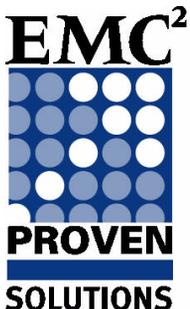# EMC Virtual Infrastructure for Microsoft Applications—Data Center Solution

Enabled by EMC Symmetrix V-Max and VMware vSphere 4.0

Reference Architecture

EMC Global Solutions

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EMC Virtual Infrastructure for Microsoft Applications Data Center Solution Enabled by EMC Symmetrix V-Max and VMware vSphere 4.0

About this Solution

This document describes a reference architecture of an Enterprise solution tested and validated in the EMC Global Solutions Centers (GSC).

The Global Solutions Center labs reflect real-world deployments in which solutions are developed, designed, tested and documented to address customer challenges. Customers can reduce the complexity, costs, and risks of deploying new technology with EMC Proven Solutions.

Leverage this reference architecture before implementing a virtualized data center solution, which combines:

- Well-documented technology options
- Recommended technology products

Document scope

This reference architecture will help transform traditional, high-maintenance data centers into a resource efficient, highly scalable virtualized infrastructure utilizing the high-end storage features of the EMC® Symmetrix® V-Max™ storage system, and the server virtualization capabilities of VMware® vSphere 4.0.

VMware vSphere and EMC Symmetrix V-Max together provide higher levels of server consolidation through virtualization, driving down capital costs while at the same time simplifying the day-to-day operational support through new features such as automated storage provisioning, and advanced VMware vSphere 4.0 features like centralized management and host availability.

This reference architecture introduces some of these capabilities through testing of real-world Microsoft application workloads. By using this reference architecture as a first point of reference, it is possible to consolidate application server workloads, while significantly improving utilization of IT resources.

Solution purpose

The purpose of this solution is to demonstrate a scalable, fully integrated virtualized Microsoft data center solution, incorporating mixed workloads for Microsoft Office SharePoint Server 2007, Microsoft SQL Server 2008, and Microsoft Exchange Server 2007.

The EMC Symmetrix V-Max storage array, combined with VMware vSphere 4.0—the industry's first cloud operating system—are leveraged to consolidate and virtualize Microsoft Tier-1 applications and to validate scalability, performance and optimization of storage and server resources. EMC delivers the power of EMC Symmetrix V-Max and VMware vSphere 4.0 advanced virtualization to maintain efficient use of resources, high availability and database protection across multi-application environments.

This solution integrates EMC PowerPath®/Virtual Edition (VE) dynamic I/O load balancing for optimal application availability and performance. PowerPath/VE, recently introduced with vSphere 4.0, brings significant multipathing capability to VMware environments allowing greater utilization and sustained performance for large virtualized infrastructures.

Virtualized storage and servers are centrally managed using EMC Symmetrix Management Console (SMC) and VMware vCenter. Additionally, EMC Replication Manager provides backup of Microsoft SQL Server and Microsoft Exchange 2007 databases.

Business challenge

It is critical that today's data centers utilize resources more efficiently to support the dynamic requirements of running multiple business applications. High availability is no longer limited to only selected mission-critical applications. Business-centric applications must now be accessible 24 x 7 to meet the growing global access needs of business. At the same time, there are significant pressures to drive down IT costs and simplify management of the data center.

A growing number of organizations are turning to server and storage virtualization technologies to cut costs—yet the average IT organization has virtualized only 10% of their server workloads. Tremendous opportunity exists to reduce operational and capital expenses that result from information growth and unused resources.

Organizations want to accelerate virtualization to include critical Microsoft Tier-1 applications, but not at the expense of service level agreements (SLAs), performance or availability. In addition to keeping data center operations running continuously, IT must reduce complexity by deploying a solution that simplifies management.

EMC has partnered with VMware to validate how virtualizing an application and backup infrastructure using Symmetrix V-Max and VMware vSphere 4.0 leads to a highly available, protected environment that is simpler to manage. EMC provides a reference architecture that outlines many of the options and advantages of Symmetrix V-Max with vSphere; this helps to achieve even greater levels of consolidation, a tremendous increase in performance, and optimization of resources.

