved into the VDI space face a number of challenges. These include:

- **Poor User Experience:** Slow login times and unreliable desktop availability (amongst others) lead to increased resistance to VDI adoption.

- **Infrastructure Cost:** Out-of-control costs prevent many organizations from starting or scaling VDI.

- **Scalability:** It is often expensive and difficult to add more seats to a VDI project; scaling can unexpectedly create or expose an infrastructure bottleneck.

- **Performance:** Traditional storage methodologies (spinning disk and hybrid storage) can produce unacceptable latencies in graphics-rich environments used by CAD designers, engineers and even everyday office users.

What This Bundle Addresses

FlashStack with Citrix XenDesktop seeks to provide a unified, contextual and secure user experience. It fills those needs in the following ways:

- **Unified**

  - Customized VDI to satisfy any use case. Citrix XenDesktop provides benefits beyond standard VDI appliance solutions, delivering fully-functioning virtual Windows or Linux desktops and the apps employees need to remain productive.

  - Single image management. Unlike traditional VDI deployments, administrators can easily and centrally manage their master images while providing users with all of their files and unique applications.

  - High performance. Consistent sub-millisecond latency with 100 percent flash storage. This level of performance offers the ability to consolidate thousands of users in a single rack.

  - Easy scalability. This bundled solution can be easily scaled without disruption to users. Offers the ability to provide repeatable growth through multiple FlashStack converged infrastructure deployments.

  - Unified support agreement. Customer support is a team effort for the partners of this bundled solution. Pure Storage and Cisco can conduct a warm handoff to each other in the event of a problem. Customers can be assured that a call to either partner will result in the smooth resolution of their problem.

  - Evergreen storage. Every three years, Pure provides customers with free, non-disruptive controller upgrades. This benefit assures that storage is kept efficient and modern without the headaches of data migrations and forklift upgrades. With Cisco, customers only pay for hardware maintenance; no additional charge for software.

- **Secure**

  - FIPS 140-2 certified AES 256 encryption. Provides industry-leading security without performance penalties at the storage layer.

  - Increased data security with desktop virtualization. Cisco data center infrastructure (Cisco UCS and Cisco Nexus Family solutions) for desktop virtualization provides strong data center, network, and desktop security, with comprehensive security from the desktop to the hypervisor. Security is enhanced with segmentation of virtual desktops, virtual machine-aware policies and administration, and network security across the LAN and WAN infrastructure.

  - Secure access. NetScaler Gateway provides secure access inside or outside the LAN's firewall with additional credentials.

- **Contextual**

  - Automation. Cisco UCS Manager automates many mundane, error-prone data center operations such as configuration and provisioning of server, network, and storage access infrastructure.

  - Desktop density. Cisco UCS B-Series Blade Servers and C-Series Rack Servers feature large memory footprints that enable high desktop per server density, helping to reduce server infrastructure requirements.

  - Enterprise-grade resiliency. Administrators can independently add or upgrade Cisco compute and firmware, as well as Pure Storage with no downtime and no disruptions to users.

  - Context-aware security: With XenApp, XenDesktop and NetScaler Unified Gateway, you can achieve more granular contextual access control by setting policies to allow different levels of access based on who, what, when, where and why someone is seeking access.

Products Included in This Bundle

This bundled solution teams products from Citrix, Cisco and Pure Storage. These products work in perfect symbiosis in eliminating common stumbling blocks to VDI adoption with converged infrastructure:

- **Citrix XenDesktop:** Citrix VDI provides a complete virtual application and desktop solution that meets all user and administrator needs from a single, easy-to-deploy platform. It provides employees the freedom to work from anywhere while cutting IT costs. Citrix VDI can deliver Windows, web, and SaaS applications or full virtual desktops to workers on any device, anywhere.

