



# EMC CLARiiON AX4-5i (2,000 User) Storage Solution for Microsoft Exchange Server 2007 SP1

## Case Study



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# About this Document

## Purpose

This document provides information about a consolidated, virtualized, out-of-the-box solution for Microsoft Exchange Server 2007 with EMC CLARiiON AX4-5 and iSCSI. All aspects of the solution required to run this environment are covered, from hardware to software, including Active Directory and the required Exchange Server roles. Disaster Recovery is also included in this solution using EMC's Replication Manager.

The consolidated solution was designed and performance testing completed to ensure all aspects of the solution performed as required. A sufficient amount of tuning was performed to ensure that the measurements achieved were consistent with real-world performance.

## Audience

This document is intended for internal EMC personnel, EMC partners, and customers.

## Introduction

The key components of this solution are:

- EMC® CLARiiON® AX4 networked storage
- VMware ESX 3.5 virtualization software
- EMC Replication Manager 5.2
- Microsoft Windows Server 2003 SP2
- Microsoft Windows Server 2008

### EMC CLARiiON AX4 networked storage

EMC CLARiiON AX4 offers affordable storage while also providing ease of use. The system has several product advantages that separate it from all other entry-level storage offerings.

EMC's CLARiiON AX4 offers:

- Ease of use for dynamic, virtualized infrastructures.
- Simple wizard-based installation and management..
- Scalability of capacity and connectivity with advanced software capabilities to support current or future requirements.
- Highest availability for virtualized IT environments based on CLARiiON technology with proven five 9s (99.999 percent) availability.
- An ideal growth path for customers consolidating for the first time.

### VMware ESX 3.5 virtualization software

The deep VMware integration provided with the EMC CLARiiON AX4 platform helps to extend the benefits of a virtual infrastructure on a number of levels.

#### Cost-effectiveness

Cost-effectiveness is a key driver for leveraging server virtualization in the first place, that is, being able to consolidate many servers into a few. With CLARiiON AX4, EMC extends this value by providing a cost-effective platform with technologies such as iSCSI, where you can leverage an existing Ethernet infrastructure and still maintain superior performance.

#### High availability

VMware has built out its set of technologies, such as High Availability and VMotion, to provide resiliency in the server layer. These technologies depend on networked storage to function. Virtualization turns physical servers into files that

are stored on a disk eventually. CLARiiON AX4 is built on CLARiiON technology with proven five 9s (99.999 percent) availability, providing a critical component for the always-on VMware environment.

### **Simple scalability**

With metaLUNs, capacity can be added as virtual machine (VM) deployments grow. The associated volumes dynamically expand while the VMs are online. Features associated with both metaLUN and virtual LUN technologies are non-disruptive and completely invisible to VMware and the guest operating systems.

The purpose of CLARiiON AX4 and VMware integration is that it complements and facilitates ease of management of a dynamic, virtualized, information infrastructure.

## **EMC Replication Manager**

EMC's Replication Manager offers an easy to use, wizard-driven replica management tool for virtual, physical Raw Device Mapping (RDM), and Microsoft iSCSI initiator discovered disks for in-guest replicas for backup acceleration, business continuity, and repurposing.

### **Benefits**

Replication Manager software delivers point-and-click replica management for business continuity:

- Creates a “gold” copy of production data for an instant restore should corruption occur.
- Streamlines the backup of production data without impacting performance, which is ideal for backup acceleration.
- Copies of production data can be created for testing, development, and reporting to minimize the impact to production.

### **Features**

Replication Manager is designed for ease of use through the following features:

- Management and automation of snapshots and clones for EMC's point-in-time replication products on CLARiiON using SnapView™ and SAN Copy™.
- Auto-discovery of applications, their associated storage, the replication technology available, VMFS datastores, VMs, and their replication configuration during each replica cycle.

- Intelligence to place applications in the proper state for application-consistent replicas such as Volume Shadow Copy Service (VSS) for Microsoft Exchange Server.
- Instant recovery back to production application data for Exchange, SQL Server, and Oracle running on VMs using virtual disks, physical RDM, or Microsoft iSCSI initiator discovered disks. For VMFS containing VMs, create replicas for backup and instant restore through Replication Manager or perform a simple restore via the VMware vCenter Server of a single VM from a mounted replica created by Replication Manager.

## Executive summary

This case study details a proposed solution intended for small-to-medium commercial Exchange 2007 SP1 customers who would like to consolidate and run their infrastructure on a virtualized platform, ensuring high performance and high availability for all aspects of the solution. The case study includes a backup-to-disk option to ensure the quick restoration of data, if required.

The solution was designed to satisfy the I/O latency requirements of Microsoft Exchange Server 2007 SP1 for up to 2,000 users, running on VMware's ESX Server with an EMC CLARiiON AX4-5i storage array. EMC's Replication Manager software was used to create disk backups of the Exchange database and log volumes.

Testing on basic performance using Microsoft's Jetstress tool included the following:

- 24-hour stress test
- 2-hour performance test
- Soft recovery test

# Solution Overview

This chapter contains information on the solution and the products used.

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## Solution description

This case study describes a solution for utilizing two disk array enclosures (DAE), with a total of 24 drives, to allow an organization to successfully deploy up to 2,000 Microsoft Exchange Server 2007 users with EMC CLARiiON AX4-5i. This solution was developed and validated on a virtualized platform using VMware's ESX 3.5 server.

The log drives were configured as an EMC six-disk RAID 1/0 group. This RAID group also contained the virtual machine files for the guest operating systems.

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**Note:** It is not always necessary for the VMs to have their own RAID group. In this particular solution, this was the best option given the small size of the configuration and availability of only 24 disks.

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The database drives were configured as an EMC eight-disk RAID 1/0 group. These disks were dedicated to the Exchange database files. The remaining disks in the system were used for creating disk-based backups of the data and also included two hotspare disks.

For more information about Windows hardware compatibility with EMC CLARiiON AX4-5, visit:

<http://www.windowsservercatalog.com/item.aspx?idItem=53f4f795-0c47-2df1-24b7-690341b1769e>

Sizing and configuring storage for use with Microsoft Exchange Server is a complicated process, driven by many variables and factors, which vary from one organization to another.

One method often used to simplify the sizing and configuration of large amounts of EMC CLARiiON storage for use with Microsoft Exchange Server 2007 is to define a unit of measure. Such a unit of measure—in this case, one server with 14 storage spindles (eight for databases and six for logs)—meets all of the Microsoft Exchange Server recommended metrics for excellent reliability, scalability, and performance.

This unit of measure—or *building block*—needs to be scalable so that an organization can take this block of work and multiply it by some factor until the required number of Microsoft Exchange Server users (that is, Microsoft MAPI Outlook users) has been properly met or configured to satisfy the Microsoft Exchange Server recommended performance metrics.

