Reference Architecture

EMC® INFRASTRUCTURE FOR CITRIX XENDESKTOP 5.5

EMC VNX™ Series (NFS), Cisco UCS, Citrix XenDesktop 5.5, XenApp 6.5, and XenServer 6

- Simplify management and decrease TCO
- Streamline Application Delivery
- Minimize the risk of virtual desktop deployment

EMC Solutions Group

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Reference architecture overview

Document purpose

EMC's commitment to consistently maintain and improve quality is led by the Total Customer Experience (TCE) program, which is driven by Six Sigma methodologies. As a result, EMC has built Customer Integration Labs in its Global Solutions Centers to reflect realworld deployments in which TCE use cases are developed and executed. These use cases provide EMC with insight into the challenges currently facing its customers.

This document describes the reference architecture of the EMC® Infrastructure for Citrix XenDesktop 5.5, EMC VNX™ Series (NFS), Cisco UCS, Citrix XenDesktop 5.5, XenApp 6.5, and XenServer 6 solution, which is tested and validated by the EMC Solutions Group.

Introduction to the EMC VNX Series

VNX series delivers uncompromising scalability and flexibility for the midtier while providing market-leading simplicity and efficiency to minimize total cost of ownership (TCO). Customers can benefit from the new VNX features such as:

- Next-generation unified storage, optimized for virtualized applications
- Extended cache using Flash drives with FAST Cache and Fully Automated Storage Tiering for Virtual Pools (FAST VP) that can be optimized for the highest system performance and lowest storage cost simultaneously on both block and file
- Multiprotocol support for file, block, and object with object access through Atmos™ Virtual Edition (Atmos VE)
- Simplified management with EMC Unisphere™ for a single management interface for all NAS, SAN, and replication needs
- Up to three times improvement in performance with the latest Intel Xeon multicore processor technology, optimized for Flash
- 6 gigabit/s SAS back end with the latest drive technologies supported:
  - 3. 5” 100 GB and 200 GB Flash, 3.5” 300 GB, and 600 GB 15k or 10k rpm SAS, and 3.5” 1 TB, 2 TB and 3 TB 7.2k rpm NL-SAS
  - 2. 5” 100 GB and 200 GB Flash 300 GB, 600 GB, and 900 GB 10k rpm SAS
- Expanded EMC UltraFlex™ I/O connectivity—Fibre Channel (FC), Internet Small Computer System Interface (iSCSI), Common Internet File System (CIFS), Network File System (NFS) including parallel NFS (pNFS), Multi-Path File System (MPFS), and Fibre Channel over Ethernet (FCoE) connectivity for converged networking over Ethernet

The VNX series includes five new software suites and three new software packs, making it easier and simpler to attain the maximum overall benefits.

Software suites available

- VNX FAST Suite—Automatically optimizes for the highest system performance and the lowest storage cost simultaneously (FAST VP is not part of the FAST Suite for the VNX5100).

- VNX Local Protection Suite—Practices safe data protection and repurposing.
- VNX Remote Protection Suite—Protects data against localized failures, outages and disasters.
- VNX Application Protection Suite—Automates application copies and proves compliance.
- VNX Security and Compliance Suite—Keeps data safe from changes, deletions, and malicious activity.

Software packs available

- VNX Total Efficiency Pack—Includes all five software suites (not available for the VNX5100).
- VNX Total Protection Pack—Includes local, remote and application protection suites
- VNX Total Value Pack—Includes all three protection software suites and the Security and Compliance Suite (the VNX5100 exclusively supports this package).

Solution purpose

The purpose of this reference architecture is to build and demonstrate the functionality, performance, and scalability of virtual desktops enabled by the EMC VNX series, Citrix XenDesktop 5.5, XenApp 6.5, and XenServer 6. This solution is built on Machine Creation Services (MCS) in XenDesktop 5.5, and a VNX5300™ platform with multiprotocol support, which provides Network File System (NFS) storage for the XenServer Storage Repository (SR), and CIFS-based storage for user data and XenApp profiles.

This document validates the performance of the solution and provides guidelines for building similar solutions.

This reference architecture is not intended to be a comprehensive guide to every aspect of this solution. Refer to *EMC Infrastructure for Citrix XenDesktop 5.5, EMC VNX Series (NFS), Cisco UCS, Citrix XenDesktop 5.5, XenApp 6.5, and XenServer 6—Proven Solution Guide*, available on the EMC Online Support website, for more detailed information on performance and scalability testing.

The business challenge

Customers require a scalable, tiered, and highly available infrastructure to deploy their virtual desktop environment. There are several new technologies available to assist them in designing a virtual desktop solution, but they need to know how to use these technologies to maximize their investment, support service-level agreements, and reduce their desktop TCO.

