

AN INTEGRATED VIRTUALIZATION SOLUTION FOR MICROSOFT EXCHANGE

Building a simple, flexible, resilient infrastructure can be essential to successful Microsoft® Exchange Server 2007 deployments. By using a virtualized solution based on VMware® Infrastructure 3 software, Dell™ PowerEdge™ servers, and Dell/EMC CX3-20 storage arrays, organizations can create a scalable and highly available Exchange implementation.

For many organizations, e-mail systems form a critical part of their communications infrastructure—one in which any outage, regardless of length or cause, can impair the organization's ability to operate effectively. But the expense and complexity of implementing and supporting a highly available and disaster-tolerant Microsoft Exchange infrastructure can be a constant challenge.

Virtualizing Exchange using the VMware Infrastructure 3 platform can help enterprises overcome this challenge.¹ In addition to simplifying IT by enabling organizations to use their server, storage, and networking resources efficiently while helping control costs, features such as VMware VMotion™ technology, VMware Distributed Resource Scheduler (VMware DRS), and VMware High Availability (VMware HA) provide the tools to create a truly flexible and resilient IT infrastructure that can respond quickly to changing needs.

In conjunction with Dell and EMC, VMware has created a virtualization solution for Exchange Server 2007 based on VMware Infrastructure 3, Dell PowerEdge servers, and Dell/EMC CX3-20 Internet SCSI (iSCSI) storage arrays that is designed for small and midsize organizations and provides a flexible, robust platform for a wide variety of application and workload environments. In December 2007, EMC

engineers used the Microsoft Exchange Server Jetstress and Microsoft Exchange Load Generator (LoadGen) tools to compare the performance, latency, and processor utilization of this virtualized solution with those of a comparable non-virtualized configuration. The results illustrated the minimal impact of virtualizing the Exchange environment compared with a traditional non-virtualized deployment, helping demonstrate the feasibility of using this type of solution in enterprise data centers.

ADVANTAGES OF VIRTUALIZING EXCHANGE SERVER 2007

A virtualized deployment of Exchange Server 2007 can offer a number of advantages in enterprise environments. For example, because Exchange Server 2007 is less I/O-intensive than Exchange Server 2003, it can provide near-native performance in a properly sized and configured VMware virtual machine (VM) on similar hardware. Virtualization can also help organizations reduce deployment costs through server virtualization; accelerate deployment times through VM templates; take advantage of cost-effective iSCSI technology; use VMware VMotion, VMware DRS, and VMware HA to help increase flexibility and uptime; and simplify disaster recovery.

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Microsoft Exchange Server 2007

Performance

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¹ Because Exchange is a core part of daily operations for many enterprises, administrators should understand the current support policies in place from Microsoft before deploying a virtualized Exchange infrastructure. Microsoft does not typically test or support Microsoft software running with non-Microsoft hardware virtualization software, although for customers with Premier-level support, they will use "commercially reasonable efforts" to investigate issues with these implementations. Many VMware partners also provide end-to-end support for Microsoft software running in VMware environments. For more information, visit support.microsoft.com/kb/q897615 and www.vmware.com/support/policies/ms_support_statement.html.

Near-native performance

Exchange Server 2003 was extremely disk I/O intensive, and implementing a proper storage design often required administrators to dedicate a large number of high-performance disk spindles exclusively to Exchange. Exchange Server 2007 has significantly reduced disk I/O demands compared with Exchange Server 2003, most notably because it is designed to run on a 64-bit platform. This architectural change increases the amount of memory available to the database buffer cache, helping reduce disk access for reads and increase write buffering. Exchange Server 2007 has also increased the maximum number of databases, which enables increased checkpoint depth per user and helps reduce the necessity to read from disk by using the dirty pages in memory.

Other I/O-specific changes in Exchange Server 2007 include increased write size (from 4 KB to 8 KB) and increased I/O coalescing (from 64 KB to 1 MB), typically resulting in larger but fewer writes than were necessary in Exchange Server 2003. VMware Infrastructure 3 supports the use of 64-bit Microsoft Windows Server® 2003 operating systems, and these and other architectural changes have helped substantially increase the performance of Exchange Server 2007 in a VMware VM compared with Exchange Server 2003.