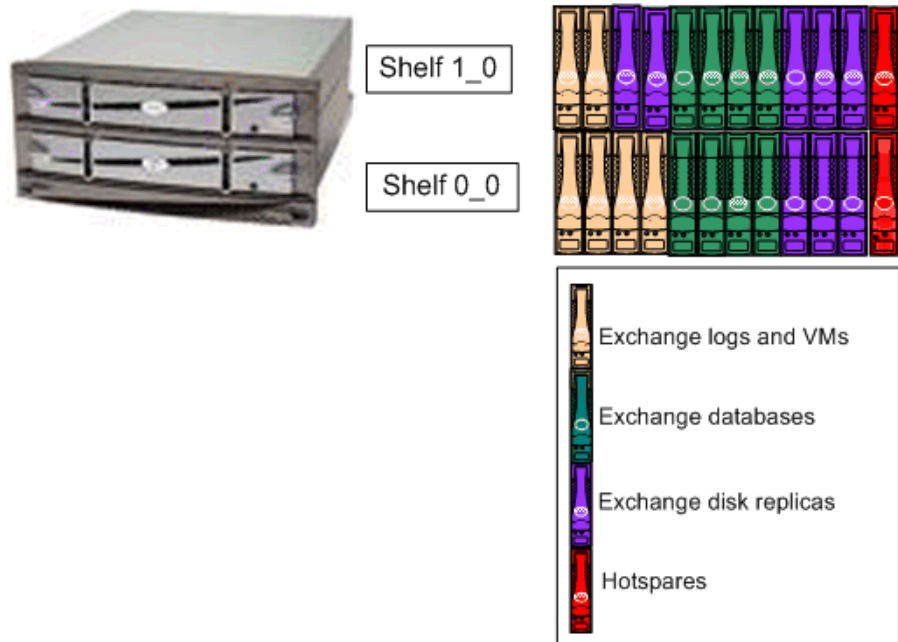
A properly-configured unit matches the Microsoft Exchange Server recommendations for a healthy-performing system, from both a disk and an end-user perspective.

Table 1 describes the characteristics of each building block.

**Table 1 Building block characteristics**

Item	Description
Number of users	2,000
Number of Exchange servers	1
IOPS per user	0.5
Mailbox size	300 MB
Number of disks required for logs and database	14
Disk type	300 GB 15k Fibre Channel
RAID type	1/0

Figure 1 shows the drive layout of this solution.



**Figure 1 Hardware layout**

# Physical disk layout

Figure 2 illustrates the layout of the overall physical architecture of the solution.

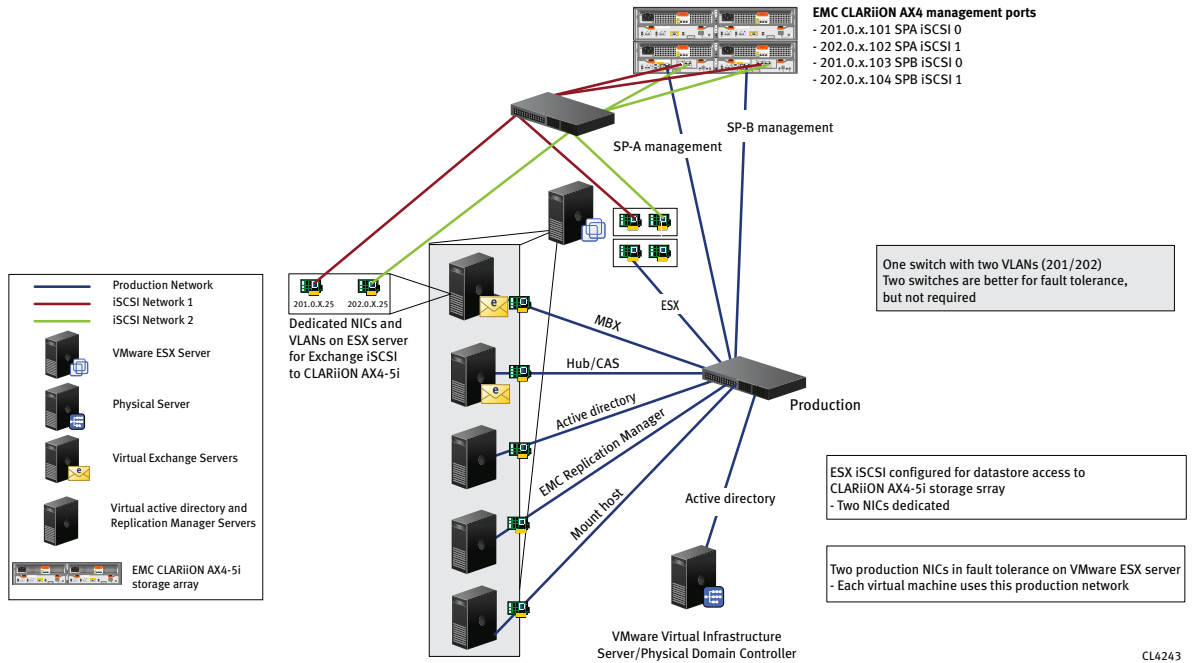


Figure 2 Physical architecture of the solution

CL4243

## Customer profile

This solution is intended for commercial Exchange customers who would like to consolidate, virtualize, and remotely replicate their Exchange users on a high-performance, highly available storage platform. This configuration is designed to support up to 2,000 Exchange users in a small-to-medium business, with the following assumptions:

- One physical domain controller also used as a VMware vCenter Server
- One virtual Exchange Server for the dual Hub/CAS role
- One virtual Exchange Server for the mailbox role
- Up to 2,000 users per Exchange server
- Very heavy 0.5 IOPS per user profile
- 300 MB user mailbox
- Eight Exchange storage groups per server
- One database per storage group
- Microsoft Windows Server 2003
- Microsoft Windows Server 2008

## Tested deployment

The following tables summarize the tested environment for the solution.

### Simulated Exchange configuration

Table 2 lists the simulated Exchange configuration details.

**Table 2 Simulated Exchange configuration**

Item	Description
Number of Exchange mailboxes simulated	2,000
Number of hosts	1
Number of mailboxes/hosts	1
Number of storage groups/host	8
Number of mailbox stores/storage group	8
Number of mailboxes/mailbox store	250
Number of mailbox store LUNS/storage group	1
Simulated profile: I/Os per second per mailbox (IOPS)	0.50
Database LUN size	90 GB
Log LUN size	25 GB
Backup LUN size/storage group	N/A
Total database size for performance testing	608 GB
% formatted storage capacity used by Exchange database **	84%

\*\*Storage performance characteristics change based on the percentage utilization of the individual disks. Tests that use a small percentage of the storage (~25%) may exhibit reduced throughput if the storage capacity utilization is significantly increased beyond what is tested in this document.