This solution builds a replica of a common customer virtual desktop infrastructure (VDI) environment and validates the environment for performance, scalability, and functionality. Customers will achieve:

- Increased control and security of their global, mobile desktop environment, which is typically their most at-risk environment
- Better end-user productivity with a more consistent environment
- Simplified management with the environment contained in the data center

- Better support of service-level agreements and compliance initiatives
- Lower operational and maintenance costs

The technology solution

This solution demonstrates how to use EMC VNX5300 and Cisco Unified Computing System (UCS) B-Series platforms to provide the storage and computer resources for a Citrix XenDesktop 5.5 environment by using Windows 7 virtual desktops provisioned by MCS, in conjunction with Citrix XenApp 6.5 environment.

Planning and designing the storage infrastructure for a Citrix XenDesktop and XenApp environment is a critical step because the shared storage must be able to absorb large bursts of input/output (I/O) that occur over the course of a workday. These bursts can lead to periods of erratic and unpredictable virtual desktop performance. Users may adapt to slow performance, but unpredictable performance frustrates them and reduces efficiency.

To provide predictable performance for a VDI environment, the storage system must be able to handle the peak I/O load from the clients while keeping response time to a minimum. Designing for this workload involves the deployment of many disks to handle brief periods of extreme I/O pressure, which is expensive to implement. This solution uses EMC VNX Fast Cache to reduce the number of disks required.

Solution benefits

This solution aids in the design and implementation stages required for the successful implementation of virtual desktops on Citrix XenDesktop 5.5. The solution balances performance requirements and cost by using new features in the VNX operating environment, such as VNX FAST Cache. VNX support for NFS also enables the use of NFS-based SR for XenServer to provide cost-effective, easily deployable storage for the desktop virtualization platform.

The VNX series is powered by Intel-Xeon processors for intelligent storage that automatically and efficiently scales in performance while ensuring data integrity and security.

Using desktop virtualization provides organizations with additional benefits such as:

- Increased security by centralizing business-critical information.
- Increased compliance as information is moved from endpoints into the data center.
- Simplified and centralized management of desktops.
- Increased productivity for virtual workforces in any location.
- Increased use of the latest mobile devices to drive innovation throughout the business.
- Increased adaptability to business change with fast, flexible desktop delivery for setting up an offshore location, mergers and acquisitions, branch expansion, and other initiatives.

Solution architecture

Architecture diagram

This solution provides a summary and characterization of the tests performed to validate the EMC Infrastructure for Citrix XenDesktop 5.5, EMC VNX Series (NFS), Cisco UCS, Citrix XenDesktop 5.5, XenApp 6.5, and XenServer 6. It involves building a 1,000-seat Citrix XenDesktop 5.5 environment on VNX and using new VNX features to provide a compelling, cost-effective desktop virtualization platform.

Figure 1 depicts the overall logical architecture of the solution.

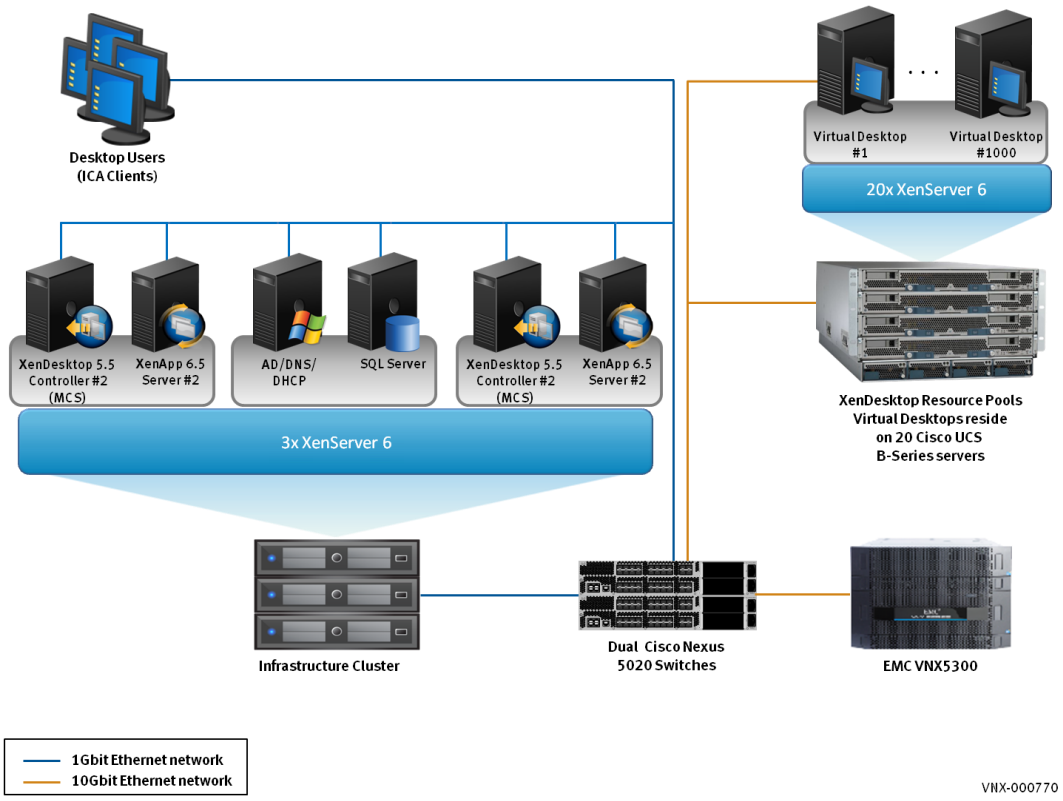

Figure 1. Reference architecture

Reference architecture overview

The reference architecture consists of the following components.