- **FlashStack with Cisco UCS and Pure Storage FlashArray**: FlashStack CI (Converged Infrastructure) is a flexible, all-flash converged infrastructure solution that brings the flash revolution to enterprise data centers, faster. It combines the latest in compute, network, storage hardware and virtualization software, into a single, integrated architecture that speeds time to deployment, lowers overall IT costs and reduces deployment risk. Highly efficient components reduce the costs associated with power, cooling and data center space. Based on 100 percent flash storage, FlashStack CI provides the performance and reliability commonly required by business-critical applications.

  The hardware foundation of FlashStack CI includes Pure Storage FlashArrays, Cisco UCS Blade and Rack Servers, Cisco Nexus ethernet switches and Cisco MDS fibre channel switches. VMware vSphere provides the virtualization technology.

  Customers can leverage FlashStack's extensive pre-integration with popular private cloud platforms such as Cisco UCS Director to build an impactful cloud, quickly. FlashStack is hybrid-cloud ready, with support for tools like Cisco's CloudCenter, and for use cases such as backup to the cloud and dev/test.

Technical Overview

Deployment of this bundled solution will be simple to implement for virtually all business organizations. Key deployment considerations for each component of this bundle include the following:

Citrix: Deploying XenDesktop begins with installing the following components. This process prepares for delivery of applications and desktops to users inside your firewall.

- One or more Delivery Controllers

- Citrix Studio

- Citrix Director

- Citrix StoreFront

- Citrix License Server

- One or more Citrix Virtual Delivery Agents (VDAs)

- Optional components and technologies such as the Universal Print Server, the Federated Authentication Service, and Self-Service Password Reset

System requirements for XenDesktop Install can be found here.

Additional details can be found in the Pure Storage Design Guide for Citrix XenDesktop.

Customers can now opt for XenDesktop service on Citrix Cloud. Using the XenApp and XenDesktop Service, you can deliver secure virtual apps and desktops to any device, and leave most of the product installation, setup, configuration, upgrades, and monitoring to Citrix. You maintain complete control over applications, policies, and users while delivering the best user experience on any device, under any network condition.

You connect to the XenApp and XenDesktop Service through Cloud Connector, which serves as a channel for communication between Citrix Cloud and your resource locations. Cloud Connector enables cloud management without requiring any complex networking or infrastructure configuration such as VPNs or IPsec tunnels. For the XenApp and XenDesktop Service, resource locations contain the machines and other resources that deliver applications and desktops to your subscribers.

More details here: https://docs.citrix.com/en-us/xenapp-and-xendesktop/service.html

Cisco Unified Computing System: Offers stateless pool of virtual computing resources through the concept of service profiles. The concept of stateless computing facilitates much greater scalability and provides maximum flexibility for data center utilization. With the programmability of Cisco UCS Manager and the simplified server access of Cisco SingleConnect technology, you can easily deploy 1 server or 1000 servers.

Additional details about Cisco Unified Computing Systems can be found here.

Pure Storage: Infrastructure requirements for this bundled solution are as follows:

- FlashStack: Consists of a combined stack of hardware (storage, network and compute) and software (Cisco UCS Manager, Citrix XenDesktop, VMware vCenter/ESXi, and Pure Storage GUI and Pure1).

- Network: Cisco Nexus 9396 Switch, Cisco MDS 9148 and Cisco UCS Fabric Interconnect 6248UP for external and internal connectivity of IP and FC network.

- Storage: Pure Storage FlashArray//M20 with Fibre Channel connectivity.

- Compute: Cisco UCS B200 M5 Blade Servers. C240 M5 Rack Servers are also supported for users who need high-end GPU cards.

- Virtualization: Citrix XenDesktop 7.x, Citrix Provisioning Services (PVS)


Solution Description

Deployment of this bundled solution is a relatively simple, straightforward blueprint. The architecture deployed is highly modular. While each customer's environment might vary in configuration, the reference architecture overviewed below can easily be scaled as requirements and demands change. This flexibility includes scaling up (adding additional resources within a Cisco UCS Domain) and scaling out (adding additional Cisco UCS Domains and Pure Storage FlashArrays).