## Hardware

Table 3 details the hardware resources used in the environment.

**Table 3 Hardware specification**

Item	Description
Storage connectivity	iSCSI
Storage model and OS/firmware revision	<a href="http://www.windowsservercatalog.com/item.aspx?idItem=53f4f795-0c47-2df1-24b7-690341b1769e">http://www.windowsservercatalog.com/item.aspx?idItem=53f4f795-0c47-2df1-24b7-690341b1769e</a> CLARiiON AX4-5i FLARE® 02.23
Storage cache	1 GB
Number of storage controllers	2
Number of storage ports	4
Maximum bandwidth of storage connectivity to host	4 Gb/s
Switch type/model/firmware revision	Dell PowerConnect 6224 2.0.0.12
HBA model and firmware	Intel PRO/1000 MT Network Connection
Number of HBAs/host	2 (TOE off)
Host server type	Dell R900, 32 GB RAM, 4 Intel Processors ~1596 Mhz
Total number of disks tested in solution	14
Maximum number of spindles that can be hosted in the storage	60

## Software

Table 4 details the software resources used in the environment.

**Table 4 Software specification**

Item	Description
HBA driver	E1G6032E.sys File Version 8.3.2.8
HBA QueueTarget setting	N/A
HBA QueueDepth setting	N/A
Multipathing	PowerPath® 5.1 SP2
Host OS	Microsoft Windows Server 2003 SP2 Enterprise Edition Microsoft Windows Server 2008 Enterprise Edition
ESE.dll file version	8.1.240.5
Replication solution name/version	N/A

## Primary storage disk configuration (mailbox store disks)

Table 5 lists the disk configuration (mailbox store disks) for the environment.

**Table 5 Disk configuration (mailbox store)**

Item	Description
Disk type, speed and firmware revision	iSCSI 15k
Raw capacity per disk (GB)	268 GB
Number of physical disks in test	8
Total raw storage capacity (GB)	2.144 TB
Disk slice size (GB)	45 GB
Number of slices per LUN or number of disks per LUN	2
RAID level	1/0

**Table 5 Disk configuration (mailbox store) (continued)**

Item	Description
Total formatted capacity	720 GB
Storage capacity utilization	33.5%
Database capacity utilization	28%

### Primary storage disk configuration (transactional log disks)

Table 6 lists the disk configuration (transactional log disks) for the environment.

**Table 6 Disk configuration**

Item	Description
Disk type, speed and firmware revision	iSCSI 15k
Raw capacity per disk (GB)	268 GB
Number of spindles in test	6
Total raw storage capacity (GB)	1.6 TB
Disk slice size	N/A
Number of slices per LUN or number of disks per LUN	N/A
RAID level	1/0
Total formatted capacity	200 GB

### Replicated storage hardware

A separate RAID group was created with eight physical disks to facilitate RM clone replicas.

### Replicated storage software

EMC's Replication Manager 5.2 was used.

### Replicated storage disk configuration (mailbox store disks)

To facilitate a two-day rotation for the RM clones, 16 regular LUNs were bound. These LUNs were the exact same size as the production database LUNs.

## Replicated storage disk configuration (transactional log disks)

To facilitate a two-day rotation for the RM clones, 16 regular LUNs were bound. These LUNs were the exact same size as the production log LUNs.

## Product list

The following section lists the products used in the solution.

### EMC CLARiiON AX4

EMC CLARiiON AX4 is a versatile and cost-effective solution for organizations looking for an alternative to server-based storage. The CLARiiON AX4 system delivers performance, scalability, and advanced data management features in one, easy-to-use, storage solution.

Advanced capabilities start with the scalability to meet the needs of today and the requirements of tomorrow. Single-controller AX4 models are a low-cost approach to deploying external storage and provide an economical storage platform for applications such as backup-to-disk and a variety of data archiving tasks. Dual-controller models offer the superior availability, connectivity, and performance that business-critical data and applications require.

- 12 drives per enclosure
- Scaling up to 60 drives through four expansion enclosures
- Up to 60 TB of capacity
- Storage for up to 64 hosts

With both iSCSI and Fibre Channel models, the CLARiiON AX4 system enables organizations to choose a network interconnect that is right for their environments. CLARiiON AX4 iSCSI arrays provide the foundation for cost-effective shared storage using widely available IP networking components for direct-attach for a network using conventional Ethernet switches. CLARiiON AX4 arrays using 4 Gb/s Fibre Channel connections utilize low-cost host bus adapters to provide cost-effective, direct-attach configurations with a wide range of SAN switch options to create SANs for up to 64 high-availability servers. Each controller supports two front-end ports, either 4 Gb/s Fibre Channel or 1 Gb/s iSCSI.

The CLARiiON AX4 system can be equipped with serial-attached SCSI (SAS) for performance-oriented applications and serial ATA (SATA) drives to deliver the lowest cost per gigabyte and highest capacity per drive. The ability to mix SAS and SATA drives within each enclosure provides the most flexible and economical system configurations for all needs.

The EMC CLARiiON AX4 series delivers functionality that unleashes the benefits of tiered storage and is the answer to storage consolidation for heterogeneous environments. It supports Windows, Linux, AIX, HP-UX, Solaris and VMware.

## EMC Replication Manager

Replication Manager delivers simple management of multiple replicas for different reasons, while leveraging EMC's best-of-breed, point-in-time replication technology. The combination of Replication Manager and EMC point-in-time replication technology provides a powerful, easy-to-use solution enabling customers to manage and repurpose replicas of their business data for improved flexibility and productivity.

Replication Manager has the ability to instantly create VM-consistent replicas of VMFS datastores containing virtual machines via the Replication Manager Proxy Server. This streamlines VMFS replica management for customers by providing near-instant backup and recovery of VMFS replicas by leveraging EMC's array based snapshots and clones. This functionality allows customers to implement faster deployment of virtual desktops and VMs. It is easy to use with wizards and a point-and-click user interface. Users can even perform a single virtual machine-level restore of a replica through the VMware vCenter Server using a replica created and mounted by Replication Manager.

If your business would like to significantly reduce custom scripting for a more streamlined replication process that is repeatable, not error prone, and ensures that best practices are used, Replication Manager is an ideal solution.

## VMware virtualization technology

Virtualization is a proven software technology that is rapidly transforming the IT landscape and fundamentally changing the way that people compute. Today's powerful computer hardware was originally designed to run only a single operating system and a single application, but virtualization breaks that bond, making it possible to run multiple operating systems and multiple applications on the same computer at the same time, increasing the utilization and flexibility of the hardware.

In essence, virtualization lets you transform hardware into software. Use software such as VMware ESX Server to transform or "virtualize" the hardware resources of a computer—including the CPU, RAM, hard disk and network controller—to create a fully functional virtual machine that can run its own operating system and applications just like a "real" computer.