Reduced deployment costs through server consolidation

Exchange Server 2007 runs exclusively on 64-bit hardware and can require up to five distinct server roles—Mailbox, Client Access, Hub Transport, Edge Transport, and Unified Messaging—depending on the functionality needed in a particular environment. New 64-bit servers can contain powerful dual-core and quad-core processors and handle up to 64 GB of RAM. In the Exchange environments of small and midsize organizations, these powerful servers often use only a small portion of their full compute

resources. Running multiple VMware VMs on these 64-bit systems can help maximize resource utilization and help increase return on investment for this server hardware, and represents an opportunity to take advantage of VMware virtualization as part of the upgrade cycle for testing, evaluating, and deploying Exchange Server 2007. Because VMware Infrastructure 3 enables administrators to run more workloads on a single server than they typically could on a non-virtualized server, it can help organizations increase server utilization.

Reduced deployment times using virtual machine templates

VMware virtualization enables enterprises to build a set of common VM images that administrators can easily update and quickly provision, helping reduce the time required to deploy new VMs, including Exchange VMs. The ability to rapidly and consistently deploy VMs can help streamline testing and development cycles, accelerate production deployments, assist in troubleshooting, and allow easy adjustments to changing workloads in the environment.

Using VMware VM templates can help organizations significantly reduce the time required to deploy server images. This approach helps free up valuable IT resources for work on other important tasks.

Cost-effective iSCSI connectivity

Deploying Fibre Channel storage area networks (SANs) can be an expensive proposition for small and midsize organizations. VMware Infrastructure 3 supports iSCSI SANs using a number of different storage initiator choices. Combined with the

performance and reliability of Dell/EMC CX3-20 iSCSI storage arrays, the virtualized Exchange solution can provide cost-effective, reliable storage for Exchange Server 2007. The disk storage for Exchange Server 2007 in the virtualized Exchange solution has been designed to scale in 500-user increments and has been tested and validated for performance comparable to non-virtualized configurations on similar hardware.

VMware VMotion, VMware DRS, and VMware HA

The cost and complexity of clustering software such as Microsoft Cluster Service can make that software unsuitable for many small and midsize organizations—potentially leaving essential enterprise systems without a high-availability solution. VMware Infrastructure 3 integrates several features that organizations can use to provide high availability in a virtualized Exchange Server 2007 environment:

- **VMware VMotion:** Can migrate live, running VMs from one physical server to another with no loss of service
- **VMware DRS:** Dynamically load balances VMware VMs across the entire pool of server resources; the use of functional server roles in Exchange Server 2007 can work well with the DRS feature because DRS typically functions most efficiently when distributing multiple small VMs
- **VMware HA:** Can automatically restart VMs on another server following a hardware failure

Simplified disaster recovery

Many disaster recovery solutions require similar server hardware at the disaster

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recovery site to help avoid potential driver and software incompatibility problems. Systems deployed on VMware VMs can help eliminate this hardware requirement, and can be brought online on virtually any supported host server running virtually anywhere in the world. VMware Infrastructure 3 can help simplify Exchange disaster recovery by helping reduce both hardware compatibility constraints and the number of servers required at the disaster recovery site. And because each VM is encapsulated as a small set of files, this approach can also help simplify replication.

VIRTUALIZED EXCHANGE SERVER 2007 ARCHITECTURE

This virtualized Exchange Server 2007 solution has been designed and optimized for small and midsize organizations. It comprises four key layers: VMware Infrastructure 3, Dell/EMC CX3-20 iSCSI storage, Dell PowerEdge servers, and Microsoft Exchange Server 2007. In addition to the advantages of VMware Infrastructure 3 and Exchange Server 2007 discussed in the preceding sections, the Dell/EMC CX3-20 storage and Dell PowerEdge servers that make up the

middle layers of the virtualized Exchange solution provide their own advantages.

On top of the virtualization layer is the core storage—the Dell/EMC CX3-20 iSCSI storage array. This dual-protocol system supports both Fibre Channel and iSCSI connectivity and includes dual redundant storage processors with battery-backed cache. Support for data in-place upgrades allows the storage array to scale easily as the environment grows.

The storage architecture is based on a building-block design that can scale as the environment grows and requires additional space and fault tolerance (see Figure 1). The building blocks help minimize design and operations complexity in increments of four-disk RAID-10 building blocks, with a 0.5 I/Os per second (IOPS) user profile and a maximum mailbox size of 250 MB. As the user workload grows, adding performance, scale, and capacity is typically simple and predictable.

Integrating with the Dell/EMC CX3-20 storage for rapid Microsoft Volume Shadow Copy Service (VSS)-based clone backups is EMC® Replication Manager software, which automates and manages the backup and recovery process. The virtualized Exchange Server 2007 solution uses EMC Replication Manager 5.0 software to help easily automate the process of creating disk-based replica copies of Exchange databases.

