

ESRP Storage Program  
EMC Celerra NS40 (850 User) iSCSI Storage Solution for  
Microsoft Exchange Server 2007

**Tested with:** ESRP – Storage Version 2.0  
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## Overview

This document provides information on EMC Celerra NS40 storage solution for Microsoft Exchange Server 2007, based on the *Microsoft Exchange Solution Reviewed Program (ESRP) – Storage program*\*. For any questions or comments regarding the contents of this document, see the section [Contact Information](#).

\*The *ESRP – Storage* program was developed by Microsoft Corporation to provide a common storage testing framework for EMC to provide information on its storage solutions for the Microsoft Exchange Server software. For more details on the *Microsoft ESRP – Storage* program, please visit:

<http://www.microsoft.com/technet/prodtechnol/exchange/2007/esrp.msp>

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## Features

This document describes an approach that can be used to configure Microsoft Exchange 2007 with EMC's Celerra NS40 storage system. The EMC Celerra NS40 meets the storage needs of a wide range of applications that include:

- Mail/messaging
- Databases
- File/print and Web services
- Distributed applications
- Remote replication

In addition, the NS40 supports a wide range of server operating environments like Microsoft Windows, Linux, Solaris, AIX, HP-UX, and VMware ESX Server.

The Celerra NS40 is a high-performance, full-function IP-storage platform. It delivers NAS and iSCSI capabilities to consolidate application storage and file servers in either an integrated configuration, or as a gateway connected to a CLARiiON or Symmetrix storage system.

Easy to deploy and simple to manage, the **NS40/Integrated** is all-in-one IP storage for customers looking for enterprise-class capabilities packaged for specific applications, departments, or locations. It provides customers the flexibility to upgrade to a **NS40G** gateway if they want to add Fibre Channel SAN capabilities. The **NS40G** gateway is the most cost-effective way to add NAS and iSCSI to existing EMC SAN environments. Both offerings are available in single- and dual-blade configurations. Regardless of the configuration, Celerra platforms offer a full suite of advanced functionality:

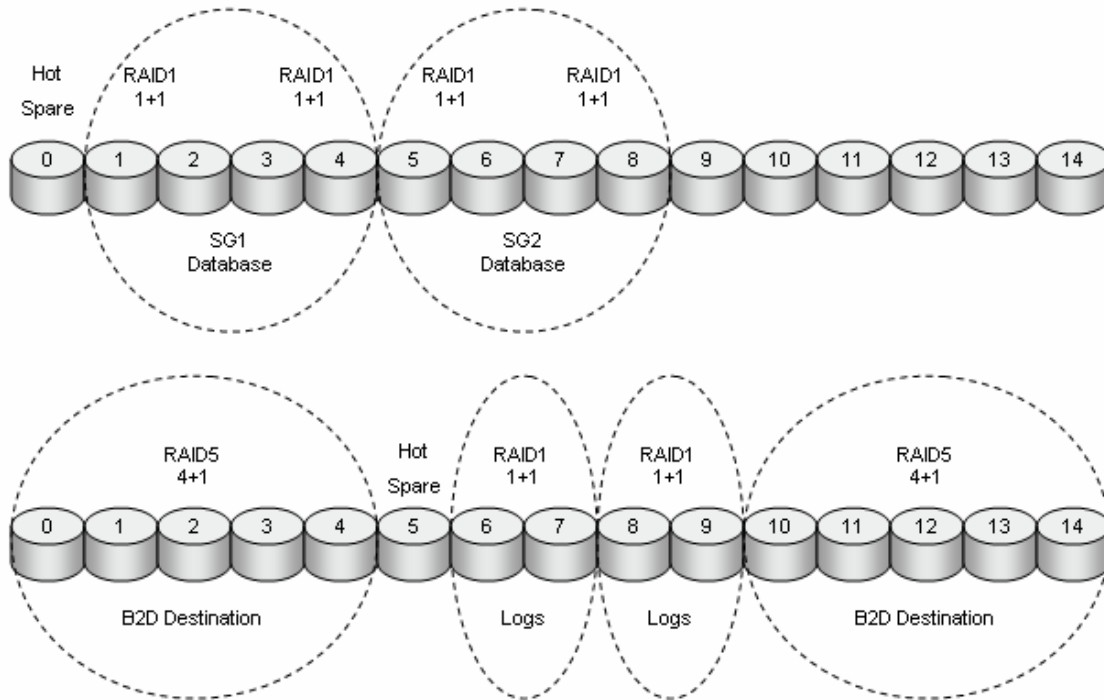
- Robust snap and replication capabilities offer protection of data.
- Celerra FileMover API allows automated policy-based movement of files between tiers of storage.
- File Level Retention provides disk-based WORM functionality.
- Automated Volume Management and Virtual Provisioning improve storage utilization.
- Celerra Multi-path File System for iSCSI (MPFSi) accelerates file access up to four times faster than standard NAS, without the need to recode applications.

The performance results and best practices discussed in this document provides proven guidelines for configuring the Celerra NS40 for high-performance Exchange environments. For this solution, an integrated Celerra NS40 storage system was used and configured for 850 Exchange 2007 users. Each of the 850 users had a profile of 0.5 IOPS and a 250 MB mailbox.

## Solution Description

Sizing and configuring storage for use with Microsoft Exchange is a complicated process. It is driven by many variables and factors, which vary from organization to organization. One method often used to simplify the sizing and configuration is to define a building block. In this case, the building block is defined as six disk spindles. The testing in this document proves that two six spindle building blocks (eight spindles for the databases and four spindles for the logs) meets and exceeds the Microsoft Exchange Server recommended metrics for reliability, scalability, and performance.

Our testing determined that twelve 15K FC spindles can easily satisfy the I/O workload of 850, 0.5 IOPS Exchange users. Each storage group in Exchange 2007 is recommended to have only one database. The 850 users were distributed among four Exchange storage groups. The Exchange databases for SG1 and SG2 are striped over four disk spindles from two 1+1 RAID 1 groups. The Exchange databases for SG3 and SG4 are striped over another four disk spindles from an additional two 1+1 RAID 1 groups. The logs for SG1 and SG2 will be stored on a single 1+1 RAID 1 group. The logs for SG3 and SG4 will be stored on another single 1+1 RAID 1 group. The diagram of the disk layout is shown in Figure 1.



**Figure 1 - Building Block 1 and 2**

The ESRP-Storage program focuses on storage solution testing to address performance and reliability issues with storage design. However, storage is not the only factor to take into consideration when designing a scalable Exchange solution. Other factors which affect the server scalability are:

- Server processor utilization
- Server physical and virtual memory limitations
- Resource requirements for other applications
- Directory and network service latencies
- Network infrastructure limitations
- Replication and recovery requirements
- Client usage profiles

All these factors are beyond the scope of ESRP-Storage. Therefore, the number of mailboxes hosted per server as part of the tested configuration may not necessarily be viable for some customer deployments.

For more information on identifying and addressing performance bottlenecks in an Exchange system, please refer to Performance Issues available at <http://technet.microsoft.com/en-us/library/bb397229.aspx>

Another tool to consider is Microsoft Operations Manager. The Exchange Server 2007 Management Pack for Microsoft Operations Manager includes rules and scripts to monitor and report on performance, availability, and reliability of all Exchange 2007 server roles including Mailbox, Client Access, Hub Transport, Edge Transport and Unified Messaging. Monitoring Exchange 2007 with Microsoft Operations Manager 2005 SP1, available at

<http://technet.microsoft.com/en-us/library/de353bdc-f872-4cf6-b36b-12d4a773e974.aspx>

## Targeted Customer Profile

This solution is intended for businesses hosting 850 Exchange mailboxes. The configuration used for testing is as below:

- Number of mailbox servers presented to the storage array — 1
- User IO profile for testing — 0.42 (0.5 IOPS tested)
- User mailbox size for testing — 250 MB
- Backup strategy for testing — Streaming Backup to Disk
- Time for Restore — 2 hours, 45 minutes per SG, Tested 100 GB database per SG

## Tested Deployment

The following tables summarize the testing environment:

### Simulated Exchange Configuration

Number of Exchange mailboxes simulated	850
Number of hosts	1
Number of mailboxes/host	850
Number of storage groups/host	4
Number of mailbox stores/storage group	1
Number of mailboxes/mailbox store	212
Number of mailbox store LUNs/storage group	1
Simulated profile: I/O's per second per mailbox (IOPS, include 20% headroom)	0.5
Database LUN size	118 GB
Log LUN size	11.8 GB
Backup LUN size/storage group	165 GB
Total database size for performance testing	379 GB
% Storage capacity used by Exchange database**	82%

\*\* 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 paper.

### Primary Storage Hardware

Storage Connectivity (Fibre Channel, SAS, SATA, iSCSI)	iSCSI
Storage model and OS/firmware revision	EMC Celerra NS40 DART 5.5.27.5
Storage cache	4 GB
Number of storage controllers	2
Number of storage ports	2 Tested – 8 possible
Maximum bandwidth of storage connectivity to host	4*1Gb per SP

Switch type/model/firmware revision	Dell 5324 Version 2.21 Build No. 3.04
HBA model and firmware	Intel(R) PRO/1000 MT Dual Port Server Adapter
Number of HBA's/host	2
Host server type	Dell PowerEdge 2950 2: Dual Core [01]: EM64T Family 6 Model 15 Stepping 6 GenuineIntel ~2328 Mhz [02]: EM64T Family 6 Model 15 Stepping 6 GenuineIntel ~2328 Mhz [03]: EM64T Family 6 Model 15 Stepping 6 GenuineIntel ~2328 Mhz [04]: EM64T Family 6 Model 15 Stepping 6 GenuineIntel ~2328 Mhz
Total number of disks tested in solution	22
Maximum number of spindles that can be hosted in the storage	240

### Primary Storage Software

HBA driver	Microsoft iSCSI Software Initiator 2.04 Intel® PRO/1000 PT Dual Port Server Adapter
HBA QueueTarget Setting	Not Applicable
HBA QueueDepth Setting	Not Applicable
Multi-Pathing	Multiple Connections per Session (MC/S)
Host OS	Microsoft® Windows® Server 2003, Enterprise Edition *64 SP1 5.2.3790 Service Pack 1 Build 3790
ESE.dll file version	08.01.0075.000
Replication solution name/version	Not Applicable

### Primary Storage Disk Configuration (Mailbox Store Disks)

Disk type, speed and firmware revision	4 Gbps FC SCSI 15,000 RPM – 60AC
Raw capacity per disk (GB)	146 GB
Number of physical disks in test	8
total raw storage capacity (GB)	1168 GB
Disk slice size (GB)	Not Applicable
Number of slices per LUN or number of disks per LUN	Not Applicable
Number of Luns Per Raid Group	2
LUN Size in GB	118.4
Raid level	Raid 1_0
Total formatted capacity	474 GB
Storage capacity utilization	41%
Database capacity utilization	34%

### Primary Storage Disk Configuration (Transactional Log Disks)

Disk type, speed and firmware revision	4Gbps FC SCSI 15,000 RPM – 60AC
Raw capacity per disk (GB)	146 GB
Number of spindles in test	4
total raw storage capacity (GB)	292 GB

Disk slice size (GB)	Not Applicable
Number of slices per LUN or number of disks per LUN	Not Applicable
Number of Luns per Raid Group	2
LUN Size in GB	11.8
Raid level	Raid 1_0
Total formatted capacity	23.6 GB

## ***Streaming Backup***

### **Disk Configuration (Streaming Backup to disk)**

Disk type, speed and firmware revision	4Gbps FC SCSI 15,000 RPM – 60AC
Raw capacity per disk (GB)	146GB
Number of spindles in test	10
Total raw storage capacity (GB)	1460GB
Disk slice size (GB)	Not Applicable
Number of slices per LUN or number of disks per LUN	Not Applicable
Number of Luns per Raid Group	1
Raid level	Raid 5
Total formatted capacity	907 GB

## **Best Practices**

Microsoft Exchange server is a disk-intensive application. Based on the testing run using the ESRP framework, EMC would recommend the Exchange 2007 best practices to improve the storage performance.