Multiple virtual machines share hardware resources without interfering with each other so that you can safely run several operating systems and applications at the same time on a single computer.

## Microsoft Exchange Server 2007

Microsoft Exchange Server 2007 is the latest version of Microsoft Exchange Server, the industry's leading server for e-mail, calendaring, and unified messaging. Exchange Server 2007 has been designed specifically to meet today's business and IT challenges while delivering on the capabilities demanded by mobile workforces. The enhancements of Exchange Server 2007 fall into three major areas:

- Built-in protection from spam, viruses, e-mail spoofing and snooping, system downtime, and compliance risk
- Anywhere access to vital communications - such as e-mail, voice mail, and calendars from a variety of clients and devices
- Operational efficiency to help optimize hardworking and networking investments, and improve IT productivity

## Best Practices

This chapter contains information on best practices.

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## Best practices

Microsoft Exchange Server is a disk-intensive application. It is characterized as a very bursty read/write operation to the database files, with a sequential (mostly 512 byte) write operation to the transaction logs. It is this random, bursty workload—with periods of high peaks—that makes designing a well-performing storage solution with Microsoft Exchange Server a challenge. Different corporate environments have different user and storage requirements, so storage design cannot be based simply on generalizations.

Based on the testing, EMC recommends following these best practices to improve storage performance with Exchange solutions. For Microsoft's Exchange 2007 best practices on storage design, visit:

<http://technet.microsoft.com/en-us/library/bb124518.aspx>.

1. Isolate the Microsoft Exchange Database workload from other I/O intensive applications or workloads. This ensures the highest levels of performance for Microsoft Exchange and makes troubleshooting efforts easier in the event of a disk-related Microsoft Exchange performance issue.
2. TcpAckFrequency = 1 for each iSCSI connection. Refer to the information at <http://support.microsoft.com/kb/328890>.
3. Size and configure the environment for spindle performance as the primary consideration, with storage capacity as the secondary.
4. For iSCSI configuration, use PowerPath 5.1.0 utilizing a balanced path approach. Log in with NIC0 into the A0(Spa) and B0(Spb), and NIC1 into B1(Spb) and A1(Spa).
5. Tuning the AX4 storage system parameters is important for obtaining the best performance. The following list details the optimal parameters for Exchange:
  - Cache page size of 8 KB
  - Balance read and write caching
  - Read and write cache enabled for all LUNs
  - Read cache minimum of 50-100 MB for prefetch

### VMware ESX Server and virtual machine

1. The specification of your physical hosts must be great enough to provide sufficient resources for all of the virtual machines you plan to run, and must provide headroom for spikes in resource utilization.

2. Where multiple ESX Servers are required to host the number of desired virtual machines, distribute the virtual machine types (for example, Exchange 2007 roles) evenly across all available ESX Servers.
3. RDM is recommended for Exchange when using SAN features such as array-based replication. RDM is recommended in this case, not for performance reasons, but because these technologies require lower-level disk control.

More information about Exchange and VMware best practices can be found at: [http://www.vmware.com/pdf/exchange\\_best\\_practices.pdf](http://www.vmware.com/pdf/exchange_best_practices.pdf).



## Test Result Summary

This chapter provides a high-level summary of the test data.

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## Test result summary

This chapter provides a high-level summary of the test data, as well as links to the detailed reports that are generated by the testing. The reports are located in [Appendix A](#).

Microsoft has recommended thresholds for latency for Exchange Servers. When running Jetstress, the application uses some of these latencies to determine whether the test has passed or failed.

Some of the more important counters for Microsoft Exchange Server are listed in the following table.

Disk	Avg. Disk sec/Read	Avg. Disk sec/Write
Database LUNs	< 20 ms	< 50 ms
Log LUNs	N/A	< 10 ms

For more information, visit:

<http://technet.microsoft.com/en-us/library/bb201720.aspx>

### Test one: Reliability

A number of the tests in the framework are designed to test reliability over a 24-hour period. The goal of these tests is to verify that the storage can handle a high I/O load for a long period of time while replicating synchronously.

Following the stress test, both log and database files on production and DR hosts are analyzed for integrity to ensure there is no database/log corruption.

### Test two: Primary storage performance

To see the Jetstress performance results (2-hour performance test), see the section “[Microsoft Exchange Server 2007 Jetstress - 2-hour](#)” on page 36.

Performance testing exercises the storage with maximum sustainable Exchange-type I/O for two hours. The test is used to show how long it takes for the storage to respond to an I/O under load. The data included in the following tables is a sample taken from each of the attached hosts. It is the average of all the logical disks in the two hour test duration.

The sum of all of the logical disk I/Os and average of all the logical disks I/O latency in the 2 hours test duration are listed in “[Test three: Individual server metrics](#)” on page 27.

### Test three: Individual server metrics

The information in these tables includes the sum of I/Os across storage groups and the average latency across all storage groups on a per-server basis.

<b>Database I/O</b>	
Database disks transfers/sec	1073.094
Database disks reads/sec	498.373
Database disks writes/sec	574.723
Average database disk read latency (ms)	18
Average database disk write latency (ms)	14
<b>Transaction log I/O</b>	
Log disks writes/sec	346.707
Average log disk write latency (ms)	6

### Log read-only performance

This test is to measure the maximum rate at which the log files can be played against the databases. The following table shows the average rate for 500 log files played in a single storage group. Each log file is 1 MB in size.

Average time to play one log file (sec)	1.32
-----------------------------------------	------



## Conclusion

This chapter contains the conclusion information.

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## Conclusion

This document was developed by EMC Global Solutions. The test results and data presented in this document are based on tests introduced in the EMC storage solution test framework. Customers should not quote the data directly for their pre-deployment verification. It is still necessary to go through the exercises to validate the storage design for a specific customer environment.

The EMC storage solution program is not designed to be a benchmarking program. Tests are not designed to get the maximum throughput for a given solution. Rather, it is focused on producing recommendations from vendors for the Exchange application. Therefore, the data presented in this document should not be used for direct comparisons among the solutions.

## Contact for additional information

EMC recommends that you consult with EMC Professional Services to assist with the design and deployment of a similar solution. For information about this or any other EMC solution, use the following numbers:

United States: **(800) 782-4362 (SVC-4EMC)**

Canada: **(800) 543-4782 (543-4SVC)**

Worldwide: **(508) 497-7901**

For additional information about EMC products and services available to customers and partners, refer to:

**<http://www.emc.com>**

or

**<http://powerlink.emc.com>**

## Jetstress Results

This appendix contains more detailed test reports.

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## Test results

This section provides a high-level summary of the performance test data.