Dell PowerEdge servers make up the next layer, between the storage and Exchange software, and are designed for high performance, ease of use, and overall efficiency. The common platform used by the PowerEdge server family helps simplify management and maintenance while helping reduce cost and complexity, and administrators can quickly deploy and integrate the servers with VMware Infrastructure 3 and Dell/EMC storage.

Figure 2 shows the PowerEdge servers used in the virtualized Exchange Server 2007 test environment. Organizations that are already running a VMware environment and using the Microsoft Active Directory® directory service likely already have most of this infrastructure in place. The primary

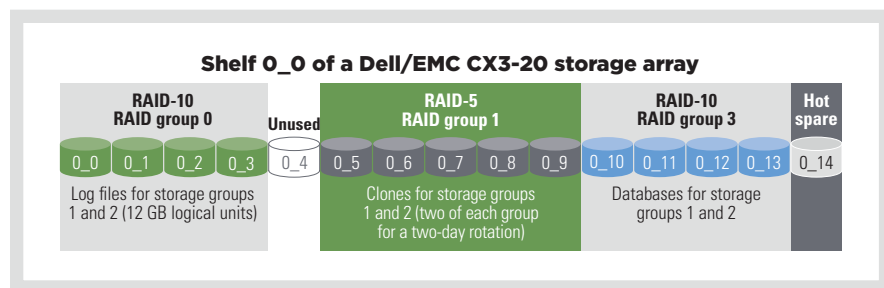


Figure 1. Building blocks for 500 users using two Microsoft Exchange storage groups with two EMC Replication Manager clones

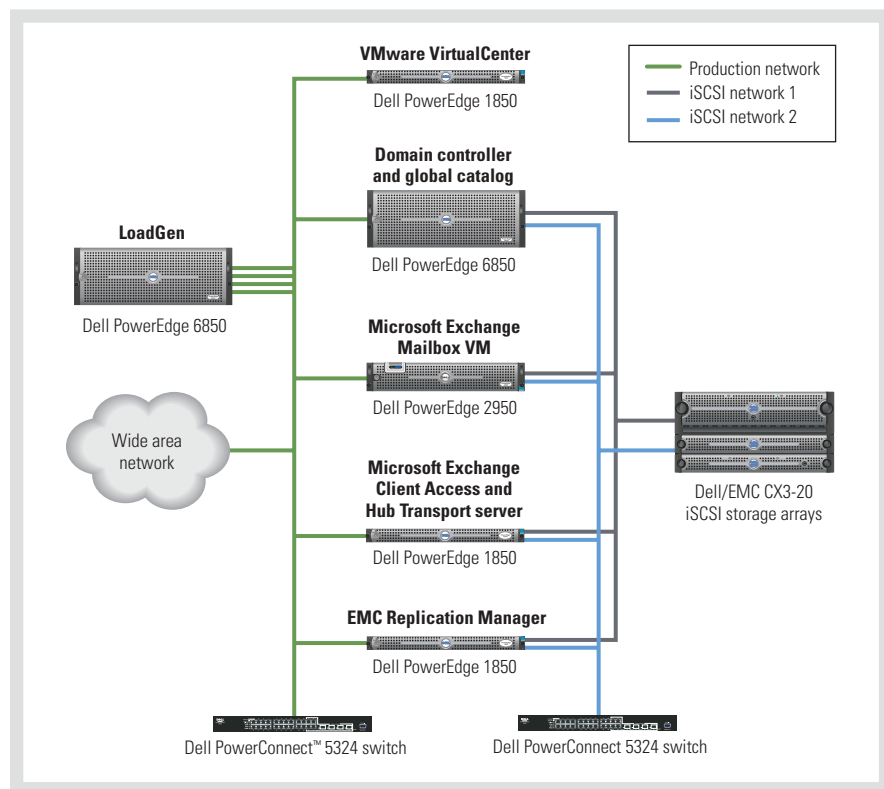


Figure 2. Dell PowerEdge servers used in the virtualized Microsoft Exchange Server 2007 test environment

	Thread count	Performance (IOPS)	Database read latency (ms)*	Database write latency (ms)*	Log write latency (ms)*
Non-virtualized configuration	14	1379.992	19, 20, 19, 19	6, 6, 6, 6	2, 2, 2, 2
Virtualized configuration	14	1366.697	19, 19, 18, 19	7, 7, 7, 7	3, 3, 3, 3

*Latency results are given for each of the four storage groups used in the tests.