The virtual desktops are powered by Citrix Provisioning Services 7.9 with a mix of Citrix XenDesktop 7.9, which now incorporates both tradition persistent and non-persistent virtual Windows 8/10 desktops and hosted shared Server 2008 R2 or Server 2012 R2 server desktops, providing unparalleled scale and management simplicity.

Architecture Overview

The FlashArray//M20 contains no special configurations or value changes from the default values. The FlashArray contains twenty drive bays fully populated with two 256 gigabyte SSDs, each with two NVRAM devices for 10 terabytes of raw space in total. The UCS hosts are redundantly connected to the controllers with two FC connections to each controller from two HBAs on each host over the fibre channel protocol for a total of eight logical paths. Customers can easily and non-disruptively upgrade to the latest hardware and software innovations with Pure, including the new, 100 percent NVMe FlashArray//X.

A cluster group is configured with all the ESXi hosts and a private volume was created for boot from SAN for each host. One 30 terabyte and two 50 terabyte LUNs are shared across the entire host group for hosting the desktops: one for XenDesktop infrastructure, one for MCS and one for PVS, respectively.
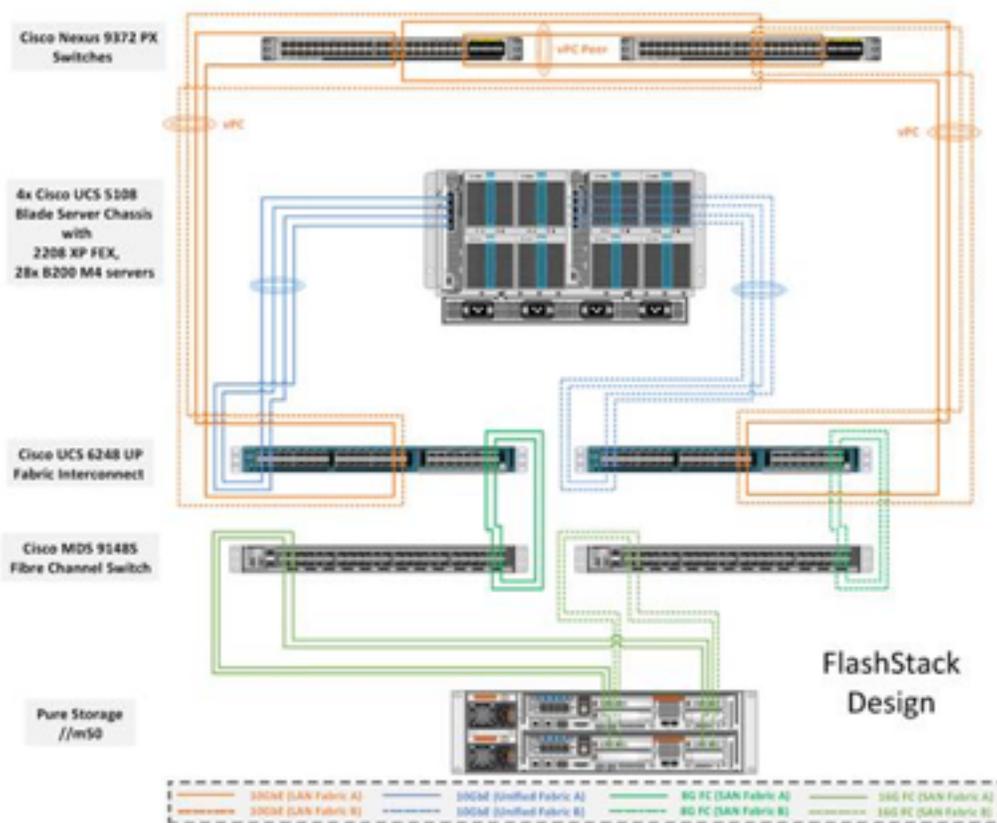
The above graphic provides an overview of the FlashStack architecture, and illustrates the cabling requirements for Citrix XenDesktop configuration.