### Microsoft Exchange Server 2007 Jetstress - 24-hour

#### Stress test result report

#### Test summary

<b>Overall Test Result</b>	<b>Pass</b>
<b>Machine Name</b>	F2EXN1
<b>Test Description</b>	
<b>Test Start Time</b>	22/01/2009 16:05:22
<b>Test End Time</b>	23/01/2009 16:22:11
<b>Jetstress Version</b>	08.02.0060.000
<b>Ese Version</b>	08.01.0240.005
<b>Operating System</b>	Windows Server (R) 2008 Enterprise Service Pack 1 (6.0.6001.65536)
<b>Performance Log</b>	C:\Jetstress Testing\24 hour test\Stress_2009_1_22_16_5_41.blg

#### Database sizing and throughput

<b>Achieved I/O per Second</b>	1099.455
<b>Capacity Percentage</b>	100%
<b>Throughput Percentage</b>	100%
<b>Initial database size</b>	621567672320
<b>Final database size</b>	663953211392
<b>Database files (count)</b>	8

### Jetstress system parameters

Thread count	7 (per-storage group)
Log buffers	9000
Minimum database cache	256.0 MB
Maximum database cache	2048.0 MB
Insert operations	40%
Delete operations	30%
Replace operations	5%
Read operations	25%
Lazy commits	55%

### Disk subsystem performance

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec	Avg. Disk Bytes/Write
Database (S:\SG1DB)	0.019	0.014	65.818	71.604	(n/a)
Database (T:\SG2DB)	0.017	0.014	65.983	71.788	(n/a)
Database (S:\SG3DB)	0.019	0.014	65.919	71.691	(n/a)
Database (T:\SG4DB)	0.018	0.014	65.847	71.651	(n/a)
Database (S:\SG5DB)	0.018	0.013	65.863	71.596	(n/a)
Database (T:\SG6DB)	0.017	0.013	65.752	71.265	(n/a)
Database (S:\SG7DB)	0.019	0.013	65.746	71.240	(n/a)
Database (T:\SG8DB)	0.018	0.013	65.985	71.707	(n/a)
Log (T:\SG1LOGS)	0.000	0.005	0.000	43.287	4512.055
Log (S:\SG2LOGS)	0.000	0.006	0.000	42.663	4575.488
Log (T:\SG3LOGS)	0.000	0.005	0.000	43.149	4510.277
Log (S:\SG4LOGS)	0.000	0.006	0.000	42.896	4546.934
Log (T:\SG5LOGS)	0.000	0.005	0.000	43.049	4525.726
Log (S:\SG6LOGS)	0.000	0.006	0.000	42.370	4572.956

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec	Avg. Disk Bytes/Write
Log (T:\SG7LOGS)	0.000	0.005	0.000	42.718	4556.402
Log (S:\SG8LOGS)	0.000	0.006	0.000	42.910	4543.826

### Host system performance

Counter	Average	Minimum	Maximum
% Processor Time	16.754	8.822	31.217
Available MBytes	8472.026	8417.000	8678.000
Free System Page Table Entries	33559115.810	33558799.000	33559298.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	56864851.563	56729600.000	57176064.000
Pool Paged Bytes	280585243.319	279998464.000	310218752.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

### Test log

22/01/2009 16:05:21 -- Command Line: "C:\PROGRA~1\EXCHAN~1\jetstresscmd.exe" /c "C:\Jetstress Testing\24 hour test\JetstressConfig.xml"

22/01/2009 16:05:21 -- Jetstress testing begins ...

22/01/2009 16:05:22 -- Prepare testing begins ...

22/01/2009 16:05:31 -- Attaching databases ...

22/01/2009 16:05:31 -- Prepare testing ends.

22/01/2009 16:05:31 -- Dispatching transactions begins ...

22/01/2009 16:05:31 -- Database cache settings: (minimum: 256.0 MB, maximum: 2.0 GB)

22/01/2009 16:05:31 -- Database flush thresholds: (start: 20.5 MB, stop: 41.0 MB)

22/01/2009 16:05:41 -- Database read latency thresholds: (average: 0.02 seconds/read, maximum: 0.1 seconds/read).

22/01/2009 16:05:41 -- Log write latency thresholds: (average: 0.01 seconds/write, maximum: 0.1 seconds/write).

22/01/2009 16:05:46 -- Operation mix: Sessions 7, Inserts 40%, Deletes 30%, Replaces 5%, Reads 25%, Lazy Commits 55%.

22/01/2009 16:05:46 -- Performance logging begins (interval: 15000 ms).

22/01/2009 16:05:46 -- Attaining prerequisites:

22/01/2009 16:22:04 -- \MSEExchange Database(JetstressCmd)\Database Cache Size, Last: 1933631000.0  
(lower bound: 1932735000.0, upper bound: none)  
23/01/2009 16:22:04 -- Performance logging ends.  
23/01/2009 16:22:04 -- JetInterop batch transaction stats: 206683, 207430, 207060, 207263, 207029,  
206601, 206641, and 206959.  
23/01/2009 16:22:05 -- Dispatching transactions ends.  
23/01/2009 16:22:05 -- Shutting down databases ...  
23/01/2009 16:22:11 -- Instance672.1 (complete), Instance672.2 (complete), Instance672.3 (complete),  
Instance672.4 (complete), Instance672.5 (complete), Instance672.6 (complete), Instance672.7 (complete),  
and Instance672.8 (complete)  
23/01/2009 16:22:11 -- C:\Jetstress Testing\24 hour test\Stress\_2009\_1\_22\_16\_5\_41.blg has 5799 samples.  
23/01/2009 16:22:11 -- Creating test report ...  
23/01/2009 16:24:30 -- Volume S:\SG1DB has 0.0185 for Avg. Disk sec/Read.  
23/01/2009 16:24:30 -- Volume T:\SG2DB has 0.0174 for Avg. Disk sec/Read.  
23/01/2009 16:24:30 -- Volume S:\SG3DB has 0.0187 for Avg. Disk sec/Read.  
23/01/2009 16:24:30 -- Volume T:\SG4DB has 0.0180 for Avg. Disk sec/Read.  
23/01/2009 16:24:30 -- Volume S:\SG5DB has 0.0181 for Avg. Disk sec/Read.  
23/01/2009 16:24:30 -- Volume T:\SG6DB has 0.0175 for Avg. Disk sec/Read.  
23/01/2009 16:24:30 -- Volume S:\SG7DB has 0.0186 for Avg. Disk sec/Read.  
23/01/2009 16:24:30 -- Volume T:\SG8DB has 0.0180 for Avg. Disk sec/Read.  
23/01/2009 16:24:31 -- Volume T:\SG1LOGS has 0.0055 for Avg. Disk sec/Write.  
23/01/2009 16:24:31 -- Volume T:\SG1LOGS has 0.0000 for Avg. Disk sec/Read.  
23/01/2009 16:24:31 -- Volume S:\SG2LOGS has 0.0056 for Avg. Disk sec/Write.  
23/01/2009 16:24:31 -- Volume S:\SG2LOGS has 0.0000 for Avg. Disk sec/Read.  
23/01/2009 16:24:31 -- Volume T:\SG3LOGS has 0.0055 for Avg. Disk sec/Write.  
23/01/2009 16:24:31 -- Volume T:\SG3LOGS has 0.0000 for Avg. Disk sec/Read.  
23/01/2009 16:24:31 -- Volume S:\SG4LOGS has 0.0056 for Avg. Disk sec/Write.  
23/01/2009 16:24:31 -- Volume S:\SG4LOGS has 0.0000 for Avg. Disk sec/Read.  
23/01/2009 16:24:31 -- Volume T:\SG5LOGS has 0.0055 for Avg. Disk sec/Write.  
23/01/2009 16:24:31 -- Volume T:\SG5LOGS has 0.0000 for Avg. Disk sec/Read.  
23/01/2009 16:24:31 -- Volume S:\SG6LOGS has 0.0056 for Avg. Disk sec/Write.  
23/01/2009 16:24:31 -- Volume S:\SG6LOGS has 0.0000 for Avg. Disk sec/Read.  
23/01/2009 16:24:31 -- Volume T:\SG7LOGS has 0.0055 for Avg. Disk sec/Write.  
23/01/2009 16:24:31 -- Volume T:\SG7LOGS has 0.0000 for Avg. Disk sec/Read.  
23/01/2009 16:24:31 -- Volume S:\SG8LOGS has 0.0056 for Avg. Disk sec/Write.  
23/01/2009 16:24:31 -- Volume S:\SG8LOGS has 0.0000 for Avg. Disk sec/Read.  
23/01/2009 16:24:31 -- Test has 0 Maximum Database Page Fault Stalls/sec.  
23/01/2009 16:24:31 -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.  
23/01/2009 16:24:31 -- C:\Jetstress Testing\24 hour test\Stress\_2009\_1\_22\_16\_5\_41.xml has 5734 samples  
queried.