Technology solution

This solution demonstrates a powerful, highly efficient consolidated Microsoft applications data center on a virtualized infrastructure. Full integration and high availability (HA) features of VMware vSphere 4.0 and the innovative EMC Symmetrix V-Max storage system, along with PowerPath/VE dynamic load balancing, formulate the basis of the solution.

More specifically, the solution presents findings and build considerations around how Microsoft SharePoint Server 2007, Microsoft SQL Server 2008, and Microsoft Exchange 2007 share the same infrastructure in a mixed workload environment providing:

• Efficiency of server hardware and data center infrastructure resources through virtualization enabled by VMware vSphere 4.0

• 75% reduction in initial storage requirements through the use of Symmetrix Thin Provisioning

• True value of VMware with a flexible, balanced, and highly available virtual infrastructure

• High availability achieved by Symmetrix V-Max storage redundancy, and host and connectivity redundancy achieved by VMware clusters

• Fast and simplified provisioning using Autoprovisioning Groups and virtually provisioned LUNs—90% fewer clicks to manage the storage environment

• 40% better application performance with EMC PowerPath/VE unique multipathing capabilities, enabling customers to automate optimal server, storage, and path utilization in a dynamic virtual environment

• A streamlined data protection methodology for multi-application data centers

• The processing power of up to 8 vCPUs using vSphere 4.0

• Simplified application protection using Replication Manager to rapidly back up and recover SharePoint, SQL Server and Exchange databases while providing granular item level recovery enabled by Kroll Ontrack software

User profile

The validated build design and test results for this solution are based on the following enterprise-level, mixed Microsoft workload environments:

- Microsoft SQL Server 2008—75,000 users

- Microsoft Exchange 2007—8,000 Very Heavy (0.50 IOPs) users

- Microsoft SharePoint 2007—168,000 Heavy user load (1% concurrency) as defined in *http://technet.microsoft.com/en-us/library/cc261795.aspx*

Solution details

This section briefly describes the key solution components. For details about all of the components that make up the solution, see "Hardware resources" on page 12, and "Software resources" on page 12.

EMC Symmetrix V-Max

The EMC Symmetrix V-Max storage system provides unsurpassed availability, consolidation, performance, application integration, power efficiency, and information-centric security. The future-proof architecture and full complement of powerful virtualization software define the requirements for today's high-end networked storage systems.

The Symmetrix V-Max reaches beyond the industry standard for high-end information storage systems by integrating new technologies for virtualized environments, including:

- **Autoprovisioning Groups**—The Autoprovisioning Groups feature provides an easier, faster way to provision storage in Symmetrix V-Max arrays. In virtual server environments applications running on V-Max arrays require a fault-tolerant environment with clustered servers as well as multiple paths to devices for guest Virtual Machines (VMs). Autoprovisioning Groups were developed to make storage allocation easier and faster, especially with multi-application environments.

- **Advanced Tiered Storage Management**—Symmetrix Virtual Provisioning™ allows customers to present a large amount of capacity to a host and then consume space only as needed from a shared pool. This improves total cost of ownership (TCO) by reducing initial overallocation of storage capacity and simplifies management by reducing the steps required to support growth.

- **Virtual LUNs**—Enhanced Virtual LUN Technology enables data migration within an array without host or application disruption. Virtual LUNs bring a tiered storage strategy to life by easily moving information throughout the storage system as its value changes over time. It can assist in system reconfiguration, performance improvement, and consolidation efforts while helping maintain vital service levels.

VMware vSphere 4.0

VMware vSphere 4.0 is the next logical step in IT computing, allowing customers to bring the power of cloud computing to their IT infrastructures. Building on the power of VMware Infrastructure, VMware vSphere 4.0 increases control over IT environments by supporting any OS, application or hardware product.

VMware vSphere 4.0 is built on a proven virtualization platform to provide the foundation for internal and external clouds, using federation and standards to bridge cloud infrastructures—creating a secure, private cloud. Organizations of all sizes can achieve the full benefits of cloud computing, delivering the highest levels of application service agreements with the lowest total cost per application workload.