For Exchange 2007 best practices on storage design, please visit <http://technet.microsoft.com/en-us/library/bb124518.aspx>

## ***Core Storage/Replication***

1. Use DISKPART (in Windows 2003x64 SP1) to align all Microsoft Exchange Server related disks. Use a value of 64 to align the NTFS partitions at a 64 KB boundary.
2. Isolate the Microsoft Exchange Server database workload from other workloads. This ensures the highest level of performance for Microsoft Exchange Server and simplifies troubleshooting in the event of a disk related Microsoft Exchange performance problem.
3. Set TcpAckFrequency = 1 per <http://support.microsoft.com/kb/328890> to improve iSCSI performance.
4. Size and configure the environment based on disk spindle performance. Storage capacity should be a secondary issue. In other words, size for performance and then capacity.
5. Place the Microsoft Exchange Server logs and databases on separate physical disks and in different RAID groups.

See the following Microsoft documentation for storage based replication best practices and support criteria:

Deployment Guidelines for Data Replication

<http://www.microsoft.com/technet/prodtechnol/exchange/guides/E2k3DataRepl/bedf62a9-dff7-49a8-bd27-b2f1c46d5651.mspx>

Multi-site data replication support for Exchange  
<http://support.microsoft.com/?kbid=895847>

**Note:** In the event a performance problem cannot be resolved using common performance analysis, EMC Corporation strongly recommends that a case be opened with EMC Customer Service so that the appropriate Customer Support resource may be engaged.

## **Backup strategy**

A well designed and implemented disaster recovery strategy should be a top priority for every Microsoft Exchange Server deployment. Proper planning must be done prior to configuration in order to meet required service-level agreements (SLAs) for server downtime. Various backup and restore strategies can be implemented, depending on the requirements of the environment. EMC offers multiple solutions to protect an Exchange environment. EMC Replication Manager can manage snapshot and replication in an Exchange environment. EMC Networker allows an Exchange environment to be backed up to tape or to disk. Both of these products work in conjunction with Volume Shadow Copy services (VSS) as proven techniques, having undergone vigorous testing.

In this solution, the tested method for backup was a one stage disk-to-disk backup. With this configuration, several best practice considerations must be understood in order to achieve optimal performance.

1. Disk-to-disk backup LUNs should be configured in separate disk groups. Workload isolation will optimize performance of the streaming backups and minimize the impact on the production workload.
2. Higher capacity Fiber Channel or ATA drives should be utilized if the environment requires additional backup copies of the data on the primary disks. FATA drives should not be utilized to host production Exchange traffic without careful consideration of the performance impact. ATA drives operate at a lower rotational speed and will provide much lower throughput than Fiber Channel drives. ATA drives are also designed for an 8\*5 duty cycle and are not meant to operate 24\*7. Over-utilization will result in a shorter mean time between failures (MTBF) when compared to Fiber Channel drives which are rated for 24\*7 use.

## **Test Result Summary**

This section provides a high level summary of the test data from ESRP as well as links to the detailed reports located in Appendix: Test Reports, which are generated by the ESRP testing framework.

## **Reliability**

The goal of these tests is to determine the reliability of the underlying storage subsystem. These tests run for a period of 24 hours and ensure that the storage can handle extreme IO workloads for significant periods of time. After a test run, both the logs and databases are verified to ensure that there is no data corruption.

The reliability test on the Celerra NS40 provided the following results:

- Errors reported in the system and application event logs: None
- Errors reported for database and log checksum: None
- Error during back-to-disk test: None
- Error in database checksum on the remote storage database: N/A

The Jetstress performance results (24-hour performance test) can be found under the [Reliability Test](#) section in Appendix B.

## Primary Storage Performance Results

The Primary Storage performance testing is designed to exercise the storage with maximum sustainable Exchange type of IO for two hours. The test is to show how long it takes for the storage to respond to an IO under load. The data below is the sum of all the logical disk I/O's, and average of all the logical disks I/O latency in the 2 hours test duration. Each server is listed separately and the aggregate numbers across all servers is listed as well.

## Individual Server Metrics

The sum of I/O's across Storage Groups and the average latency across all Storage Groups on a per server basis.

<b>Database I/O</b>	
Average Database Disk Transfers/sec	464.213
Average Database Disk Reads/sec	235.106
Average Database Disk Writes/sec	229.107
Average Database Disk Read Latency (ms)	12
Average Database Disk Write Latency (ms)	3
<b>Transaction Log I/O</b>	
Average Log Disk Writes/sec	152.977
Average Log Disk Write Latency (ms)	2

The Jetstress performance results (two hour performance test) can be found under the [Performance Test](#) section in Appendix A.

Also, refer to [Appendix E](#) – Performance Test Results (Maximum IOPS) to find results that characterize the maximum performance of the disk layout.

## Streaming Backup Performance

The goal of these tests is to characterize the streaming backup performance of the underlying storage subsystem. ESRP requires two types of tests. The first test characterizes the read performance of the storage by performing a checksum of the logs and databases. The second test characterizes the end-to-end backup-to-disk performance of the storage.

## Database Read-only Performance

This test characterizes the read performance of the database. The following table shows the average rate for a single database file.

MB read/sec per storage group	9.9325
MB read/sec total	39.73
File size/sec taken	389939.08/39260

## Log Read-only Performance

This test characterizes the rate at which log files can be played back against the database. 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)	0.824374959
---	-------------

## Backup to Disk Performance

This test characterizes the end-to-end backup-to-disk performance of the storage. This test will backup all the database files to disk. The following table shows an average rate at which each storage group can be backed up:

Total database size per storage group (GB)	380.8
Time taken to backup each storage group	2:43:35
Average MB backed up/sec	39.73
Average MB backed up/sec per storage group	9.9326

## Conclusion

The Celerra NS40 produced impressive performance results when tested in conjunction with Exchange 2007. The results clearly show that a Celerra NS40 can satisfy the performance requirements of 850 Heavy Exchange users with six physical disk spindles (four spindles for database and two spindles for log). This is defined as the basic Celerra Exchange building block. This building block approach simplifies the sizing of the solution and allows predictable scaling.

This document is developed by EMC, and reviewed by the Microsoft Exchange Product team. The test results and data presented in this document are based on the tests in the ESRP test framework. Customers should not use this data directly for pre-deployment verification. It is still necessary to validate the storage design for a specific environment. A careful analysis of each environment must be performed in order to understand the specific requirement of the architecture and to adapt a solution that best fits those needs. The results in this document prove that the Celerra NS40 can support a high-performance Microsoft Exchange Server configuration.

The ESRP program is not designed to be a benchmarking program as the tests are not designed to produce maximum throughput for a given solution. Rather, the tests focus on producing recommendations from vendors for running Microsoft Exchange. Essentially, the data presented in this document should not be used for comparisons amongst different solutions.

## Contact Information

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

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For additional information on EMC Products and Services available to customers and partners, please refer to:

<http://EMC.com> or <http://powerlink.EMC.com>

## Appendix A: Stress Testing

### ***Stress Test Result Report***

Test Summary

<b>Overall Test Result</b>	<b>Pass</b>
<b>Machine Name</b>	RTPSOL395
<b>Test Description</b>	
<b>Test Start Time</b>	5/3/2007 7:40:39 AM
<b>Test End Time</b>	5/4/2007 7:52:56 AM
<b>Jetstress Version</b>	08.01.0075.000
<b>Ese Version</b>	08.00.0685.024
<b>Operating System</b>	Microsoft Windows Server 2003 R2 Service Pack 1 (5.2.3790.65536)
<b>Performance Log</b>	<a href="#">C:\Program Files\Exchange Jetstress\Stress_2007_5_3_7_40_42.blg</a> <a href="#">C:\Program Files\Exchange Jetstress\DBChecksum_2007_5_4_7_52_56.blg</a>

Database Sizing and Throughput

<b>Achieved I/O per Second</b>	442.1
<b>Capacity Percentage</b>	100%
<b>Throughput Percentage</b>	100%
<b>Initial database size</b>	408889131008
<b>Final database size</b>	453693210624
<b>Database files (count)</b>	4

Jetstress System Parameters

<b>Thread count</b>	2 (per-storage group)
<b>Log buffers</b>	9000
<b>Minimum database cache</b>	128.0 MB
<b>Maximum database cache</b>	1024.0 MB
<b>Insert operations</b>	25%
<b>Delete operations</b>	10%
<b>Replace operations</b>	50%
<b>Read operations</b>	15%
<b>Lazy commits</b>	80%

## Disk Subsystem Performance

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec	Avg. Disk Bytes/Write
Database (E:)	0.013	0.003	58.097	52.906	(n/a)
Database (F:)	0.013	0.003	57.934	52.777	(n/a)
Database (G:)	0.013	0.003	57.876	52.679	(n/a)
Database (H:)	0.013	0.002	57.358	52.473	(n/a)
Log (K:)	0.002	0.002	1.285	33.033	10595.115
Log (L:)	0.002	0.002	1.288	32.929	10641.505
Log (M:)	0.002	0.002	1.294	33.116	10594.648
Log (N:)	0.002	0.002	1.291	32.894	10629.672

## Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	2.000	0.105	10.288
Available MBytes	29515.043	29478.000	30427.000
Free System Page Table Entries	16754364.000	16754364.000	16754364.000
Transition Pages RePurposed/sec	0.596	0.000	855.490
Pool Nonpaged Bytes	91266432.000	90869760.000	91664384.000
Pool Paged Bytes	994458503.680	993566720.000	1000845312.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

## Test Log

5/3/2007 7:40:39 AM -- Jetstress testing begins ...  
 5/3/2007 7:40:39 AM -- Prepare testing begins ...  
 5/3/2007 7:40:41 AM -- Attaching databases ...  
 5/3/2007 7:40:41 AM -- Prepare testing ends.  
 5/3/2007 7:40:41 AM -- Dispatching transactions begins ...  
 5/3/2007 7:40:41 AM -- Database cache settings: (minimum: 128.0 MB, maximum: 1.0 GB)  
 5/3/2007 7:40:41 AM -- Database flush thresholds: (start: 10.2 MB, stop: 20.5 MB)  
 5/3/2007 7:40:42 AM -- Database read latency thresholds: (average: 0.02 seconds/read, maximum: 0.1 seconds/read).  
 5/3/2007 7:40:42 AM -- Log write latency thresholds: (average: 0.01 seconds/write, maximum: 0.1 seconds/write).  
 5/3/2007 7:40:44 AM -- Operation mix: Sessions 2, Inserts 25%, Deletes 10%, Replaces 50%, Reads 15%, Lazy Commits 80%.  
 5/3/2007 7:40:44 AM -- Performance logging begins (interval: 15000 ms).  
 5/3/2007 7:40:44 AM -- Attaining prerequisites:  
 5/3/2007 7:52:52 AM -- \Database(JetstressWin)\Database Cache Size, Last: 966959100.0 (lower bound: 966367600.0, upper bound: none)  
 5/4/2007 7:52:53 AM -- Performance logging ends.

5/4/2007 7:52:53 AM -- JetInterop batch transaction stats: 273770, 273545, 274281, and 273051.  
5/4/2007 7:52:53 AM -- Dispatching transactions ends.  
5/4/2007 7:52:53 AM -- Shutting down databases ...  
5/4/2007 7:52:56 AM -- Instance3628.1 (complete), Instance3628.2 (complete), Instance3628.3 (complete), and Instance3628.4 (complete)  
5/4/2007 7:52:57 AM -- Performance logging begins (interval: 15000 ms).  
5/4/2007 7:52:57 AM -- Verifying database checksums ...  
5/4/2007 8:48:54 AM -- E: (100% processed), F: (100% processed), G: (100% processed), and H: (100% processed)  
5/4/2007 8:48:55 AM -- Performance logging ends.  
5/4/2007 8:48:55 AM -- [C:\Program Files\Exchange Jetstress\DBChecksum\\_2007\\_5\\_4\\_7\\_52\\_56.blg](#) has 223 samples.  
5/4/2007 8:48:58 AM -- [C:\Program Files\Exchange Jetstress\DBChecksum\\_2007\\_5\\_4\\_7\\_52\\_56.html](#) is saved.  
5/4/2007 8:48:58 AM -- Verifying log checksums ...  
5/4/2007 8:49:04 AM -- K:\ (22 logs passed), L:\ (21 logs passed), M:\ (22 logs passed), and N:\ (21 logs passed)  
5/4/2007 8:49:04 AM -- [C:\Program Files\Exchange Jetstress\Stress\\_2007\\_5\\_3\\_7\\_40\\_42.blg](#) has 5808 samples.  
5/4/2007 8:49:04 AM -- Creating test report ...  
5/4/2007 8:49:36 AM -- Volume E: has 0.0125 for Avg. Disk sec/Read.  
5/4/2007 8:49:36 AM -- Volume F: has 0.0126 for Avg. Disk sec/Read.  
5/4/2007 8:49:36 AM -- Volume G: has 0.0126 for Avg. Disk sec/Read.  
5/4/2007 8:49:36 AM -- Volume H: has 0.0125 for Avg. Disk sec/Read.  
5/4/2007 8:49:36 AM -- Volume K: has 0.0021 for Avg. Disk sec/Write.  
5/4/2007 8:49:36 AM -- Volume K: has 0.0019 for Avg. Disk sec/Read.  
5/4/2007 8:49:36 AM -- Volume L: has 0.0021 for Avg. Disk sec/Write.  
5/4/2007 8:49:36 AM -- Volume L: has 0.0019 for Avg. Disk sec/Read.  
5/4/2007 8:49:36 AM -- Volume M: has 0.0021 for Avg. Disk sec/Write.  
5/4/2007 8:49:36 AM -- Volume M: has 0.0019 for Avg. Disk sec/Read.  
5/4/2007 8:49:36 AM -- Volume N: has 0.0021 for Avg. Disk sec/Write.  
5/4/2007 8:49:36 AM -- Volume N: has 0.0019 for Avg. Disk sec/Read.  
5/4/2007 8:49:36 AM -- Test has 0 Maximum Database Page Fault Stalls/sec.  
5/4/2007 8:49:36 AM -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.

## Database Checksum Results

Checksum Statistics – All

Database	Seen pages	Bad pages	Correctable pages	Wrong page no pages	File length / seconds taken
E:\Jetstress1.edb	13840498	0	0	0	1632 MBytes / 3351 seconds
F:\Jetstress1.edb	13844594	0	0	0	1664 MBytes / 3351 seconds
G:\Jetstress1.edb	13850226	0	0	0	1708 MBytes / 3357 seconds
H:\Jetstress1.edb	13847154	0	0	0	1684 MBytes / 3357 seconds
(Sum)	55382472	0	0	0	2595 MBytes / 13417 seconds

## Disk Subsystem Performance (of checksum)

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec
E:	0.155	0.011	519.494	0.005
F:	0.137	0.016	519.652	0.004
G:	0.130	0.040	518.014	0.004
H:	0.121	0.011	517.486	0.005

## Memory System Performance (of checksum)

Counter	Average	Minimum	Maximum
% Processor Time	25.116	4.246	36.980
Available MBytes	30306.126	30265.000	30321.000
Free System Page Table Entries	16754294.314	16754294.000	16754364.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	103580199.031	101683200.000	104255488.000
Pool Paged Bytes	996196866.296	995254272.000	998502400.000

## Test Log

5/3/2007 7:40:39 AM -- Jetstress testing begins ...  
 5/3/2007 7:40:39 AM -- Prepare testing begins ...  
 5/3/2007 7:40:41 AM -- Attaching databases ...  
 5/3/2007 7:40:41 AM -- Prepare testing ends.  
 5/3/2007 7:40:41 AM -- Dispatching transactions begins ...  
 5/3/2007 7:40:41 AM -- Database cache settings: (minimum: 128.0 MB, maximum: 1.0 GB)  
 5/3/2007 7:40:41 AM -- Database flush thresholds: (start: 10.2 MB, stop: 20.5 MB)  
 5/3/2007 7:40:42 AM -- Database read latency thresholds: (average: 0.02 seconds/read, maximum: 0.1 seconds/read).  
 5/3/2007 7:40:42 AM -- Log write latency thresholds: (average: 0.01 seconds/write, maximum: 0.1 seconds/write).  
 5/3/2007 7:40:44 AM -- Operation mix: Sessions 2, Inserts 25%, Deletes 10%, Replaces 50%, Reads 15%, Lazy Commits 80%.  
 5/3/2007 7:40:44 AM -- Performance logging begins (interval: 15000 ms).  
 5/3/2007 7:40:44 AM -- Attaining prerequisites:  
 5/3/2007 7:52:52 AM -- \Database(JetstressWin)\Database Cache Size, Last: 966959100.0 (lower bound: 966367600.0, upper bound: none)  
 5/4/2007 7:52:53 AM -- Performance logging ends.  
 5/4/2007 7:52:53 AM -- JetInterop batch transaction stats: 273770, 273545, 274281, and 273051.  
 5/4/2007 7:52:53 AM -- Dispatching transactions ends.  
 5/4/2007 7:52:53 AM -- Shutting down databases ...  
 5/4/2007 7:52:56 AM -- Instance3628.1 (complete), Instance3628.2 (complete), Instance3628.3 (complete), and Instance3628.4 (complete)  
 5/4/2007 7:52:57 AM -- Performance logging begins (interval: 15000 ms).  
 5/4/2007 7:52:57 AM -- Verifying database checksums ...  
 5/4/2007 8:48:54 AM -- E: (100% processed), F: (100% processed), G: (100% processed), and H: (100% processed)  
 5/4/2007 8:48:55 AM -- Performance logging ends.  
 5/4/2007 8:48:55 AM -- [C:\Program Files\Exchange Jetstress\DBChecksum 2007\\_5\\_4\\_7\\_52\\_56.blg](#) has 223 samples.

## Appendix B: Performance Testing

### Performance Test Result Report

Test Summary

<b>Overall Test Result</b>	Pass
<b>Machine Name</b>	RTPSOL395
<b>Test Description</b>	
<b>Test Start Time</b>	5/2/2007 11:25:46 AM
<b>Test End Time</b>	5/2/2007 2:52:07 PM
<b>Jetstress Version</b>	08.01.0075.000
<b>Ese Version</b>	08.00.0685.024
<b>Operating System</b>	Microsoft Windows Server 2003 R2 Service Pack 1 (5.2.3790.65536)
<b>Performance Log</b>	<a href="#">C:\Program Files\Exchange Jetstress\Performance_2007_5_2_12_40_4.blg</a> <a href="#">C:\Program Files\Exchange Jetstress\DBChecksum_2007_5_2_14_52_7.blg</a>

Database Sizing and Throughput

<b>Achieved I/O per Second</b>	464.213
<b>Capacity Percentage</b>	100%
<b>Throughput Percentage</b>	100%
<b>Initial database size</b>	408889131008
<b>Final database size</b>	413578362880
<b>Database files (count)</b>	4

Jetstress System Parameters

<b>Thread count</b>	2 (per-storage group)
<b>Log buffers</b>	9000
<b>Minimum database cache</b>	128.0 MB
<b>Maximum database cache</b>	1024.0 MB
<b>Insert operations</b>	25%
<b>Delete operations</b>	10%
<b>Replace operations</b>	50%
<b>Read operations</b>	15%
<b>Lazy commits</b>	80%

## Disk Subsystem Performance

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec	Avg. Disk Bytes/Write
Database (E:)	0.012	0.003	59.854	57.898	(n/a)
Database (F:)	0.012	0.003	58.278	57.022	(n/a)
Database (G:)	0.012	0.003	57.878	56.614	(n/a)
Database (H:)	0.012	0.003	59.096	57.573	(n/a)
Log (K:)	0.002	0.002	1.514	38.471	10732.948
Log (L:)	0.002	0.002	1.524	38.328	10691.837
Log (M:)	0.002	0.002	1.518	37.812	10798.261
Log (N:)	0.002	0.002	1.516	38.366	10747.171

## Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	2.172	0.619	3.490
Available MBytes	30382.657	30205.000	31216.000
Free System Page Table Entries	16755114.000	16755114.000	16755114.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	67581870.391	67186688.000	68395008.000
Pool Paged Bytes	63992383.150	60657664.000	67932160.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

## Test Log

5/2/2007 11:25:45 AM -- Jetstress testing begins ...  
 5/2/2007 11:25:46 AM -- Prepare testing begins ...  
 5/2/2007 11:25:46 AM -- Duplicating 4 databases:  
 5/2/2007 12:40:00 PM -- 100.0% of 380.8 GB complete (380.8 GB duplicated).  
 5/2/2007 12:40:03 PM -- Attaching databases ...  
 5/2/2007 12:40:03 PM -- Prepare testing ends.  
 5/2/2007 12:40:03 PM -- Dispatching transactions begins ...  
 5/2/2007 12:40:03 PM -- Database cache settings: (minimum: 128.0 MB, maximum: 1.0 GB)  
 5/2/2007 12:40:03 PM -- Database flush thresholds: (start: 10.2 MB, stop: 20.5 MB)  
 5/2/2007 12:40:04 PM -- Database read latency thresholds: (average: 0.02 seconds/read, maximum: 0.05 seconds/read).  
 5/2/2007 12:40:04 PM -- Log write latency thresholds: (average: 0.01 seconds/write, maximum: 0.05 seconds/write).  
 5/2/2007 12:40:05 PM -- Operation mix: Sessions 2, Inserts 25%, Deletes 10%, Replaces 50%, Reads 15%, Lazy Commits 80%.  
 5/2/2007 12:40:05 PM -- Performance logging begins (interval: 15000 ms).  
 5/2/2007 12:40:05 PM -- Attaining prerequisites:  
 5/2/2007 12:52:01 PM -- \Database(JetstressWin)\Database Cache Size, Last: 968310800.0

(lower bound: 966367600.0, upper bound: none)  
5/2/2007 2:52:03 PM -- Performance logging ends.  
5/2/2007 2:52:03 PM -- JetInterop batch transaction stats: 28718, 28416, 28257, and 28567.  
5/2/2007 2:52:03 PM -- Dispatching transactions ends.  
5/2/2007 2:52:03 PM -- Shutting down databases ...  
5/2/2007 2:52:07 PM -- Instance3628.1 (complete), Instance3628.2 (complete), Instance3628.3 (complete), and Instance3628.4 (complete)  
5/2/2007 2:52:08 PM -- Performance logging begins (interval: 15000 ms).  
5/2/2007 2:52:08 PM -- Verifying database checksums ...  
5/2/2007 3:43:30 PM -- E: (100% processed), F: (100% processed), G: (100% processed), and H: (100% processed)  
5/2/2007 3:43:31 PM -- Performance logging ends.  
5/2/2007 3:43:31 PM -- [C:\Program Files\Exchange Jetstress\DBChecksum\\_2007\\_5\\_2\\_14\\_52\\_7.blg](#) has 205 samples.  
5/2/2007 3:43:34 PM -- [C:\Program Files\Exchange Jetstress\DBChecksum\\_2007\\_5\\_2\\_14\\_52\\_7.html](#) is saved.  
5/2/2007 3:43:34 PM -- Verifying log checksums ...  
5/2/2007 3:43:39 PM -- K:\ (21 logs passed), L:\ (22 logs passed), M:\ (22 logs passed), and N:\ (22 logs passed)  
5/2/2007 3:43:39 PM -- [C:\Program Files\Exchange Jetstress\Performance\\_2007\\_5\\_2\\_12\\_40\\_4.blg](#) has 527 samples.  
5/2/2007 3:43:39 PM -- Creating test report ...  
5/2/2007 3:43:43 PM -- Volume E: has 0.0122 for Avg. Disk sec/Read.  
5/2/2007 3:43:43 PM -- Volume F: has 0.0122 for Avg. Disk sec/Read.  
5/2/2007 3:43:43 PM -- Volume G: has 0.0122 for Avg. Disk sec/Read.  
5/2/2007 3:43:43 PM -- Volume H: has 0.0122 for Avg. Disk sec/Read.  
5/2/2007 3:43:43 PM -- Volume K: has 0.0021 for Avg. Disk sec/Write.  
5/2/2007 3:43:43 PM -- Volume K: has 0.0020 for Avg. Disk sec/Read.  
5/2/2007 3:43:43 PM -- Volume L: has 0.0021 for Avg. Disk sec/Write.  
5/2/2007 3:43:43 PM -- Volume L: has 0.0019 for Avg. Disk sec/Read.  
5/2/2007 3:43:43 PM -- Volume M: has 0.0021 for Avg. Disk sec/Write.  
5/2/2007 3:43:43 PM -- Volume M: has 0.0019 for Avg. Disk sec/Read.  
5/2/2007 3:43:43 PM -- Volume N: has 0.0021 for Avg. Disk sec/Write.  
5/2/2007 3:43:43 PM -- Volume N: has 0.0019 for Avg. Disk sec/Read.  
5/2/2007 3:43:43 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.  
5/2/2007 3:43:43 PM -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.

## Database Checksum Results

Checksum Statistics - All

Database	Seen pages	Bad pages	Correctable pages	Wrong page no pages	File length / seconds taken
E:\Jetstress1.edb	12620130	0	0	0	290 MBytes / 3078 seconds
F:\Jetstress1.edb	12621666	0	0	0	302 MBytes / 3075 seconds
G:\Jetstress1.edb	12621922	0	0	0	304 MBytes / 3081 seconds
H:\Jetstress1.edb	12621922	0	0	0	304 MBytes / 3081 seconds
(Sum)	50485640	0	0	0	1203 MBytes / 12317 seconds

### Disk Subsystem Performance (of checksum)

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec
E:	0.194	0.032	515.457	0.005
F:	0.152	0.006	515.659	0.004
G:	0.146	0.125	514.044	0.005
H:	0.143	0.028	513.290	0.007

### Memory System Performance (of checksum)

Counter	Average	Minimum	Maximum
% Processor Time	24.925	5.756	36.615
Available MBytes	31202.537	31193.000	31204.000
Free System Page Table Entries	16754904.341	16754904.000	16754974.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	81471238.244	79855616.000	82092032.000
Pool Paged Bytes	60621379.434	60489728.000	61587456.000

### Test Log

5/2/2007 11:25:45 AM -- Jetstress testing begins ...  
 5/2/2007 11:25:46 AM -- Prepare testing begins ...  
 5/2/2007 11:25:46 AM -- Duplicating 4 databases:  
 5/2/2007 12:40:00 PM -- 100.0% of 380.8 GB complete (380.8 GB duplicated).  
 5/2/2007 12:40:03 PM -- Attaching databases ...  
 5/2/2007 12:40:03 PM -- Prepare testing ends.  
 5/2/2007 12:40:03 PM -- Dispatching transactions begins ...  
 5/2/2007 12:40:03 PM -- Database cache settings: (minimum: 128.0 MB, maximum: 1.0 GB)  
 5/2/2007 12:40:03 PM -- Database flush thresholds: (start: 10.2 MB, stop: 20.5 MB)  
 5/2/2007 12:40:04 PM -- Database read latency thresholds: (average: 0.02 seconds/read, maximum: 0.05 seconds/read).  
 5/2/2007 12:40:04 PM -- Log write latency thresholds: (average: 0.01 seconds/write, maximum: 0.05 seconds/write).  
 5/2/2007 12:40:05 PM -- Operation mix: Sessions 2, Inserts 25%, Deletes 10%, Replaces 50%, Reads 15%, Lazy Commits 80%.  
 5/2/2007 12:40:05 PM -- Performance logging begins (interval: 15000 ms).  
 5/2/2007 12:40:05 PM -- Attaining prerequisites:  
 5/2/2007 12:52:01 PM -- \Database(JetstressWin)\Database Cache Size, Last: 968310800.0 (lower bound: 966367600.0, upper bound: none)  
 5/2/2007 2:52:03 PM -- Performance logging ends.  
 5/2/2007 2:52:03 PM -- JetInterop batch transaction stats: 28718, 28416, 28257, and 28567.  
 5/2/2007 2:52:03 PM -- Dispatching transactions ends.  
 5/2/2007 2:52:03 PM -- Shutting down databases ...  
 5/2/2007 2:52:07 PM -- Instance3628.1 (complete), Instance3628.2 (complete), Instance3628.3 (complete), and Instance3628.4 (complete)  
 5/2/2007 2:52:08 PM -- Performance logging begins (interval: 15000 ms).  
 5/2/2007 2:52:08 PM -- Verifying database checksums ...

5/2/2007 3:43:30 PM -- E: (100% processed), F: (100% processed), G: (100% processed),  
and H: (100% processed)  
5/2/2007 3:43:31 PM -- Performance logging ends.  
5/2/2007 3:43:31 PM -- [C:\Program Files\Exchange  
Jetstress\DBChecksum\\_2007\\_5\\_2\\_14\\_52\\_7.blg](#) has 205 samples.