## Microsoft Exchange Server 2007 Jetstress - 2-hour

### Test summary

<b>Overall Test Result</b>	<b>Pass</b>
<b>Machine Name</b>	F1EXN1
<b>Test Description</b>	
<b>Test Start Time</b>	19/11/2008 10:24:55
<b>Test End Time</b>	19/11/2008 12:40:29
<b>Jetstress Version</b>	08.02.0060.000
<b>Ese Version</b>	08.01.0240.005
<b>Operating System</b>	Windows Server (R) 2008 Enterprise Service Pack 1 (6.0.6001.65536)
<b>Performance Log</b>	C:\Jetstress Testing\Metas within Raid Group\Jetstress 7 threads\Performance_2008_11_19_10_25_15.blg

### Database sizing and throughput

<b>Achieved I/O per Second</b>	1073.094
<b>Planned I/O per Second</b>	100%
<b>Throughput Percentage</b>	100%
<b>Initial database size</b>	626722471936
<b>Final database size</b>	630782558208
<b>Database files (count)</b>	8

### Jetstress system parameters

Thread count	7 (per-storage group)
Log buffers	9000
Minimum database cache	256.0 MB
Maximum database cache	2048.0 MB
Insert operations	40%
Delete operations	30%
Replace operations	5%
Read operations	25%
Lazy commits	55%

### Disk subsystem performance

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec	Avg. Disk Bytes/Write
Database (S:\T1SG1DB)	0.019	0.015	62.107	72.341	(n/a)
Database (T:\T1SG2DB)	0.018	0.014	62.647	72.474	(n/a)
Database (S:\T1SG3DB)	0.019	0.014	63.958	73.975	(n/a)
Database (T:\T1SG4DB)	0.018	0.014	61.979	70.719	(n/a)
Database (S:\T1SG5DB)	0.018	0.014	62.175	72.043	(n/a)
Database (T:\T1SG6DB)	0.017	0.014	61.169	70.231	(n/a)
Database (S:\T1SG7DB)	0.018	0.014	62.392	71.658	(n/a)
Database (T:\T1SG8DB)	0.018	0.014	61.946	71.282	(n/a)
Log (T:\T1SG1LOGS)	0.000	0.006	0.000	43.813	4477.224
Log (S:\T1SG2LOGS)	0.000	0.006	0.000	43.756	4479.906
Log (T:\T1SG3LOGS)	0.000	0.006	0.000	44.376	4519.053
Log (S:\T1SG4LOGS)	0.000	0.006	0.000	42.414	4538.495
Log (T:\T1SG5LOGS)	0.000	0.006	0.000	43.543	4510.555
Log (S:\T1SG6LOGS)	0.000	0.006	0.000	42.482	4593.585

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec	Avg. Disk Bytes/Write
Log (T:\T1SG7LOGS)	0.000	0.006	0.000	42.968	4583.994
Log (S:\T1SG8LOGS)	0.000	0.006	0.000	43.355	4569.706

### Host system performance

Counter	Average	Minimum	Maximum
% Processor Time	17.739	12.305	41.149
Available MBytes	8535.552	8529.000	8716.000
Free System Page Table Entries	33558324.617	33557754.000	33558435.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	55241732.285	54915072.000	55459840.000
Pool Paged Bytes	106554526.527	106500096.000	106729472.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

### Test log

19/11/2008 10:24:31 -- Command Line: "C:\PROGRA~1\EXCHAN~1\jetstresscmd.exe" /c "C:\Jetstress Testing\Metas within Raid Group\Jetstress 7 threads\Jetstress.xml"

19/11/2008 10:24:31 -- Jetstress testing begins ...

19/11/2008 10:24:55 -- Prepare testing begins ...

19/11/2008 10:25:05 -- Attaching databases ...

19/11/2008 10:25:05 -- Prepare testing ends.

19/11/2008 10:25:05 -- Dispatching transactions begins ...

19/11/2008 10:25:05 -- Database cache settings: (minimum: 256.0 MB, maximum: 2.0 GB)

19/11/2008 10:25:05 -- Database flush thresholds: (start: 20.5 MB, stop: 41.0 MB)

19/11/2008 10:25:15 -- Database read latency thresholds: (average: 0.02 seconds/read, maximum: 0.05 seconds/read).

19/11/2008 10:25:15 -- Log write latency thresholds: (average: 0.01 seconds/write, maximum: 0.05 seconds/write).

19/11/2008 10:25:18 -- Operation mix: Sessions 7, Inserts 40%, Deletes 30%, Replaces 5%, Reads 25%, Lazy Commits 55%.

19/11/2008 10:25:18 -- Performance logging begins (interval: 15000 ms).

19/11/2008 10:25:18 -- Attaining prerequisites:

19/11/2008 10:40:22 -- \MSEExchange Database(JetstressCmd)\Database Cache Size, Last: 1933279000.0  
(lower bound: 1932735000.0, upper bound: none)

19/11/2008 12:40:23 -- Performance logging ends.