EMC VNX5300 platform – Provides storage by using IP (NAS) connections for virtual desktops, and infrastructure virtual machines such as Citrix XenDesktop controllers, XenApp servers, Microsoft SQL Server databases, and other supporting services. User profiles, home directories, and XenApp profiles are redirected to CIFS network shares on the VNX5300 platform.

Citrix XenDesktop 5.5 controller – Two Citrix XenDesktop 5.5 controllers that provide redundant virtual desktop delivery, authenticate users, manage the assembly of users' virtual desktop environments, and broker connections between users and their virtual desktops. In this reference architecture, the controllers are installed on Windows Server 2008 R2 and hosted as virtual machines running on XenServer hosts.

Virtual desktops – One thousand virtual desktops running Windows 7 are provisioned using MCS, which is a new provisioning mechanism introduced in XenDesktop 5.

Citrix XenServer 6 – A three-node XenServer resource pool that is used to host infrastructure virtual machines. Two eight-node XenServer resource pools are used to host a total of 1,000 virtual desktops.

Citrix XenApp 6.5 servers – Two XenApp 6.5 servers that are used to provide a redundant on-demand application delivery solution that enables Windows applications to be virtualized and centrally managed. In this reference architecture, the XenApp servers are installed on Windows Server 2008 R2 and hosted as virtual machines running on XenServer hosts.

Cisco UCS B-Series servers – Three Cisco UCS chassis that contain a total of 20 B200-M1 blade servers with 72 GB of RAM per blade. The 20 blades are used to host 1,000 Windows 7 virtual desktops.

Cisco Nexus 5020 switches – Two Nexus 5020 switches that provide high port density, wire-speed performance, and extremely low latency to meet the growing demand of a 10-gigabit Ethernet network.

Microsoft Windows 2008 Domain Controller and DNS server – The Windows 2008 R2 Domain Controller that provides Active Directory services to manage the identities and relationships that make up the Windows environment for the virtual desktops. The Domain Name System (DNS) component of the Windows network infrastructure is also installed on this server. This server is hosted as a virtual machine on a XenServer host.

Microsoft Windows 2008 DHCP Server – The server that centrally manages the IP address scheme for the virtual desktops. This service is hosted on the same virtual machine as the domain controller and DNS server.

Microsoft SQL 2008 Server – The database service that stores configuration details for the Citrix XenDesktop controllers and XenApp servers. This server is hosted as a virtual machine on a XenServer host.

Mixed 10-gigabit and 1-gigabit IP network – The Ethernet network infrastructure that provides 10-gigabit connectivity between virtual desktops, XenServer hosts, and VNX platform. The 10-gigabit infrastructure enables XenServers to access NFS SR on the VNX5300 platform with high bandwidth and low latency. It enables desktop users to redirect their roaming profiles and home directories to the centrally maintained CIFS shares on the VNX5300 platform. The desktop clients, XenDesktop management components, and Windows server infrastructure reside on the 1-gigabit network.

Hardware resources

Table 1 lists the hardware used in this solution.

Table 1. Solution hardware

Hardware	Quantity	Configuration	Notes
EMC VNX5300	1	• Two Data Movers (active/standby) • Three disk array enclosures configured with: ▪ Forty-one 300 GB, 15 k rpm 3.5-inch SAS disks ▪ Twenty-five 2 TB, 7200 rpm 3.5-inch NL-SAS disks ▪ Three 100 GB, 3.5-inch Flash drives	VNX shared storage
Cisco Nexus 5020	2	Forty 10 Gb ports	Redundant LAN A/B configuration
Cisco UCS B200-M1 blades	20	• Memory: 72 GB RAM • CPU: Two Intel Xeon E5540 2.5 GHz quadcore processors • Internal storage: Two 146 GB internal SAS disks • External storage: VNX5300 (NFS) • HBA/NIC: M71KR-Q Qlogic Converged Network Adapter (CNA)	Two XenServer resource pools to host 1,000 virtual desktops
Other servers	3	• Memory: 20 GB RAM • CPU: Two Intel Xeon E5450 3.0 GHz quadcore processors • Storage: One 67 GB internal disk • NIC: Two Broadcom NetXtreme II BCM 1000 Base-T Adapters	XenServer resource pool to host infrastructure virtual machines

Software resources

Table 2 lists the software used in this solution.