This EMC Virtual infrastructure for Microsoft applications-data center solution delivers flexible, automatic I/O load balancing, powerful processing power and simplified network switch management with these features introduced in VMware vSphere 4.0:

- **EMC PowerPath/VE path failover integration (via VMware vStorage API for Multipathing)**—As demonstrated in this solution, constantly adjusts I/O path usage and responds to changes in I/O loads from VMs.

- **8 vCPU support**—Increases the maximum number of virtual CPUs that can be assigned to a guest VM from four to eight.

- **VMware vNetwork Distributed Switch**—Takes the vSwitch capability one step further by extending the connections across the entire cluster.

Microsoft Windows Server 2008 Enterprise edition

Microsoft Windows Server 2008 Enterprise edition delivers an enterprise-class platform for deploying business-critical applications. It improves hot-add processor capabilities and enhances security with consolidated identity management features. It reduces infrastructure costs by consolidating applications with virtualization licensing rights. Windows Server 2008 Enterprise edition provides the foundation for a highly dynamic, scalable IT infrastructure.

Microsoft SQL Server 2008

Microsoft SQL Server 2008 delivers on Microsoft's Data Platform vision by helping organizations to manage any data, any place, any time. It allows data storage from structured, semi-structured, and unstructured documents, such as images and rich media, directly within the database. SQL Server 2008 delivers a rich set of integrated services that enables organizations to do more with their data, such as query, search, synchronize, report, and analyze.

Microsoft Office SharePoint Server 2007

Microsoft Office SharePoint Server (MOSS) 2007 is a server program that is part of the 2007 Microsoft Office suite. MOSS 2007 provides an integrated group of server capabilities, which provides a single, integrated location, and helps improve organizational effectiveness by providing comprehensive content management and enterprise search, accelerating shared business processes, and facilitating information sharing across boundaries.

Microsoft Exchange Server 2007

Microsoft Exchange Server 2007 is designed to meet today's communication and collaboration challenges. It provides advanced e-mail and scheduling while delivering new methods of access for employees, greater productivity for IT administrators, and increased security and compliance capabilities for organizations.

EMC PowerPath/VE

PowerPath/VE allows customers to standardize on a single multipathing solution across their environment. For customers who are standardizing using VMware, this means they have access to flexible and automatic I/O load balancing to manage the complexity of VMs and I/O-intensive applications in hyper-consolidated environments. Additionally, PowerPath/VE support for VMware vSphere 4.0 environments increases the number of always-active

initiators, as opposed to idle failover-standby initiators for each path, to each LUN, resulting in newfound I/O horsepower from all virtual hosts in the form of multiple data streams per host.

EMC Replication Manager

EMC Replication Manager manages EMC point-in-time replication through a centralized management console. Replication Manager coordinates the entire data replication process—from discovery and configuration to the management of multiple application consistent disk-based replicas. It allows data center administrators to auto-discover replication environments and enable streamlined management by scheduling, recording, and cataloging replica information including auto-expiration.