19/11/2008 12:40:23 -- JetInterop batch transaction stats: 19303, 19331, 19706, 19090, 19313, 19142,  
19357, and 19057.

19/11/2008 12:40:23 -- Dispatching transactions ends.

19/11/2008 12:40:23 -- Shutting down databases ...

19/11/2008 12:40:29 -- Instance696.1 (complete), Instance696.2 (complete), Instance696.3 (complete),  
Instance696.4 (complete), Instance696.5 (complete), Instance696.6 (complete), Instance696.7 (complete),  
and Instance696.8 (complete)

19/11/2008 12:40:29 -- C:\Jetstress Testing\Metas within Raid Group\Jetstress 7  
threads\Performance\_2008\_11\_19\_10\_25\_15.blg has 538 samples.

19/11/2008 12:40:29 -- Creating test report ...

19/11/2008 12:40:42 -- Volume S:\T1SG1DB has 0.0191 for Avg. Disk sec/Read.

19/11/2008 12:40:42 -- Volume T:\T1SG2DB has 0.0178 for Avg. Disk sec/Read.

19/11/2008 12:40:42 -- Volume S:\T1SG3DB has 0.0188 for Avg. Disk sec/Read.

19/11/2008 12:40:42 -- Volume T:\T1SG4DB has 0.0183 for Avg. Disk sec/Read.

19/11/2008 12:40:42 -- Volume S:\T1SG5DB has 0.0177 for Avg. Disk sec/Read.

19/11/2008 12:40:42 -- Volume T:\T1SG6DB has 0.0174 for Avg. Disk sec/Read.

19/11/2008 12:40:42 -- Volume S:\T1SG7DB has 0.0182 for Avg. Disk sec/Read.

19/11/2008 12:40:42 -- Volume T:\T1SG8DB has 0.0182 for Avg. Disk sec/Read.

19/11/2008 12:40:42 -- Volume T:\T1SG1LOGS has 0.0056 for Avg. Disk sec/Write.

19/11/2008 12:40:42 -- Volume T:\T1SG1LOGS has 0.0000 for Avg. Disk sec/Read.

19/11/2008 12:40:42 -- Volume S:\T1SG2LOGS has 0.0056 for Avg. Disk sec/Write.

19/11/2008 12:40:42 -- Volume S:\T1SG2LOGS has 0.0000 for Avg. Disk sec/Read.

19/11/2008 12:40:42 -- Volume T:\T1SG3LOGS has 0.0056 for Avg. Disk sec/Write.

19/11/2008 12:40:42 -- Volume T:\T1SG3LOGS has 0.0000 for Avg. Disk sec/Read.

19/11/2008 12:40:42 -- Volume S:\T1SG4LOGS has 0.0057 for Avg. Disk sec/Write.

19/11/2008 12:40:42 -- Volume S:\T1SG4LOGS has 0.0000 for Avg. Disk sec/Read.

19/11/2008 12:40:42 -- Volume T:\T1SG5LOGS has 0.0056 for Avg. Disk sec/Write.

19/11/2008 12:40:42 -- Volume T:\T1SG5LOGS has 0.0000 for Avg. Disk sec/Read.

19/11/2008 12:40:42 -- Volume S:\T1SG6LOGS has 0.0056 for Avg. Disk sec/Write.

19/11/2008 12:40:42 -- Volume S:\T1SG6LOGS has 0.0000 for Avg. Disk sec/Read.

19/11/2008 12:40:42 -- Volume T:\T1SG7LOGS has 0.0056 for Avg. Disk sec/Write.

19/11/2008 12:40:42 -- Volume T:\T1SG7LOGS has 0.0000 for Avg. Disk sec/Read.

19/11/2008 12:40:42 -- Volume S:\T1SG8LOGS has 0.0056 for Avg. Disk sec/Write.

19/11/2008 12:40:42 -- Volume S:\T1SG8LOGS has 0.0000 for Avg. Disk sec/Read.

19/11/2008 12:40:42 -- Test has 0 Maximum Database Page Fault Stalls/sec.

19/11/2008 12:40:42 -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.

19/11/2008 12:40:42 -- C:\Jetstress Testing\Metas within Raid Group\Jetstress 7  
threads\Performance\_2008\_11\_19\_10\_25\_15.xml has 477 samples queried.

## Microsoft Exchange Server 2007 Jetstress - Soft recovery

### Soft recovery test result report

#### Soft recovery statistics - All

Database Instance	Log files replayed	Elapsed seconds
Instance3368.1	500	659.5493922
Instance3368.2	509	654.5022588
Instance3368.3	506	668.2998402
Instance3368.4	505	663.0495714
Instance3368.5	511	678.8003778
Instance3368.6	501	664.799661
Instance3368.7	502	674.800173
Instance3368.8	512	666.5497506

#### Disk subsystem performance

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec	Avg. Disk Bytes/Write
Database (S:\SG1DB)	0.168	0.017	338.344	7.263	(n/a)
Database (T:\SG2DB)	0.158	0.015	339.969	7.359	(n/a)
Database (S:\SG3DB)	0.186	0.017	345.820	7.386	(n/a)
Database (T:\SG4DB)	0.173	0.016	343.937	7.376	(n/a)
Database (S:\SG5DB)	0.168	0.016	346.021	7.375	(n/a)
Database (T:\SG6DB)	0.172	0.015	343.503	7.285	(n/a)
Database (S:\SG7DB)	0.182	0.015	349.575	7.339	(n/a)
Database (T:\SG8DB)	0.174	0.019	344.317	7.436	(n/a)
Log (T:\SG1LOGS)	0.003	0.000	24.472	0.051	135.821
Log (S:\SG2LOGS)	0.003	0.000	24.858	0.047	141.304
Log (T:\SG3LOGS)	0.003	0.000	24.961	0.042	76.126

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec	Avg. Disk Bytes/Write
Log (S:\SG4LOGS)	0.003	0.000	24.882	0.050	135.821
Log (T:\SG5LOGS)	0.003	0.000	25.027	0.006	50.258
Log (S:\SG6LOGS)	0.003	0.000	24.580	0.036	46.802
Log (T:\SG7LOGS)	0.003	0.000	24.712	0.033	32.458
Log (S:\SG8LOGS)	0.003	0.000	25.101	0.044	110.986

### Host system performance

Counter	Average	Minimum	Maximum
% Processor Time	44.475	21.047	89.449
Available MBytes	8864.756	8627.000	10710.000
Free System Page Table Entries	33559493.366	33559255.000	33559592.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	56732746.927	52826112.000	57319424.000
Pool Paged Bytes	276129267.512	274563072.000	276238336.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

### Test log

22/01/2009 12:21:20 -- Command Line: "C:\PROGRA~1\EXCHAN~1\jetstresscmd.exe" /c "C:\Jetstress Testing\Soft Recovery\JetstressConfig.xml"

22/01/2009 12:21:20 -- Jetstress testing begins ...