## Appendix C: Streaming Backup Testing

### ***Streaming backup Test Result Report***

Streaming Backup Statistics - All

Database Instance	Database Size (MBytes)	Elapsed Backup Time	MBytes Transferred/sec
Instance3628.1	97484.77	02:44:37	9.87
Instance3628.2	97484.77	02:44:30	9.88
Instance3628.3	97484.77	02:42:45	9.98
Instance3628.4	97484.77	02:42:28	10.00

Jetstress System Parameters

<b>Thread count</b>	2 (per-storage group)
<b>Log buffers</b>	9000
<b>Minimum database cache</b>	128.0 MB
<b>Maximum database cache</b>	1024.0 MB
<b>Insert operations</b>	25%
<b>Delete operations</b>	10%
<b>Replace operations</b>	50%
<b>Read operations</b>	15%
<b>Lazy commits</b>	80%

Disk Subsystem Performance

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec	Avg. Disk Bytes/Write
Database (E:)	0.006	0	80.036	0.004	(n/a)
Database (F:)	0.006	0.000	80.072	0.006	(n/a)
Database (G:)	0.006	0	79.783	0.009	(n/a)
Database (H:)	0.006	0	79.789	0.008	(n/a)
Log (K:)	0.000	0	0.000	0.002	24.800
Log (L:)	0	0	0.001	0.006	75.133
Log (M:)	0	0	0.001	0.008	110.327
Log (N:)	0	0	0.002	0.008	102.384

## Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	63.181	24.558	91.770
Available Mbytes	30485.326	30053.000	30827.000
Free System Page Table Entries	16754694.000	16754694.000	16754694.000
Transition Pages RePurposed/sec	9490.821	0.000	23962.993
Pool Nonpaged Bytes	84957730.346	74010624.000	91500544.000
Pool Paged Bytes	609183811.095	68141056.000	1060573184.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

## Test Log

5/3/2007 1:54:21 AM -- Prepare testing begins ...  
5/3/2007 1:54:21 AM -- Duplicating 4 databases:  
5/3/2007 1:57:34 AM -- 4.5% of 380.8 GB complete (17.2 GB duplicated).  
5/3/2007 1:57:34 AM -- Prepare testing ends.  
5/3/2007 1:58:02 AM -- Jetstress testing begins ...  
5/3/2007 1:58:02 AM -- Prepare testing begins ...  
5/3/2007 1:58:02 AM -- Duplicating 4 databases:  
5/3/2007 3:12:27 AM -- 100.0% of 380.8 GB complete (380.8 GB duplicated).  
5/3/2007 3:12:27 AM -- Attaching databases ...  
5/3/2007 3:12:27 AM -- Prepare testing ends.  
5/3/2007 3:12:29 AM -- Performance logging begins (interval: 15000 ms).  
5/3/2007 3:12:29 AM -- Streaming backup databases ...  
5/3/2007 5:57:08 AM -- Performance logging ends.  
5/3/2007 5:57:09 AM -- Instance3628.1 (100% processed), Instance3628.2 (100% processed), Instance3628.3 (100% processed), and Instance3628.4 (100% processed)  
5/3/2007 5:57:10 AM -- [C:\Program Files\Exchange Jetstress\StreamingBackup\\_2007\\_5\\_3\\_3\\_12\\_27.blg](C:\Program Files\Exchange Jetstress\StreamingBackup_2007_5_3_3_12_27.blg) has 641 samples.  
5/3/2007 5:57:11 AM -- Creating test report ...

## Appendix D: Soft Recovery Testing

### SoftRecovery Test Result Report

Soft-Recovery Statistics - All

Database Instance	Log files replayed	Elapsed seconds
Instance3628.1	500	422.2085292
Instance3628.2	524	425.708574
Instance3628.3	528	432.9586668
Instance3628.4	513	421.4585196

#### Disk Subsystem Performance

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec	Avg. Disk Bytes/Write
Database (E:)	0.115	0.039	210.335	4.770	(n/a)
Database (F:)	0.108	0.042	217.700	4.982	(n/a)
Database (G:)	0.105	0.043	221.569	4.926	(n/a)
Database (H:)	0.105	0.040	207.169	4.896	(n/a)
Log (K:)	0.009	0.047	38.394	1.940	3905.911
Log (L:)	0.009	0.043	40.238	2.026	4158.871
Log (M:)	0.009	0.041	40.382	2.019	4071.869
Log (N:)	0.009	0.045	39.400	2.003	4096.322

#### Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	7.289	2.673	13.478
Available MBytes	30527.495	30167.000	31396.000
Free System Page Table Entries	16754694.000	16754694.000	16754694.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	77902203.259	76779520.000	79986688.000
Pool Paged Bytes	76491339.852	66576384.000	267657216.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

## Test Log

5/2/2007 11:25:45 AM -- Jetstress testing begins ...  
5/2/2007 11:25:46 AM -- Prepare testing begins ...  
5/2/2007 11:25:46 AM -- Duplicating 4 databases:  
5/2/2007 12:40:00 PM -- 100.0% of 380.8 GB complete (380.8 GB duplicated).  
5/2/2007 12:40:03 PM -- Attaching databases ...  
5/2/2007 12:40:03 PM -- Prepare testing ends.  
5/2/2007 12:40:03 PM -- Dispatching transactions begins ...  
5/2/2007 12:40:03 PM -- Database cache settings: (minimum: 128.0 MB, maximum: 1.0 GB)  
5/2/2007 12:40:03 PM -- Database flush thresholds: (start: 10.2 MB, stop: 20.5 MB)  
5/2/2007 12:40:04 PM -- Database read latency thresholds: (average: 0.02 seconds/read, maximum: 0.05 seconds/read).  
5/2/2007 12:40:04 PM -- Log write latency thresholds: (average: 0.01 seconds/write, maximum: 0.05 seconds/write).  
5/2/2007 12:40:05 PM -- Operation mix: Sessions 2, Inserts 25%, Deletes 10%, Replaces 50%, Reads 15%, Lazy Commits 80%.  
5/2/2007 12:40:05 PM -- Performance logging begins (interval: 15000 ms).  
5/2/2007 12:40:05 PM -- Attaining prerequisites:  
5/2/2007 12:52:01 PM -- \Database(JetstressWin)\Database Cache Size, Last: 968310800.0 (lower bound: 966367600.0, upper bound: none)  
5/2/2007 2:52:03 PM -- Performance logging ends.  
5/2/2007 2:52:03 PM -- JetInterop batch transaction stats: 28718, 28416, 28257, and 28567.  
5/2/2007 2:52:03 PM -- Dispatching transactions ends.  
5/2/2007 2:52:03 PM -- Shutting down databases ...  
5/2/2007 2:52:07 PM -- Instance3628.1 (complete), Instance3628.2 (complete), Instance3628.3 (complete), and Instance3628.4 (complete)  
5/2/2007 2:52:08 PM -- Performance logging begins (interval: 15000 ms).  
5/2/2007 2:52:08 PM -- Verifying database checksums ...  
5/2/2007 3:43:30 PM -- E: (100% processed), F: (100% processed), G: (100% processed), and H: (100% processed)  
5/2/2007 3:43:31 PM -- Performance logging ends.  
5/2/2007 3:43:31 PM -- [C:\Program Files\Exchange Jetstress\DBChecksum\\_2007\\_5\\_2\\_14\\_52\\_7.blg](C:\Program Files\Exchange Jetstress\DBChecksum_2007_5_2_14_52_7.blg) has 205 samples.  
5/2/2007 3:43:34 PM -- [C:\Program Files\Exchange Jetstress\DBChecksum\\_2007\\_5\\_2\\_14\\_52\\_7.html](C:\Program Files\Exchange Jetstress\DBChecksum_2007_5_2_14_52_7.html) is saved.  
5/2/2007 3:43:34 PM -- Verifying log checksums ...  
5/2/2007 3:43:39 PM -- K:\ (21 logs passed), L:\ (22 logs passed), M:\ (22 logs passed), and N:\ (22 logs passed)  
5/2/2007 3:43:39 PM -- [C:\Program Files\Exchange Jetstress\Performance\\_2007\\_5\\_2\\_12\\_40\\_4.blg](C:\Program Files\Exchange Jetstress\Performance_2007_5_2_12_40_4.blg) has 527 samples.  
5/2/2007 3:43:39 PM -- Creating test report ...  
5/2/2007 3:43:43 PM -- Volume E: has 0.0122 for Avg. Disk sec/Read.  
5/2/2007 3:43:43 PM -- Volume F: has 0.0122 for Avg. Disk sec/Read.  
5/2/2007 3:43:43 PM -- Volume G: has 0.0122 for Avg. Disk sec/Read.  
5/2/2007 3:43:43 PM -- Volume H: has 0.0122 for Avg. Disk sec/Read.  
5/2/2007 3:43:43 PM -- Volume K: has 0.0021 for Avg. Disk sec/Write.  
5/2/2007 3:43:43 PM -- Volume K: has 0.0020 for Avg. Disk sec/Read.  
5/2/2007 3:43:43 PM -- Volume L: has 0.0021 for Avg. Disk sec/Write.  
5/2/2007 3:43:43 PM -- Volume L: has 0.0019 for Avg. Disk sec/Read.  
5/2/2007 3:43:43 PM -- Volume M: has 0.0021 for Avg. Disk sec/Write.  
5/2/2007 3:43:43 PM -- Volume M: has 0.0019 for Avg. Disk sec/Read.  
5/2/2007 3:43:43 PM -- Volume N: has 0.0021 for Avg. Disk sec/Write.  
5/2/2007 3:43:43 PM -- Volume N: has 0.0019 for Avg. Disk sec/Read.  
5/2/2007 3:43:43 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.  
5/2/2007 3:43:43 PM -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.  
5/2/2007 3:43:43 PM -- [C:\Program Files\Exchange Jetstress\Performance\\_2007\\_5\\_2\\_12\\_40\\_4.html](C:\Program Files\Exchange Jetstress\Performance_2007_5_2_12_40_4.html) is saved.