Environment architecture

Figure 1 illustrates the overall physical architecture of the environment.
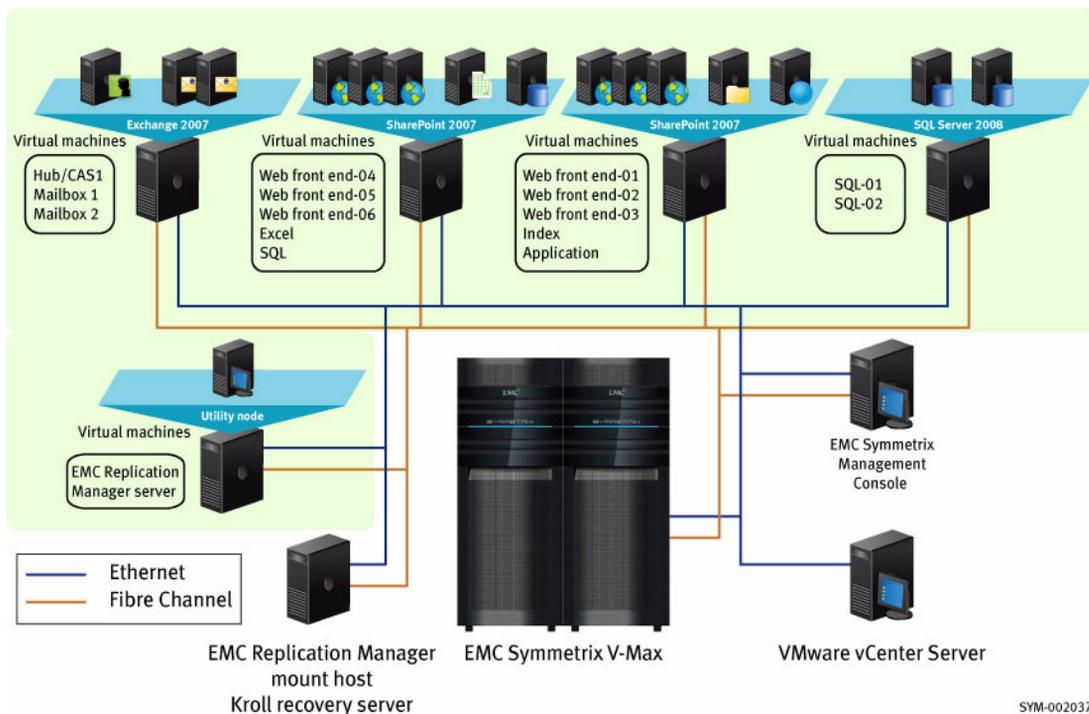
Figure 1 **EMC Virtual Infrastructure for Microsoft Applications—Data Center Solution Enabled by EMC Symmetrix V-Max and VMware vSphere 4.0**

Hardware resources

Table 1 lists the hardware resources used in this solution.

Table 1   Hardware resources

Equipment	Quantity	Configuration
Storage	1	EMC Symmetrix V-Max • 222 x 300 GB, 15k rpm Fibre Channel disks • 18 x 1 TB, 7.2k, SATA disks (These drives were used to extend backup capabilities, and are not a requirement for this solution.)
Fibre Channel switch	One for this deployment (Two recommended for redundancy)	4 Gb/s Enterprise Class Fibre Channel switch, (requires a minimum of 48 ports)
Enterprise network switch	One for this deployment (Two recommended for redundancy)	Gigabit Ethernet network switch (requires a minimum of 32 ports)
Servers	5	Four 2.93 GHz 8 MB L2 Cache quad-core processors, 64 GB RAM

Software resources

Table 2 lists the software resources used in this solution.

Table 2   Software resources

Title	Version
Microsoft Windows Server 2003 R2	SP2 Enterprise edition (64-bit)
Microsoft Windows Server 2008	SP1 Enterprise edition (64 bit)
Microsoft Exchange 2007 Enterprise edition	SP1
VMware vSphere	4.0
Microsoft SQL Server 2008	SP1 Enterprise edition (64-bit)
Microsoft Office SharePoint Server 2007	SP1 + Dec CU

Table 2   Software resources (continued)

Title	Version
Kroll Ontrack PowerControls	5.1.0
EMC Solutions Enabler	7.0.0.4
EMC Symmetrix Management Console (SMC)	7.0.0.3
VMware vCenter Server	4.0.0
PowerPath/VE	5.4.0
EMC Replication Manager	5.2 SP1 (with URM00059805)

Environment profile

The virtualized enterprise applications are comprised of the following VMs:

- Microsoft SQL Server 2008
    - Two SQL servers
- Microsoft Exchange 2007
    - Two mailbox servers
    - One HUB/CAS
- Microsoft SharePoint 2007
    - Six WFEs
    - One SQL 2005 server
    - One application server
    - One Excel server
    - One Index server

SharePoint farm profile

Table 3 lists the parameters and assumptions for the SharePoint farm.

Table 3   SharePoint farm details

Parameter	Value
SharePoint farm user data	1.0 TB
SharePoint user capacity	194,000 heavy users at 1% concurrency
Site collections	1
Sites	15
VMware ESX Server™	2
VMs	**Ten VMs that include:** One SQL 2005 server Six WFEs (running query role) One Index Server One Application services One Excel services (also running central admin)

Microsoft Exchange Server 2007 profile

Table 4 lists the parameters and assumptions for Microsoft Exchange Server 2007.