22/01/2009 12:21:20 -- Prepare testing begins ...

22/01/2009 12:21:32 -- Attaching databases ...

22/01/2009 12:21:32 -- Prepare testing ends.

22/01/2009 12:21:32 -- Dispatching transactions begins ...

22/01/2009 12:21:32 -- Database cache settings: (minimum: 256.0 MB, maximum: 2.0 GB)

22/01/2009 12:21:32 -- Database flush thresholds: (start: 20.5 MB, stop: 41.0 MB)

22/01/2009 12:21:44 -- Database read latency thresholds: (average: 0.02 seconds/read, maximum: 0.05 seconds/read).

22/01/2009 12:21:44 -- Log write latency thresholds: (average: 0.01 seconds/write, maximum: 0.05 seconds/write).

22/01/2009 12:21:50 -- Operation mix: Sessions 7, Inserts 40%, Deletes 30%, Replaces 5%, Reads 25%,

Lazy Commits 55%.

22/01/2009 12:21:50 -- Performance logging begins (interval: 15000 ms).

22/01/2009 12:21:50 -- Generating log files ...

22/01/2009 13:54:37 -- T:\SG1LOGS (100.2% generated), S:\SG2LOGS (102.0% generated), T:\SG3LOGS (101.2% generated), S:\SG4LOGS (101.2% generated), T:\SG5LOGS (102.4% generated), S:\SG6LOGS (100.4% generated), T:\SG7LOGS (100.6% generated), and S:\SG8LOGS (102.6% generated)

22/01/2009 13:54:37 -- Performance logging ends.

22/01/2009 13:54:37 -- JetInterop batch transaction stats: 14422, 14627, 14782, 14661, 14631, 14566, 14724, and 14781.

22/01/2009 13:54:37 -- Dispatching transactions ends.

22/01/2009 13:54:37 -- Shutting down databases ...

22/01/2009 13:54:43 -- Instance3368.1 (complete), Instance3368.2 (complete), Instance3368.3 (complete), Instance3368.4 (complete), Instance3368.5 (complete), Instance3368.6 (complete), Instance3368.7 (complete), and Instance3368.8 (complete)

22/01/2009 13:54:43 -- C:\Jetstress Testing\Soft Recovery\Performance\_2009\_1\_22\_12\_21\_44.blg has 369 samples.

22/01/2009 13:54:43 -- Creating test report ...

22/01/2009 13:54:53 -- Volume S:\SG1DB has 0.0179 for Avg. Disk sec/Read.

22/01/2009 13:54:53 -- Volume T:\SG2DB has 0.0164 for Avg. Disk sec/Read.

22/01/2009 13:54:53 -- Volume S:\SG3DB has 0.0180 for Avg. Disk sec/Read.

22/01/2009 13:54:53 -- Volume T:\SG4DB has 0.0171 for Avg. Disk sec/Read.

22/01/2009 13:54:53 -- Volume S:\SG5DB has 0.0177 for Avg. Disk sec/Read.

22/01/2009 13:54:53 -- Volume T:\SG6DB has 0.0169 for Avg. Disk sec/Read.

22/01/2009 13:54:53 -- Volume S:\SG7DB has 0.0187 for Avg. Disk sec/Read.

22/01/2009 13:54:53 -- Volume T:\SG8DB has 0.0171 for Avg. Disk sec/Read.

22/01/2009 13:54:53 -- Volume T:\SG1LOGS has 0.0052 for Avg. Disk sec/Write.

22/01/2009 13:54:53 -- Volume T:\SG1LOGS has 0.0000 for Avg. Disk sec/Read.

22/01/2009 13:54:53 -- Volume S:\SG2LOGS has 0.0053 for Avg. Disk sec/Write.

22/01/2009 13:54:53 -- Volume S:\SG2LOGS has 0.0000 for Avg. Disk sec/Read.

22/01/2009 13:54:53 -- Volume T:\SG3LOGS has 0.0052 for Avg. Disk sec/Write.

22/01/2009 13:54:53 -- Volume T:\SG3LOGS has 0.0000 for Avg. Disk sec/Read.

22/01/2009 13:54:53 -- Volume S:\SG4LOGS has 0.0055 for Avg. Disk sec/Write.

22/01/2009 13:54:53 -- Volume S:\SG4LOGS has 0.0000 for Avg. Disk sec/Read.

22/01/2009 13:54:53 -- Volume T:\SG5LOGS has 0.0051 for Avg. Disk sec/Write.

22/01/2009 13:54:53 -- Volume T:\SG5LOGS has 0.0001 for Avg. Disk sec/Read.

22/01/2009 13:54:53 -- Volume S:\SG6LOGS has 0.0054 for Avg. Disk sec/Write.

22/01/2009 13:54:53 -- Volume S:\SG6LOGS has 0.0002 for Avg. Disk sec/Read.

22/01/2009 13:54:53 -- Volume T:\SG7LOGS has 0.0052 for Avg. Disk sec/Write.

22/01/2009 13:54:53 -- Volume T:\SG7LOGS has 0.0000 for Avg. Disk sec/Read.

22/01/2009 13:54:53 -- Volume S:\SG8LOGS has 0.0054 for Avg. Disk sec/Write.

22/01/2009 13:54:53 -- Volume S:\SG8LOGS has 0.0001 for Avg. Disk sec/Read.

22/01/2009 13:54:53 -- Test has 0 Maximum Database Page Fault Stalls/sec.

22/01/2009 13:54:53 -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.  
22/01/2009 13:54:53 -- C:\Jetstress Testing\Soft Recovery\Performance\_2009\_1\_22\_12\_21\_44.xml has 368 samples queried.  
22/01/2009 13:54:54 -- C:\Jetstress Testing\Soft Recovery\Performance\_2009\_1\_22\_12\_21\_44.html is saved.  
22/01/2009 13:54:58 -- Performance logging begins (interval: 4000 ms).  
22/01/2009 13:54:58 -- Recovering databases ...  
22/01/2009 14:06:16 -- Performance logging ends.  
22/01/2009 14:06:16 -- Instance3368.1 (659.5493922), Instance3368.2 (654.5022588), Instance3368.3 (668.2998402), Instance3368.4 (663.0495714), Instance3368.5 (678.8003778), Instance3368.6 (664.799661), Instance3368.7 (674.800173), and Instance3368.8 (666.5497506)  
22/01/2009 14:06:18 -- C:\Jetstress Testing\Soft Recovery\SoftRecovery\_2009\_1\_22\_13\_54\_54.blg has 164 samples.  
22/01/2009 14:06:18 -- Creating test report ...