Proof-of-Concept Testing

How effectively does Cisco/Pure Storage FlashStack Converged Infrastructure support a VDI environment? To find out performance data was gathered from testing one, four, eight, 16, 20 and 24 servers. A VDI environment of up to 2,500 Citrix desktops was simulated.

Testing conclusively proved that a FlashStack Converged Infrastructure is capable of supporting a large-scale VDI production environment without disruption or downtime — even as the environment is scaled from proof-of-concept to full-scale production comprised of thousands of virtual desktops.

Throughout the testing, sub-millisecond latency was maintained throughout every simulation run, including the final simulation of 2,500 VDI desktops. Though I/O increased significantly as the number of concurrently running desktops scaled, read latency never exceeded 0.30 milliseconds, and write latency never exceeded 0.31 milliseconds. (Latencies varied with the number of host servers deployed within each simulation.)

Key takeaways from the series of tests conducted by Pure Storage included the following observations:

- The testing team was able to perform a Machine Catalog update of 1600 MCS-based desktops in approximately 35 minutes. This included shutting down the 1600 desktops at the previous revision, cloning the updated image and booting and registering all desktops against the Delivery Controller. A peak latency of 0.7ms, IOPS of approximately 100K and bandwidth of 1.5 GB/s were observed during this operation.

- 2,500 PVS desktops were started at once with all of them registered against the Delivery Controller in approximately 32 minutes. That equates to approximately 78 PVS target devices streaming a vDisk from a Provisioning Server, booting and registering against Delivery Controllers per minute.

- The Pure Storage FlashArray consistently showed a 0.5 millisecond latency or less throughout the Login VSI tests for both reads and writes despite running against a heavy I/O workload.

- VM per host density can be further improved by purchasing servers with faster CPUs and/or more memory.

- The data reduction values ranging from 5:1 to 7.7:1 during these tests resulted using both MCS- and PVS-based desktops to showcase the XenDesktop suite of VDI solutions. While FlashStack supports both, a better data reduction ratio is generally observed with MCS-based clones. For ease of management and upgradability, PVS uses only a single streaming vDisk for the OS-layer and the attached page file/write-cache data is not as reducible. Even so, testing indicated that PVS requires somewhat less I/O than MCS, and the array at most was 28 percent full during testing, leaving a great deal of space available.

A Proven Bundled Solution That Enhances Data Center Efficiency While Maximizing VDI Benefits

As a company's data centers evolve to offer greater efficiency and productivity, the benefits ripple throughout the organization. Quite simply, the more efficient the data center, the more cost-effective all operations are.

The partnership of Cisco and Pure Storage has resulted in FlashStack, a converged infrastructure solution that offers a substantial increase in data center efficiency along with a reduction in costs. FlashStack provides proven benefits in:

- **Scalability:** Thousands of virtual desktops can be deployed within minutes on a single FlashStack.

- **Reliability:** Virtual desktops are kept online with a proven 99.9999 percent storage uptime.

- **Economy:** Per-desktop costs are lowered substantially with FlashStack's 10:1 data reduction.

When teamed with Citrix VDI, FlashStack offers an unprecedented improvement in productivity, efficiency and user satisfaction. In essence, this bundled solution provides an evolutionary leap in data center management.

For more information about Citrix Ready solutions and partners, contact Citrix.

For more information about Cisco UCS, contact Cisco.

For more information about Pure Storage FlashArray, contact Pure Storage.

Additional Links

FlashStack converged infrastructure solution design guide for Citrix XenDesktop

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About CItrix Ready

Citrix Ready identifies recommended solutions that are trusted to enhance the Citrix Delivery Center infrastructure. All products featured in Citrix Ready have completed verification testing, thereby providing confidence in joint solution compatibility. Leveraging its industry-leading alliances and partner ecosystem, Citrix Ready showcases select trusted solutions designed to meet a variety of business needs. Through the online catalog and Citrix Ready branding program, you can easily find and build a trusted infrastructure. Citrix Ready not only demonstrates current mutual product compatibility, but through continued industry relationships also ensures future interoperability. Learn more at citrixready.citrix.com.