Table 2. Solution software

Software	Configuration
VNX5300 (shared storage, file systems)	
VNX OE for file	Release 7.0.40.1
VNX OE for block	Release 31 (05.31.000.5.509)
Cisco UCS and Nexus	
Cisco UCS B-Series server	Version 1.4(3q)
Cisco Nexus 5020	Version 4.2(1)N1(1)
XenDesktop/XenApp Virtualization	
Citrix XenDesktop Controller	Version 5.5 Platinum Edition
Citrix XenApp server	Version 6.5
Operating system for XenDesktop Controller and XenApp server	Windows Server 2008 R2 Enterprise Edition
Microsoft SQL Server	Version 2008 Enterprise Edition (64-bit)
Citrix XenServer	
XenServer	6.0 (Build 50762p)
XenCenter	6.0 (Build 50489)
Virtual desktops Software used to generate the test load.	
Operating system	Microsoft Windows 7 Enterprise (32-bit) SP1
Microsoft Office	Office Enterprise 2007 SP2
Internet Explorer	8.0.7601.17514
Adobe Reader	9.1
McAfee Virus Scan	8.7.0i Enterprise
Adobe Flash Player	10.0.22.87
Bullzip PDF Printer	6.0.0.865
FreeMind	0.8.1
Login VSI (VDI workload generator)	3.0 Professional Edition

Key components

Introduction

This section briefly describes the key components of this solution.

- EMC VNX Series
- VNX FAST Cache
- Cisco UCS B-Series servers
- Cisco Nexus 5000 series
- Citrix XenDesktop 5.5
- Machine Creation Services
- Citrix XenApp 6.5
- Citrix XenServer 6

Hardware resources on page 10, and Software resources on page 11 provide more information on the components that make up the solution.

EMC VNX Series

The EMC VNX series is a dedicated network server optimized for file and block storage access that delivers high-end features in a scalable, easy-to-use package.

The VNX series delivers a single-box block and file solution, which offers a central point of management for distributed environments. This makes it possible to dynamically grow, share, and cost-effectively manage multiprotocol file systems and provide multiprotocol block access. Administrators can take advantage of the simultaneous support for NFS and CIFS protocols by enabling Windows and Linux/UNIX clients to share files by using the sophisticated file-locking mechanisms of VNX for File and VNX for Block for high-bandwidth or latency-sensitive applications.

VNX FAST Cache

VNX FAST Cache, a part of the VNX FAST Suite, enables Flash drives to be used as an expanded cache layer for the array. The VNX5300 is configured with two 100 GB Flash drives in a RAID 1 configuration for a 93 GB read/write–capable cache. This is the minimum amount of FAST Cache. Larger configurations are supported for scaling beyond 1,000 desktops.

FAST Cache is an array-wide feature available for both file and block storage. FAST Cache works by examining 64 KB chunks of data in FAST Cache-enabled objects on the array. Frequently accessed data is copied to the FAST Cache and subsequent accesses to the data chunk are serviced by FAST Cache. This enables immediate promotion of very active data to Flash drives. The use of Flash drives dramatically improves the response time for the active data and reduces data hot spots that occur within the LUN.

The FAST Cache is an extended read/write cache that enables XenDesktop to deliver consistent performance at Flash-drive speeds by absorbing read-heavy activities such as boot storms and antivirus scans, and write-heavy workloads, such as operating system patches and application updates. This extended read/write cache is an ideal caching mechanism for MCS in XenDesktop 5.5. The base desktop image and other

frequently accessed user data are serviced directly from the Flash drives without having to access the slower drives at the lower storage tier.

Cisco UCS B-Series server

Cisco UCS is a next-generation data center platform that integrates computing, networking, storage access, and virtualization into a cohesive system designed to reduce TCO and increase business agility.

The Cisco UCS B-Series blade server platform used to validate this solution is the B200 M1 blade server that is a half-width, two-socket blade server. The system uses two Intel Xeon 5500 Series processors, up to 96 GB of double data rate type three (DDR3) memory, two optional hot-swappable small form factor (SFF) serial attached SCSI (SAS) disk drives, and a single mezzanine connector for up to 20 gigabit/s of I/O throughput. The server balances simplicity, performance, and density for production-level virtualization and other mainstream data center workloads.

Cisco Nexus 5000 series switch

The Cisco Nexus 5000 series is first and foremost a family of outstanding access switches for 10-gigabit Ethernet connectivity. Most of the features on the switches are designed for high performance with 10 Gigabit Ethernet. The Cisco Nexus 5000 series also supports FCoE on each 10-gigabit Ethernet port to implement a unified data center fabric, consolidating LAN, SAN, and server clustering traffic.

Citrix XenDesktop 5.5

Citrix XenDesktop transforms Windows desktops as an on-demand service to any user, any device, anywhere. Powered by Citrix HDX technologies, XenDesktop quickly and securely delivers any type of virtual desktop, or any type of Windows, web, or software-as-a-service (SaaS) application, to all the latest PCs, Macs, tablets, smartphones, laptops and thin clients with as a high-definition user experience.