5/2/2007 3:43:43 PM -- Jetstress testing ends.  
 5/2/2007 10:24:11 PM -- Prepare testing begins ...  
 5/2/2007 10:24:11 PM -- Duplicating 4 databases:  
 5/2/2007 11:38:25 PM -- 100.0% of 380.8 GB complete (380.8 GB duplicated).  
 5/2/2007 11:38:26 PM -- Attaching databases ...  
 5/2/2007 11:38:26 PM -- Prepare testing ends.  
 5/2/2007 11:46:28 PM -- Jetstress testing begins ...  
 5/2/2007 11:46:28 PM -- Prepare testing begins ...  
 5/2/2007 11:46:30 PM -- Attaching databases ...  
 5/2/2007 11:46:30 PM -- Prepare testing ends.  
 5/2/2007 11:46:30 PM -- Dispatching transactions begins ...  
 5/2/2007 11:46:30 PM -- Database cache settings: (minimum: 128.0 MB, maximum: 1.0 GB)  
 5/2/2007 11:46:30 PM -- Database flush thresholds: (start: 10.2 MB, stop: 20.5 MB)  
 5/2/2007 11:46:31 PM -- Database read latency thresholds: (average: 0.02 seconds/read, maximum: 0.05 seconds/read).  
 5/2/2007 11:46:31 PM -- Log write latency thresholds: (average: 0.01 seconds/write, maximum: 0.05 seconds/write).  
 5/2/2007 11:46:31 PM -- Operation mix: Sessions 2, Inserts 25%, Deletes 10%, Replaces 50%, Reads 15%, Lazy Commits 80%.  
 5/2/2007 11:46:31 PM -- Performance logging begins (interval: 15000 ms).  
 5/2/2007 11:46:31 PM -- Generating log files ...  
 5/3/2007 12:31:31 AM -- K:\ (100.2% generated), L:\ (105.0% generated), M:\ (105.8% generated), and N:\ (102.8% generated)  
 5/3/2007 12:31:32 AM -- Performance logging ends.  
 5/3/2007 12:31:32 AM -- JetInterop batch transaction stats: 10109, 10143, 10274, and 9910.  
 5/3/2007 12:31:32 AM -- Dispatching transactions ends.  
 5/3/2007 12:31:32 AM -- Shutting down databases ...  
 5/3/2007 12:31:35 AM -- Instance3628.1 (complete), Instance3628.2 (complete), Instance3628.3 (complete), and Instance3628.4 (complete)  
 5/3/2007 12:31:35 AM -- Performance logging begins (interval: 15000 ms).  
 5/3/2007 12:31:35 AM -- Verifying database checksums ...  
 5/3/2007 1:22:20 AM -- E: (100% processed), F: (100% processed), G: (100% processed), and H: (100% processed)  
 5/3/2007 1:22:22 AM -- Performance logging ends.  
 5/3/2007 1:22:22 AM -- [C:\Program Files\Exchange Jetstress\DBChecksum\\_2007\\_5\\_3\\_0\\_31\\_35.blg](C:\Program Files\Exchange Jetstress\DBChecksum_2007_5_3_0_31_35.blg) has 203 samples.  
 5/3/2007 1:22:24 AM -- [C:\Program Files\Exchange Jetstress\DBChecksum\\_2007\\_5\\_3\\_0\\_31\\_35.html](C:\Program Files\Exchange Jetstress\DBChecksum_2007_5_3_0_31_35.html) is saved.  
 5/3/2007 1:22:24 AM -- Verifying log checksums ...  
 5/3/2007 1:22:48 AM -- K:\ (100 logs passed), L:\ (100 logs passed), M:\ (100 logs passed), and N:\ (100 logs passed)  
 5/3/2007 1:22:48 AM -- [C:\Program Files\Exchange Jetstress\Performance\\_2007\\_5\\_2\\_23\\_46\\_31.blg](C:\Program Files\Exchange Jetstress\Performance_2007_5_2_23_46_31.blg) has 179 samples.  
 5/3/2007 1:22:48 AM -- Creating test report ...  
 5/3/2007 1:22:49 AM -- Volume E: has 0.0116 for Avg. Disk sec/Read.  
 5/3/2007 1:22:49 AM -- Volume F: has 0.0116 for Avg. Disk sec/Read.  
 5/3/2007 1:22:49 AM -- Volume G: has 0.0115 for Avg. Disk sec/Read.  
 5/3/2007 1:22:49 AM -- Volume H: has 0.0117 for Avg. Disk sec/Read.  
 5/3/2007 1:22:49 AM -- Volume K: has 0.0022 for Avg. Disk sec/Write.  
 5/3/2007 1:22:49 AM -- Volume K: has 0.0019 for Avg. Disk sec/Read.  
 5/3/2007 1:22:49 AM -- Volume L: has 0.0021 for Avg. Disk sec/Write.  
 5/3/2007 1:22:49 AM -- Volume L: has 0.0020 for Avg. Disk sec/Read.  
 5/3/2007 1:22:49 AM -- Volume M: has 0.0021 for Avg. Disk sec/Write.  
 5/3/2007 1:22:49 AM -- Volume M: has 0.0019 for Avg. Disk sec/Read.  
 5/3/2007 1:22:49 AM -- Volume N: has 0.0021 for Avg. Disk sec/Write.  
 5/3/2007 1:22:49 AM -- Volume N: has 0.0019 for Avg. Disk sec/Read.  
 5/3/2007 1:22:49 AM -- Test has 0 Maximum Database Page Fault Stalls/sec.  
 5/3/2007 1:22:49 AM -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.  
 5/3/2007 1:22:49 AM -- <C:\Program Files\Exchange>

[Jetstress\Performance\\_2007\\_5\\_2\\_23\\_46\\_31.html](#) is saved.  
 5/3/2007 1:22:50 AM -- Performance logging begins (interval: 2000 ms).  
 5/3/2007 1:22:50 AM -- Recovering databases ...  
 5/3/2007 1:30:04 AM -- Performance logging ends.  
 5/3/2007 1:30:04 AM -- Instance3628.1 (422.2085292), Instance3628.2 (425.708574),  
 Instance3628.3 (432.9586668), and Instance3628.4 (421.4585196)  
 5/3/2007 1:30:04 AM -- [C:\Program Files\Exchange](#)  
[Jetstress\SoftRecovery\\_2007\\_5\\_3\\_1\\_22\\_49.blg](#) has 216 samples.  
 5/3/2007 1:30:04 AM -- Creating test report ...

## SoftRecovery Performance Test Result Report

### Test Summary

<b>Overall Test Result</b>	<b>Pass</b>
<b>Machine Name</b>	RTPSOL395
<b>Test Description</b>	
<b>Test Start Time</b>	5/2/2007 11:46:28 PM
<b>Test End Time</b>	5/3/2007 12:31:35 AM
<b>Jetstress Version</b>	08.01.0075.000
<b>Ese Version</b>	08.00.0685.024
<b>Operating System</b>	Microsoft Windows Server 2003 R2 Service Pack 1 (5.2.3790.65536)
<b>Performance Log</b>	<a href="#">C:\Program Files\Exchange</a> <a href="#">Jetstress\Performance_2007_5_2_23_46_31.blg</a> <a href="#">C:\Program Files\Exchange</a> <a href="#">Jetstress\DBChecksum_2007_5_3_0_31_35.blg</a>

### Database Sizing and Throughput

<b>Achieved I/O per Second</b>	457.755
<b>Capacity Percentage</b>	100%
<b>Throughput Percentage</b>	100%
<b>Initial database size</b>	408889131008
<b>Final database size</b>	410560561152
<b>Database files (count)</b>	4

### Jetstress System Parameters

<b>Thread count</b>	2 (per-storage group)
<b>Log buffers</b>	9000
<b>Minimum database cache</b>	128.0 MB
<b>Maximum database cache</b>	1024.0 MB
<b>Insert operations</b>	25%

<b>Delete operations</b>	10%
<b>Replace operations</b>	50%
<b>Read operations</b>	15%
<b>Lazy commits</b>	80%

### Disk Subsystem Performance

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec	Avg. Disk Bytes/Write
Database (E:)	0.012	0.003	57.308	54.577	(n/a)
Database (F:)	0.012	0.003	59.713	57.403	(n/a)
Database (G:)	0.012	0.002	59.559	57.464	(n/a)
Database (H:)	0.012	0.002	56.318	55.412	(n/a)
Log (K:)	0.002	0.002	1.554	40.019	10401.311
Log (L:)	0.002	0.002	1.657	40.298	10838.383
Log (M:)	0.002	0.002	1.663	40.808	10755.904
Log (N:)	0.002	0.002	1.633	39.684	10791.641

### Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	2.529	1.199	4.871
Available MBytes	30588.313	30203.000	31333.000
Free System Page Table Entries	16754904.000	16754904.000	16754904.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	72516476.425	72122368.000	72908800.000
Pool Paged Bytes	69295876.291	62377984.000	75444224.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

### Test Log

5/2/2007 11:25:45 AM -- Jetstress testing begins ...  
5/2/2007 11:25:46 AM -- Prepare testing begins ...  
5/2/2007 11:25:46 AM -- Duplicating 4 databases:  
5/2/2007 12:40:00 PM -- 100.0% of 380.8 GB complete (380.8 GB duplicated).  
5/2/2007 12:40:03 PM -- Attaching databases ...  
5/2/2007 12:40:03 PM -- Prepare testing ends.  
5/2/2007 12:40:03 PM -- Dispatching transactions begins ...  
5/2/2007 12:40:03 PM -- Database cache settings: (minimum: 128.0 MB, maximum: 1.0 GB)  
5/2/2007 12:40:03 PM -- Database flush thresholds: (start: 10.2 MB, stop: 20.5 MB)  
5/2/2007 12:40:04 PM -- Database read latency thresholds: (average: 0.02 seconds/read, maximum: 0.05 seconds/read).

5/2/2007 12:40:04 PM -- Log write latency thresholds: (average: 0.01 seconds/write, maximum: 0.05 seconds/write).

5/2/2007 12:40:05 PM -- Operation mix: Sessions 2, Inserts 25%, Deletes 10%, Replaces 50%, Reads 15%, Lazy Commits 80%.

5/2/2007 12:40:05 PM -- Performance logging begins (interval: 15000 ms).

5/2/2007 12:40:05 PM -- Attaining prerequisites:

5/2/2007 12:52:01 PM -- \Database(JetstressWin)\Database Cache Size, Last: 968310800.0 (lower bound: 966367600.0, upper bound: none)

5/2/2007 2:52:03 PM -- Performance logging ends.

5/2/2007 2:52:03 PM -- JetInterop batch transaction stats: 28718, 28416, 28257, and 28567.

5/2/2007 2:52:03 PM -- Dispatching transactions ends.

5/2/2007 2:52:03 PM -- Shutting down databases ...

5/2/2007 2:52:07 PM -- Instance3628.1 (complete), Instance3628.2 (complete), Instance3628.3 (complete), and Instance3628.4 (complete)

5/2/2007 2:52:08 PM -- Performance logging begins (interval: 15000 ms).

5/2/2007 2:52:08 PM -- Verifying database checksums ...

5/2/2007 3:43:30 PM -- E: (100% processed), F: (100% processed), G: (100% processed), and H: (100% processed)

5/2/2007 3:43:31 PM -- Performance logging ends.

5/2/2007 3:43:31 PM -- [C:\Program Files\Exchange\Jetstress\DBChecksum\\_2007\\_5\\_2\\_14\\_52\\_7.blg](C:\Program Files\Exchange\Jetstress\DBChecksum_2007_5_2_14_52_7.blg) has 205 samples.

5/2/2007 3:43:34 PM -- [C:\Program Files\Exchange\Jetstress\DBChecksum\\_2007\\_5\\_2\\_14\\_52\\_7.html](C:\Program Files\Exchange\Jetstress\DBChecksum_2007_5_2_14_52_7.html) is saved.

5/2/2007 3:43:34 PM -- Verifying log checksums ...

5/2/2007 3:43:39 PM -- K:\ (21 logs passed), L:\ (22 logs passed), M:\ (22 logs passed), and N:\ (22 logs passed)

5/2/2007 3:43:39 PM -- [C:\Program Files\Exchange\Jetstress\Performance\\_2007\\_5\\_2\\_12\\_40\\_4.blg](C:\Program Files\Exchange\Jetstress\Performance_2007_5_2_12_40_4.blg) has 527 samples.

5/2/2007 3:43:39 PM -- Creating test report ...

5/2/2007 3:43:43 PM -- Volume E: has 0.0122 for Avg. Disk sec/Read.

5/2/2007 3:43:43 PM -- Volume F: has 0.0122 for Avg. Disk sec/Read.

5/2/2007 3:43:43 PM -- Volume G: has 0.0122 for Avg. Disk sec/Read.