Table 4   Microsoft Exchange Server 2007 details

Parameter	Value
Number of Exchange 2007 users	8,000
Exchange 2007 IOPs per user	0.50 IOPs (Very Heavy)
Read/Write ratio	1:1
Number of Exchange 2007 users per server	4,000
VMware ESX Server	1
Number of ESGs per server	10
Number of Exchange 2007 mail databases per ESG	1

Table 4   Microsoft Exchange Server 2007 details (continued)

Parameter	Value
Number of Exchange 2007 users per mail database	400
Exchange 2007 user mailbox size	400 MB
Size of ESG mailbox database LUN to accommodate the specified number of databases and the deleted item retention on defrag space	210 GB database LUN (400*400 MB = 160 GB * 130%)
ESG log LUN size	30 GB log LUNs
Production Exchange 2007 databases RAID type, physical drive size, and speed	RAID 1, 300 GB, 15k rpm
Production Exchange 2007 clone RAID type, physical drive size, and speed	RAID 5 (3+1), 300 GB, 15k rpm

Microsoft SQL Server 2008 profile

Table 5 lists the parameters and assumptions for Microsoft SQL Server 2008.

Table 5   Microsoft SQL Server 2008 details

Parameter	Value
SQL Server 2008 VMs (2)	8 vCPU, 32 GB RAM
Instance number	2 (one instance per VM)
On-line transaction processing (OLTP) database	2 (75,000 users each)
OLTP database size	2 (1.3 TB each)
VMware ESX Server	1
SQL Production data RAID type, physical drive size, and speed	RAID 1, 300 GB, 15k rpm
SQL Production clone RAID type, physical drive size, and speed	RAID 5 (3+1), 300 GB, 15k rpm

EMC management profile

Table 6 lists parameters and assumptions to support EMC management software.

Table 6   EMC management details

Infrastructure servers	Value
VMware ESX 1x VM - Replication Manager server	1
Replication Manager Mount Host	1
EMC Symmetrix Management Console (SMC) Server	1

Conclusion

The shift from a physical to a virtual computing infrastructure is transforming the way organizations choose to build IT infrastructures. EMC and VMware lead the way by combining a full complement of unprecedented virtual data storage in the Symmetrix V-Max, coupled with the industry's first cloud operating system technology introduced in VMware vSphere 4.0. This Proven Solution addresses the most critical functions of these two components, enabling IT administrators to consolidate Microsoft Tier-1 applications with greater confidence.

This reference architecture depicts a validated, virtualized Microsoft data center solution for business continuity and application consolidation within IT environments. The EMC Symmetrix V-Max storage system together with VMware vSphere 4.0 provides a scalable and dynamic data center infrastructure required to accelerate virtualization of mission-critical applications.

By deploying this Proven Solution along with existing VMware investments, organizations can begin focusing on what matters most—applications. Use the configuration recommendations documented in this reference architecture and the companion white paper to ensure a more reliable and predictable outcome.

Summary of benefits

This solution provides the following benefits:

- **Minimizes operational and management costs**—Consumes space only as needed from a shared pool, improving total cost of ownership (TCO) by reducing overallocation of storage.

- **Standardized path management**—Unifies management across heterogeneous physical and virtual environments with EMC PowerPath/VE.

- **Dynamic load balancing—**Constantly adjusts I/O path usage and responds to changes in I/O loads from VMs with integrated EMC PowerPath/VE.

- **Ease of management—**Provides centralized management of the server and storage infrastructure by combining VMware vCenter and EMC SMC.

- **Reduces the amount of physical servers**—Promotes a more eco-friendly environment through the use of virtualization technology.

- **Protection against equipment failures**— Utilizes VMware and Symmetrix V-Max HA features for extended VM protection via quick restart on hardware failure.

EMC can help accelerate assessment, design, implementation, and management while lowering the implementation risks and cost of creating a virtualized multi-application data center.

To learn more about this, and other validated solutions, visit the Resource Library on *http://www.emc.com*.