FlexCast delivery technology enables IT to optimize the performance, security, and cost of virtual desktops for any type of user, including task workers, mobile workers, power users, and contractors. XenDesktop helps IT rapidly adapt to business initiatives by simplifying desktop delivery and enabling user self-service. The open, scalable, and proven architecture simplifies management, support, and integration.

Machine Creation Services

MCS is a new provisioning mechanism introduced in XenDesktop 5. It is integrated with Desktop Studio, the new XenDesktop management interface, to provision, manage, and decommission desktops throughout the desktop lifecycle management from a central point of management.

MCS allows several types of machines to be managed within a catalog in Desktop Studio, including dedicated and pooled machines. Desktop customization is persistent for dedicated machines; where a non-persistent desktop is appropriate, a pooled machine should be used.

In this solution, MCS provisions 1,000 virtual desktops that are running Windows 7. The desktops are deployed from two dedicated machine catalogs.

Desktops provisioned using MCS share a common base image within a catalog. Because of this, the base image is accessed with sufficient frequency to leverage EMC VNX FAST Cache, where frequently accessed data is promoted to Flash drives to provide optimal I/O response time with fewer physical disks.

Citrix XenApp 6.5

Citrix XenApp is an on-demand application delivery solution that enables any Windows application to be virtualized, centralized, and managed in the data center and instantly delivered as a service to users anywhere on any device. XenApp reduces the cost of application management by as much as 50 percent, increases IT responsiveness when delivering an application to distributed users, and improves application and data security.

Citrix XenServer 6

Citrix XenServer is the complete server virtualization platform from Citrix. The XenServer package contains everything needed to create and manage a deployment of virtual x86 computers running on Xen, the open-source paravirtualizing hypervisor with near-native performance.

Storage architecture

Storage layout

Figure 2 shows the layout of the disks in the reference architecture.

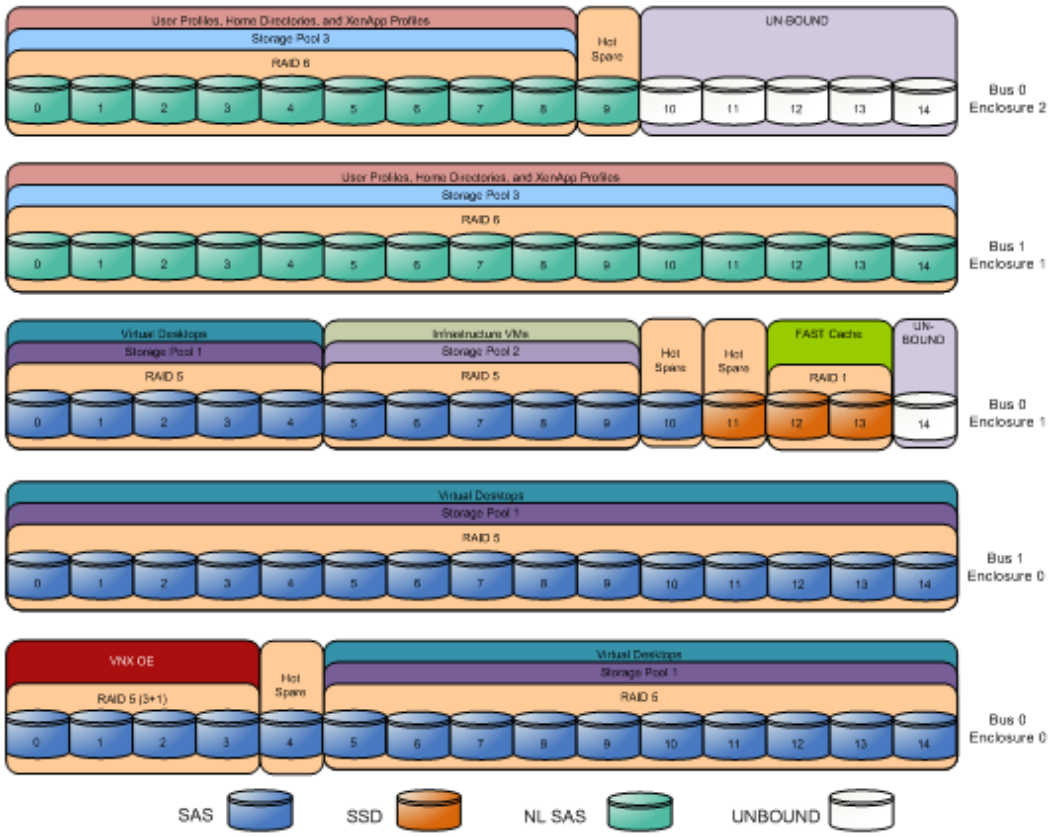

Figure 2. Storage layout

Storage layout overview

The following configuration is used in the reference architecture:

- Four SAS disks (0_0_0 to 0_0_3) are used for the VNX OE.
- Disks 0_0_4, 0_1_10, 0_1_11, and 0_2_9 are hot spares. These disks are marked as hot spare in the storage layout diagram.
- Thirty SAS disks (0_0_5 to 0_0_14, 1_0_0 to 1_0_14, and 0_1_0 to 0_1_4) on the RAID 5 storage pool 1 are used to store virtual desktops. FAST Cache is enabled for the entire pool. Thirty LUNs of 200 GB each are carved out of the pool provide the storage required to create eight NFS file systems. The file systems are presented to the XenServers as NFS SRs.
- Two Flash drives (0_1_12 and 0_1_13) are used for EMC VNX FAST Cache. There are no user-configurable LUNs on these drives.
- Five SAS disks (0_1_5 to 0_1_9) on the RAID 5 storage pool 2 are used to store the infrastructure virtual machines. A 1 TB LUN is carved out of the pool to form an NFS file system. The file system is presented to the XenServers as an NFS SR.
- Twenty four NL-SAS disks (1_1_0 to 1_1_14, and 0_2_0 to 0_2_8) on the RAID 6 storage pool 3 are used to store user data, roaming profiles, and XenApp

profiles. FAST Cache is enabled for the entire pool. Twenty-five LUNs of 1 TB each are carved out of the pool to provide the storage required to create three CIFS file systems.

- Disks 0_1_14, and 0_2_10 to 0_2_14 are unbound. They were not used for testing this solution.

VNX shared file systems

Virtual desktops use three shared file systems to:

- Store user profiles
- Redirect user storage that resides in home directories
- Store XenApp profiles in an App Hub

In general, redirecting user and application data out of the base image of VNX for File enables centralized administration, backup, and recovery, and makes the desktops more stateless. Each file system is exported to the environment through a CIFS share.

Network configuration

Network layout overview

Figure 3 shows the 10-gigabit Ethernet connectivity between the Cisco UCS B-Series servers and the EMC VNX platforms. Uplink Ethernet ports coming off the Nexus 5020 switches can be used to connect to a 10 gigabit or 1 gigabit external LAN. In this solution, a 1 gigabit LAN was used to extend Ethernet connectivity to the desktop clients, XenDesktop management components, and Windows server infrastructure.

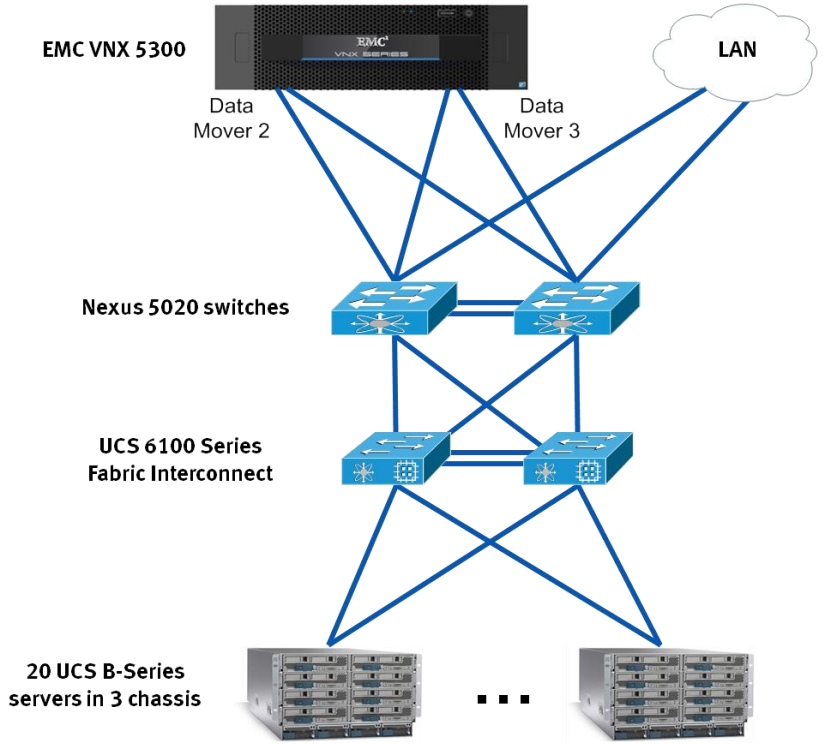

Figure 3. 10 gigabit connectivity

Host network configuration

All network interfaces on the UCS B-Series servers in this solution use 10 gigabit Ethernet connections. A dynamic host configuration protocol (DHCP) server assigns an IP address to each virtual desktop. All XenServer hosts have two 10 gigabit adapters that are bonded together to provide multipathing and network load balancing as shown in Figure 4.