5/2/2007 3:43:43 PM -- Volume H: has 0.0122 for Avg. Disk sec/Read.

5/2/2007 3:43:43 PM -- Volume K: has 0.0021 for Avg. Disk sec/Write.

5/2/2007 3:43:43 PM -- Volume K: has 0.0020 for Avg. Disk sec/Read.

5/2/2007 3:43:43 PM -- Volume L: has 0.0021 for Avg. Disk sec/Write.

5/2/2007 3:43:43 PM -- Volume L: has 0.0019 for Avg. Disk sec/Read.

5/2/2007 3:43:43 PM -- Volume M: has 0.0021 for Avg. Disk sec/Write.

5/2/2007 3:43:43 PM -- Volume M: has 0.0019 for Avg. Disk sec/Read.

5/2/2007 3:43:43 PM -- Volume N: has 0.0021 for Avg. Disk sec/Write.

5/2/2007 3:43:43 PM -- Volume N: has 0.0019 for Avg. Disk sec/Read.

5/2/2007 3:43:43 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.

5/2/2007 3:43:43 PM -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.

5/2/2007 3:43:43 PM -- [C:\Program Files\Exchange\Jetstress\Performance\\_2007\\_5\\_2\\_12\\_40\\_4.html](C:\Program Files\Exchange\Jetstress\Performance_2007_5_2_12_40_4.html) is saved.

5/2/2007 3:43:43 PM -- Jetstress testing ends.

5/2/2007 10:24:11 PM -- Prepare testing begins ...

5/2/2007 10:24:11 PM -- Duplicating 4 databases:

5/2/2007 11:38:25 PM -- 100.0% of 380.8 GB complete (380.8 GB duplicated).

5/2/2007 11:38:26 PM -- Attaching databases ...

5/2/2007 11:38:26 PM -- Prepare testing ends.

5/2/2007 11:46:28 PM -- Jetstress testing begins ...

5/2/2007 11:46:28 PM -- Prepare testing begins ...

5/2/2007 11:46:30 PM -- Attaching databases ...

5/2/2007 11:46:30 PM -- Prepare testing ends.

5/2/2007 11:46:30 PM -- Dispatching transactions begins ...

5/2/2007 11:46:30 PM -- Database cache settings: (minimum: 128.0 MB, maximum: 1.0 GB)

5/2/2007 11:46:30 PM -- Database flush thresholds: (start: 10.2 MB, stop: 20.5 MB)

5/2/2007 11:46:31 PM -- Database read latency thresholds: (average: 0.02 seconds/read,

maximum: 0.05 seconds/read).  
 5/2/2007 11:46:31 PM -- Log write latency thresholds: (average: 0.01 seconds/write,  
 maximum: 0.05 seconds/write).  
 5/2/2007 11:46:31 PM -- Operation mix: Sessions 2, Inserts 25%, Deletes 10%, Replaces  
 50%, Reads 15%, Lazy Commits 80%.  
 5/2/2007 11:46:31 PM -- Performance logging begins (interval: 15000 ms).  
 5/2/2007 11:46:31 PM -- Generating log files ...  
 5/3/2007 12:31:31 AM -- K:\ (100.2% generated), L:\ (105.0% generated), M:\ (105.8%  
 generated), and N:\ (102.8% generated)  
 5/3/2007 12:31:32 AM -- Performance logging ends.  
 5/3/2007 12:31:32 AM -- JetInterop batch transaction stats: 10109, 10143, 10274, and 9910.  
 5/3/2007 12:31:32 AM -- Dispatching transactions ends.  
 5/3/2007 12:31:32 AM -- Shutting down databases ...  
 5/3/2007 12:31:35 AM -- Instance3628.1 (complete), Instance3628.2 (complete),  
 Instance3628.3 (complete), and Instance3628.4 (complete)  
 5/3/2007 12:31:35 AM -- Performance logging begins (interval: 15000 ms).  
 5/3/2007 12:31:35 AM -- Verifying database checksums ...  
 5/3/2007 1:22:20 AM -- E: (100% processed), F: (100% processed), G: (100% processed),  
 and H: (100% processed)  
 5/3/2007 1:22:22 AM -- Performance logging ends.  
 5/3/2007 1:22:22 AM -- [C:\Program Files\Exchange  
 Jetstress\DBChecksum\\_2007\\_5\\_3\\_0\\_31\\_35.blg](C:\Program Files\Exchange\Jetstress\DBChecksum_2007_5_3_0_31_35.blg) has 203 samples.  
 5/3/2007 1:22:24 AM -- [C:\Program Files\Exchange  
 Jetstress\DBChecksum\\_2007\\_5\\_3\\_0\\_31\\_35.html](C:\Program Files\Exchange\Jetstress\DBChecksum_2007_5_3_0_31_35.html) is saved.  
 5/3/2007 1:22:24 AM -- Verifying log checksums ...  
 5/3/2007 1:22:48 AM -- K:\ (100 logs passed), L:\ (100 logs passed), M:\ (100 logs passed),  
 and N:\ (100 logs passed)  
 5/3/2007 1:22:48 AM -- [C:\Program Files\Exchange  
 Jetstress\Performance\\_2007\\_5\\_2\\_23\\_46\\_31.blg](C:\Program Files\Exchange\Jetstress\Performance_2007_5_2_23_46_31.blg) has 179 samples.  
 5/3/2007 1:22:48 AM -- Creating test report ...  
 5/3/2007 1:22:49 AM -- Volume E: has 0.0116 for Avg. Disk sec/Read.  
 5/3/2007 1:22:49 AM -- Volume F: has 0.0116 for Avg. Disk sec/Read.  
 5/3/2007 1:22:49 AM -- Volume G: has 0.0115 for Avg. Disk sec/Read.  
 5/3/2007 1:22:49 AM -- Volume H: has 0.0117 for Avg. Disk sec/Read.  
 5/3/2007 1:22:49 AM -- Volume K: has 0.0022 for Avg. Disk sec/Write.  
 5/3/2007 1:22:49 AM -- Volume K: has 0.0019 for Avg. Disk sec/Read.  
 5/3/2007 1:22:49 AM -- Volume L: has 0.0021 for Avg. Disk sec/Write.  
 5/3/2007 1:22:49 AM -- Volume L: has 0.0020 for Avg. Disk sec/Read.  
 5/3/2007 1:22:49 AM -- Volume M: has 0.0021 for Avg. Disk sec/Write.  
 5/3/2007 1:22:49 AM -- Volume M: has 0.0019 for Avg. Disk sec/Read.  
 5/3/2007 1:22:49 AM -- Volume N: has 0.0021 for Avg. Disk sec/Write.  
 5/3/2007 1:22:49 AM -- Volume N: has 0.0019 for Avg. Disk sec/Read.  
 5/3/2007 1:22:49 AM -- Test has 0 Maximum Database Page Fault Stalls/sec.  
 5/3/2007 1:22:49 AM -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.

## SoftRecovery Database Checksum Results

Checksum Statistics - All

Database	Seen pages	Bad pages	Correctable pages	Wrong page no pages	File length / seconds taken
E:\Jetstress1.edb	12526178	0	0	0	3652 MBytes / 3039 seconds
F:\Jetstress1.edb	12530018	0	0	0	3682 MBytes / 3038 seconds

G:\Jetstress1.edb	12530786	0	0	0	3688 MBytes / 3045 seconds
H:\Jetstress1.edb	12530274	0	0	0	3684 MBytes / 3044 seconds
(Sum)	50117256	0	0	0	2421 MBytes / 12168 seconds

#### Disk Subsystem Performance (of checksum)

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec
E:	0.105	0.007	516.723	0.007
F:	0.108	0.017	516.921	0.007
G:	0.099	0.001	516.987	0.006
H:	0.111	0.011	516.928	0.006

#### Memory System Performance (of checksum)

Counter	Average	Minimum	Maximum
% Processor Time	24.986	2.918	35.912
Available MBytes	31189.512	31183.000	31314.000
Free System Page Table Entries	16754694.345	16754694.000	16754764.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	82659681.103	81301504.000	83693568.000
Pool Paged Bytes	75704531.862	75177984.000	76296192.000

#### Test Log

5/2/2007 11:25:45 AM -- Jetstress testing begins ...  
 5/2/2007 11:25:46 AM -- Prepare testing begins ...  
 5/2/2007 11:25:46 AM -- Duplicating 4 databases:  
 5/2/2007 12:40:00 PM -- 100.0% of 380.8 GB complete (380.8 GB duplicated).  
 5/2/2007 12:40:03 PM -- Attaching databases ...  
 5/2/2007 12:40:03 PM -- Prepare testing ends.  
 5/2/2007 12:40:03 PM -- Dispatching transactions begins ...  
 5/2/2007 12:40:03 PM -- Database cache settings: (minimum: 128.0 MB, maximum: 1.0 GB)  
 5/2/2007 12:40:03 PM -- Database flush thresholds: (start: 10.2 MB, stop: 20.5 MB)  
 5/2/2007 12:40:04 PM -- Database read latency thresholds: (average: 0.02 seconds/read,  
 maximum: 0.05 seconds/read).  
 5/2/2007 12:40:04 PM -- Log write latency thresholds: (average: 0.01 seconds/write,  
 maximum: 0.05 seconds/write).  
 5/2/2007 12:40:05 PM -- Operation mix: Sessions 2, Inserts 25%, Deletes 10%, Replaces  
 50%, Reads 15%, Lazy Commits 80%.  
 5/2/2007 12:40:05 PM -- Performance logging begins (interval: 15000 ms).  
 5/2/2007 12:40:05 PM -- Attaining prerequisites:  
 5/2/2007 12:52:01 PM -- \Database(JetstressWin)\Database Cache Size, Last: 968310800.0  
 (lower bound: 966367600.0, upper bound: none)  
 5/2/2007 2:52:03 PM -- Performance logging ends.  
 5/2/2007 2:52:03 PM -- JetInterop batch transaction stats: 28718, 28416, 28257, and 28567.  
 5/2/2007 2:52:03 PM -- Dispatching transactions ends.