Figure 3. Jetstress performance and latency test results comparing non-virtualized and virtualized Exchange configurations

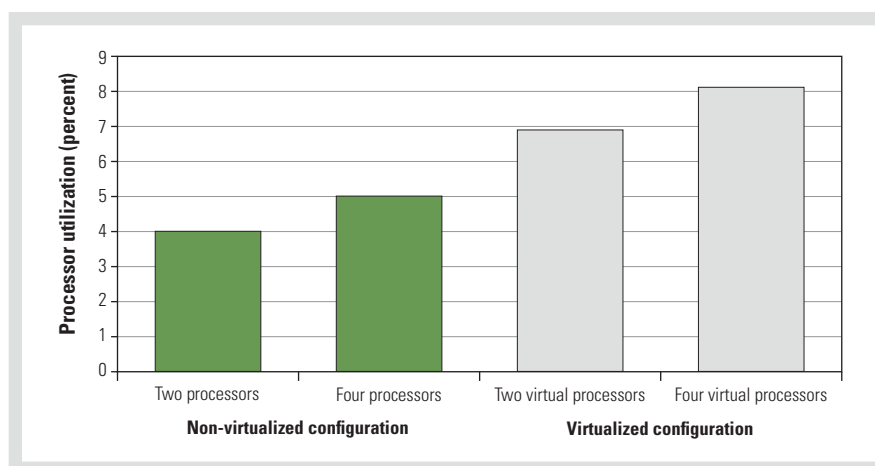


Figure 4. LoadGen processor utilization test results comparing non-virtualized and virtualized Exchange configurations

system used for testing in this environment was a Dell PowerEdge 2950 server with two dual-core Intel® Xeon® processors at 2.4 GHz and 16 GB of RAM, with the virtualized configuration utilizing two virtual processors and 12 GB of RAM and the non-virtualized configuration utilizing the same server and storage hardware. (For testing purposes, the test team limited the processors and RAM in the physical systems using the `maxmem` and `numproc` switches in the `boot.ini` file to match the processor and RAM resources of the Exchange VM.) The test team used a second PowerEdge 2950 server to test VMware VMotion, VMware DRS, and VMware HA functionality while under stress from LoadGen testing.

TEST RESULTS: PERFORMANCE, LATENCY, AND UTILIZATION

Figure 3 shows the results of Jetstress testing of the 1,000-user storage design in the virtualized Exchange Server 2007 solution using Dell PowerEdge 2950

servers and Dell/EMC CX3-20 iSCSI storage. The test team measured performance and latency for Exchange Server 2007 running on both a VMware VM and in a non-virtualized configuration using identical server and storage hardware. The tests returned similar results in both the virtualized and non-virtualized configurations.

Figure 4 shows the results of LoadGen testing of the 1,000-user storage design, which compared processor utilization in the non-virtualized configuration using two or four processors and the virtualized configuration using two or four virtual processors. These tests showed no significant advantage to using more than two virtual processors in the VM for this user profile, which helps demonstrate the minimal impact of virtualizing Exchange Server 2007.

The test team also evaluated VMware VMotion, VMware DRS, and VMware HA in the virtualized Exchange Server 2007 solution. Under a LoadGen workload, VMware VMotion and VMware DRS were able to

move the Exchange VM to a second PowerEdge 2950 server transparently to the Microsoft Office Outlook® clients. VMware HA was able to rapidly restart the Exchange Server 2007 Mailbox server role on the second PowerEdge 2950 server following a simulated failure of the primary server.

EFFICIENT, FLEXIBLE EXCHANGE SERVER 2007 DEPLOYMENT

Architectural enhancements in Exchange Server 2007 have helped significantly enhance its performance in a virtualized environment. For organizations well versed in VMware Infrastructure 3 and beginning to test and evaluate Exchange Server 2007, plan a new implementation, or migrate from a previous version of Exchange, these enhancements provide an opportunity to extend their virtualized infrastructure using the virtualized Exchange Server 2007 solution described in this article. By virtualizing Exchange Server 2007, organizations can gain advantages not typically available in non-virtualized deployments, including dynamic resource optimization, simplified and accelerated evaluation and deployment cycles, efficient utilization of high-performance 64-bit hardware, and simplified disaster recovery—all of which can translate into real-world enterprise objectives of reduced IT costs, enhanced use of IT resources, and increased reliability in messaging environments. [▶](#)

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