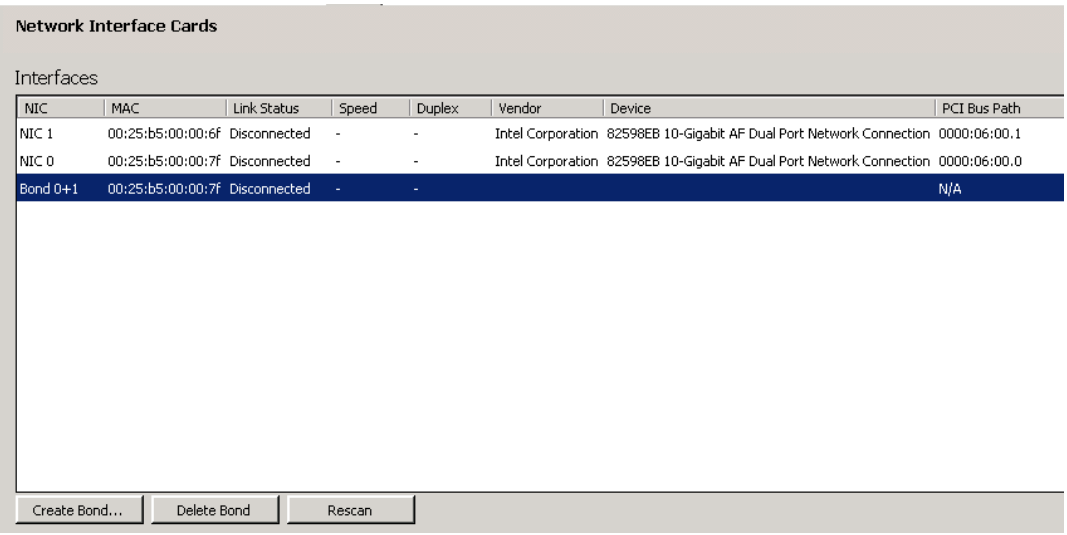

Figure 4. Network layout

VNX5300 network configuration

The VNX5300 consists of two Data Movers. The Data Movers can be configured in an active/active or active/passive configuration. In the active/passive configuration, the passive Data Mover serves as a failover device for the active Data Mover. In this solution, the Data Movers operate in active/passive mode.

The VNX5300 Data Movers are configured with two 10-gigabit interfaces on a single I/O module. Link Aggregation Control Protocol (LACP) is used to configure ports fxg-1-0 and fxg-1-1 to support virtual machine traffic, home folder access, and external access for roaming profiles.

Figure 5 shows the rear view of two VNX5300 Data Movers that include two 10-gigabit fiber Ethernet (fxg) ports each in I/O expansion slot 1.

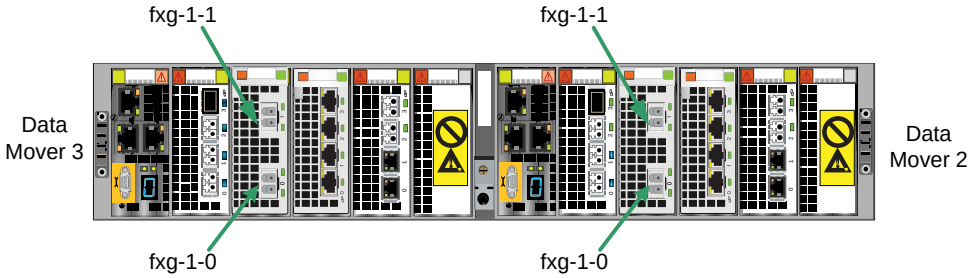

Figure 5. VNX5300 network configuration

High availability and failover

Introduction

This solution provides a highly available virtual desktop infrastructure. Each component is configured to provide a scalable, robust solution for the host, connectivity, and storage layers.

Storage layer

The VNX series is designed for five 9s availability by using redundant components throughout the array. All Data Movers, storage processors, and array components are capable of continued operation in case of hardware failure. The RAID disk configuration on the VNX back end provides protection against data loss due to hard disk failures. The available hot spare drives are dynamically allocated to replace a failing disk.

Connectivity layer

The advanced networking features of VNX series, such as Fail-Safe Network (FSN) and link aggregation, provide protection against network connection failures at the array. Each XenServer host has multiple connections to both Ethernet networks to guard against link failures. These connections are spread across multiple blades in an Ethernet switch to guard against component failure in the switch.

Host layer

The application hosts have redundant power supplies and network connections to reduce the impact of component failures in the XenServer hosts. High availability (HA) can be configured for the XenServer resource pool to help recover virtual desktops quickly in case of a complete host failure.

Validated environment profile

Profile characteristics

Table 3 provides the environment profile that was used to validate the solution.

Table 3. Validated environment profile

Profile characteristic	Value
Number of virtual desktops	1,000
Virtual desktop OS	Windows 7 Enterprise (32-bit) SP1
CPU per virtual desktop	1 vCPU
Number of virtual desktops per CPU core	6.25
RAM per virtual desktop	1 GB
Desktop provisioning method	Machine Creation Services (MCS)
Average storage available for each virtual desktop	6 GB
Average IOPS per virtual desktop at steady state	9 IOPS
Average peak IOPS per virtual desktop during boot storm	20 IOPS
Number of SRs to store virtual desktops	8
Number of virtual desktops per SR	125
Disk and RAID type for SRs	RAID 5, 300 GB, 15k rpm, 3.5-inch SAS disks
Disk and RAID type for CIFS shares to host roaming user profiles, home directories, and XenApp profiles	RAID 6, 2 TB, 7,200 rpm, 3.5-inch NL-SAS disks
Number of XenServer resource pools	2
Number of XenServer hosts per resource pool	8
Number of virtual machines per resource pool	500

Conclusion

This reference architecture provides a blueprint of a validated Citrix XenDesktop 5.5 and XenApp 6.5 virtualization solution enabled by EMC VNX platforms, Cisco UCS, and the Citrix XenServer 6 virtualization platform. The solution is able to support, and scale to, thousands of virtual desktops.

The features of the EMC VNX operating environment enable VNX series arrays to drive higher storage consolidation ratios at a lower cost than previously possible. This reduces the capital expenditure on equipment, and lowers the operational costs required to support the placement, power, and cooling of the storage arrays.

Feature	Benefits
Citrix XenDesktop 5.5	Transforms Windows desktops as an on-demand service to any user, any device, anywhere. XenDesktop quickly and securely delivers any type of virtual desktop, or any type of Windows, web, or SaaS application, to all the latest PCs, Macs, tablets, smartphones, laptops and thin clients—and does so with a high-definition HDX user experience.
Citrix XenApp 6.5	Enables organizations to improve application management in the following ways: • Centralizes applications in the data center to reduce costs • Controls and encrypts access to data and applications to improve security • Delivers applications instantly to users anywhere
Citrix XenServer 6	Integrates, manages, and automates a virtual data center with a complete, enterprise-class virtualization platform. A full suite of server virtualization tools delivers cost savings throughout the data center. Improved data center flexibility and reliability provide high-performance support for business.
EMC VNX unified storage	Provides a robust, reliable, high-performance, common storage platform for thousands of virtual desktops. This single storage platform is efficient, powerful, and built for the most demanding virtual environments. NAS storage provides NFS storage repositories for cost-effective, easily deployable storage for the desktop virtualization platform.
Cisco UCS B-Series servers	Streamlines data center resources to reduce TCO. UCS scales service delivery to increase business agility, and significantly reduce the number of devices that require setup, management, power, cooling, and cabling.

References

EMC documentation

The following documents, located on the EMC Online Support website, provide additional and relevant information. Access to these documents depends on your login credentials. Users who do not have access to a document should contact an EMC representative:

- *EMC Infrastructure for Virtual Desktops Enabled by EMC VNX Series (NFS), Cisco UCS, Vmware Vsphere 4.1, and Citrix Xendesktop 5—Reference Architecture*
- *EMC Infrastructure for Virtual Desktops Enabled by EMC VNX Series (NFS), Cisco UCS, Vmware Vsphere 4.1, and Citrix Xendesktop 5—Proven Solution Guide*
- *EMC Infrastructure for Virtual Desktops Enabled by EMC VNX Series (FC), VMware vSphere 4.1, and Citrix XenDesktop 5—Reference Architecture*
- *EMC Infrastructure for Virtual Desktops Enabled by EMC VNX Series (FC), VMware vSphere 4.1, and Citrix XenDesktop 5—Proven Solution Guide*
- *EMC Infrastructure for Virtual Desktops Enabled by EMC Celerra Unified Storage (NFS), VMware vSphere 4, and Citrix XenDesktop 4—Reference Architecture*
- *EMC Infrastructure for Virtual Desktops Enabled by EMC Celerra Unified Storage (NFS), VMware vSphere 4, and Citrix XenDesktop 4—Proven Solution Guide*
- *EMC Infrastructure for Virtual Desktops Enabled by EMC Unified Storage (FC), Microsoft Windows Server 2008 R2 Hyper-V, and Citrix XenDesktop 4—Reference Architecture*
- *EMC Infrastructure for Virtual Desktops Enabled by EMC Unified Storage (FC), Microsoft Windows Server 2008 R2 Hyper-V, and Citrix XenDesktop 4—Proven Solution Guide*
- *EMC Performance Optimization for Microsoft Windows XP for the Virtual Desktop Infrastructure—Applied Best Practices*
- *Deploying Microsoft Windows 7 Virtual Desktops with VMware View—Applied Best Practices Guide*
- *EMC Infrastructure for Virtual Desktops Enabled by EMC VNX Series (NFS), VMware vSphere 4.1, VMware View 4.6 and VMware View Composer 2.6—Reference Architecture*
- *EMC Infrastructure for Virtual Desktops Enabled by EMC VNX Series (NFS), VMware vSphere 4.1, VMware View 4.6 and VMware View Composer 2.6—Proven Solution Guide*

Other documentation

For Citrix and Cisco documentation, please refer to the Citrix and Cisco websites at www.Citrix.com and www.Cisco.com