5/2/2007 2:52:03 PM -- Shutting down databases ...  
 5/2/2007 2:52:07 PM -- Instance3628.1 (complete), Instance3628.2 (complete),  
 Instance3628.3 (complete), and Instance3628.4 (complete)  
 5/2/2007 2:52:08 PM -- Performance logging begins (interval: 15000 ms).  
 5/2/2007 2:52:08 PM -- Verifying database checksums ...  
 5/2/2007 3:43:30 PM -- E: (100% processed), F: (100% processed), G: (100% processed),  
 and H: (100% processed)  
 5/2/2007 3:43:31 PM -- Performance logging ends.  
 5/2/2007 3:43:31 PM -- [C:\Program Files\Exchange  
 Jetstress\DBChecksum\\_2007\\_5\\_2\\_14\\_52\\_7.blg](#) has 205 samples.  
 5/2/2007 3:43:34 PM -- [C:\Program Files\Exchange  
 Jetstress\DBChecksum\\_2007\\_5\\_2\\_14\\_52\\_7.html](#) is saved.  
 5/2/2007 3:43:34 PM -- Verifying log checksums ...  
 5/2/2007 3:43:39 PM -- K:\ (21 logs passed), L:\ (22 logs passed), M:\ (22 logs passed), and  
 N:\ (22 logs passed)  
 5/2/2007 3:43:39 PM -- [C:\Program Files\Exchange  
 Jetstress\Performance\\_2007\\_5\\_2\\_12\\_40\\_4.blg](#) has 527 samples.  
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 5/2/2007 3:43:43 PM -- Volume E: has 0.0122 for Avg. Disk sec/Read.  
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 5/2/2007 3:43:43 PM -- Volume G: has 0.0122 for Avg. Disk sec/Read.  
 5/2/2007 3:43:43 PM -- Volume H: has 0.0122 for Avg. Disk sec/Read.  
 5/2/2007 3:43:43 PM -- Volume K: has 0.0021 for Avg. Disk sec/Write.  
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 5/2/2007 3:43:43 PM -- Volume L: has 0.0019 for Avg. Disk sec/Read.  
 5/2/2007 3:43:43 PM -- Volume M: has 0.0021 for Avg. Disk sec/Write.  
 5/2/2007 3:43:43 PM -- Volume M: has 0.0019 for Avg. Disk sec/Read.  
 5/2/2007 3:43:43 PM -- Volume N: has 0.0021 for Avg. Disk sec/Write.  
 5/2/2007 3:43:43 PM -- Volume N: has 0.0019 for Avg. Disk sec/Read.  
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 5/2/2007 3:43:43 PM -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.  
 5/2/2007 3:43:43 PM -- [C:\Program Files\Exchange  
 Jetstress\Performance\\_2007\\_5\\_2\\_12\\_40\\_4.html](#) is saved.  
 5/2/2007 3:43:43 PM -- Jetstress testing ends.  
 5/2/2007 10:24:11 PM -- Prepare testing begins ...  
 5/2/2007 10:24:11 PM -- Duplicating 4 databases:  
 5/2/2007 11:38:25 PM -- 100.0% of 380.8 GB complete (380.8 GB duplicated).  
 5/2/2007 11:38:26 PM -- Attaching databases ...  
 5/2/2007 11:38:26 PM -- Prepare testing ends.  
 5/2/2007 11:46:28 PM -- Jetstress testing begins ...  
 5/2/2007 11:46:28 PM -- Prepare testing begins ...  
 5/2/2007 11:46:30 PM -- Attaching databases ...  
 5/2/2007 11:46:30 PM -- Prepare testing ends.  
 5/2/2007 11:46:30 PM -- Dispatching transactions begins ...  
 5/2/2007 11:46:30 PM -- Database cache settings: (minimum: 128.0 MB, maximum: 1.0 GB)  
 5/2/2007 11:46:30 PM -- Database flush thresholds: (start: 10.2 MB, stop: 20.5 MB)  
 5/2/2007 11:46:31 PM -- Database read latency thresholds: (average: 0.02 seconds/read,  
 maximum: 0.05 seconds/read).  
 5/2/2007 11:46:31 PM -- Log write latency thresholds: (average: 0.01 seconds/write,  
 maximum: 0.05 seconds/write).  
 5/2/2007 11:46:31 PM -- Operation mix: Sessions 2, Inserts 25%, Deletes 10%, Replaces  
 50%, Reads 15%, Lazy Commits 80%.  
 5/2/2007 11:46:31 PM -- Performance logging begins (interval: 15000 ms).  
 5/2/2007 11:46:31 PM -- Generating log files ...  
 5/3/2007 12:31:31 AM -- K:\ (100.2% generated), L:\ (105.0% generated), M:\ (105.8%  
 generated), and N:\ (102.8% generated)  
 5/3/2007 12:31:32 AM -- Performance logging ends.  
 5/3/2007 12:31:32 AM -- JetInterop batch transaction stats: 10109, 10143, 10274, and 9910.

5/3/2007 12:31:32 AM -- Dispatching transactions ends.  
5/3/2007 12:31:32 AM -- Shutting down databases ...  
5/3/2007 12:31:35 AM -- Instance3628.1 (complete), Instance3628.2 (complete),  
Instance3628.3 (complete), and Instance3628.4 (complete)  
5/3/2007 12:31:35 AM -- Performance logging begins (interval: 15000 ms).  
5/3/2007 12:31:35 AM -- Verifying database checksums ...  
5/3/2007 1:22:20 AM -- E: (100% processed), F: (100% processed), G: (100% processed),  
and H: (100% processed)  
5/3/2007 1:22:22 AM -- Performance logging ends.  
5/3/2007 1:22:22 AM -- [C:\Program Files\Exchange  
Jetstress\DBChecksum\\_2007\\_5\\_3\\_0\\_31\\_35.blg](#) has 203 samples.

## Appendix E: Maximum Solution IOPS Testing

The building block described under is the EMC recommended configuration for a 850 Exchange user workload at 0.5 IOPS per user. The result shown in Appendix A illustrate that this configuration achieved excellent results, with considerable room for growth.

Often the observed user workload in customer environments is greater than expected. For example, the use of Blackberry or MAPI journaling devices can significantly increase the IO workload generated by a set of users. EMC prides itself on delivering solutions that meet and exceed customer requirements and hence the configurations are designed with considerable headroom.

After proving that the building block could easily satisfy the ESRP criteria, subsequent tests were run to determine the upper limits of the configuration. The number of Jetstress threads was increased from 2 to 9 without modifying any of the other components. The achieved IOPS increased from 464.213 to 1142.18 – a 146% increase, while still providing latency results that satisfied the ESRP criteria. While this workload is not recommended for customers, as it is close to the maximum acceptable latency for ESRP, it highlights the headroom in the recommended building block.

### **Maximum Performance Test Result Report**

#### Test Summary

<b>Overall Test Result</b>	<b>Pass</b>
<b>Machine Name</b>	C2D77C1
<b>Test Description</b>	
<b>Test Start Time</b>	5/2/2007 2:31:03 PM
<b>Test End Time</b>	5/2/2007 6:07:09 PM
<b>Jetstress Version</b>	08.01.0075.000
<b>Ese Version</b>	08.01.0013.000
<b>Operating System</b>	Microsoft Windows Server 2003 Service Pack 1 (5.2.3790.65536)
<b>Performance Log</b>	<a href="#">C:\Jetstress\8disk\10t\perf_rr\Performance_2007_5_2_16_3_6.blg</a> <a href="#">C:\Jetstress\8disk\10t\perf_rr\DBChecksum_2007_5_2_18_7_9.blg</a>

## Database Sizing and Throughput

<b>Achieved I/O per Second</b>	1142.18
<b>Capacity Percentage</b>	100%
<b>Throughput Percentage</b>	100%
<b>Initial database size</b>	406984916992
<b>Final database size</b>	417852358656
<b>Database files (count)</b>	4

## Jetstress System Parameters

<b>Thread count</b>	9 (per-storage group)
<b>Log buffers</b>	9000
<b>Minimum database cache</b>	128.0 MB
<b>Maximum database cache</b>	1024.0 MB
<b>Insert operations</b>	25%
<b>Delete operations</b>	10%
<b>Replace operations</b>	50%
<b>Read operations</b>	15%
<b>Lazy commits</b>	80%

## Disk Subsystem Performance

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec	Avg. Disk Bytes/Write
Database (G:)	0.018	0.004	146.696	137.483	(n/a)
Database (H:)	0.020	0.004	148.365	138.769	(n/a)
Database (I:)	0.019	0.004	148.512	136.536	(n/a)
Database (J:)	0.019	0.004	148.650	137.169	(n/a)
Log (K:)	0.000	0.002	0.000	77.116	12897.766
Log (L:)	0.000	0.002	0.000	78.039	12874.291
Log (M:)	0.000	0.002	0.000	77.092	12718.771
Log (N:)	0	0.002	0.000	77.779	12705.015

## Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	3.606	2.263	6.011
Available MBytes	14329.826	14256.000	15207.000

Free System Page Table Entries	16759721.848	16759721.000	16759791.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	47757630.578	47386624.000	48058368.000
Pool Paged Bytes	42640824.630	42557440.000	43511808.000
Database Page Fault Stalls/sec	0.001	0.000	0.266

## Test Log

5/2/2007 2:31:03 PM -- Jetstress testing begins ...  
 5/2/2007 2:31:03 PM -- Prepare testing begins ...  
 5/2/2007 2:31:03 PM -- Duplicating 4 databases:  
 5/2/2007 4:03:05 PM -- 100.0% of 379.0 GB complete (379.0 GB duplicated).  
 5/2/2007 4:03:05 PM -- Attaching databases ...  
 5/2/2007 4:03:05 PM -- Prepare testing ends.  
 5/2/2007 4:03:05 PM -- Dispatching transactions begins ...  
 5/2/2007 4:03:05 PM -- Database cache settings: (minimum: 128.0 MB, maximum: 1.0 GB)  
 5/2/2007 4:03:05 PM -- Database flush thresholds: (start: 10.2 MB, stop: 20.5 MB)  
 5/2/2007 4:03:06 PM -- Database read latency thresholds: (average: 0.02 seconds/read, maximum: 0.05 seconds/read).  
 5/2/2007 4:03:06 PM -- Log write latency thresholds: (average: 0.01 seconds/write, maximum: 0.05 seconds/write).  
 5/2/2007 4:03:07 PM -- Operation mix: Sessions 9, Inserts 25%, Deletes 10%, Replaces 50%, Reads 15%, Lazy Commits 80%.  
 5/2/2007 4:03:07 PM -- Performance logging begins (interval: 15000 ms).  
 5/2/2007 4:03:07 PM -- Attaining prerequisites:  
 5/2/2007 4:07:02 PM -- \Database(JetstressWin)\Database Cache Size, Last: 968278000.0 (lower bound: 966367600.0, upper bound: none)  
 5/2/2007 6:07:03 PM -- Performance logging ends.  
 5/2/2007 6:07:03 PM -- JetInterop batch transaction stats: 64901, 65215, 65147, and 65262.  
 5/2/2007 6:07:04 PM -- Dispatching transactions ends.  
 5/2/2007 6:07:04 PM -- Shutting down databases ...  
 5/2/2007 6:07:09 PM -- Instance2012.1 (complete), Instance2012.2 (complete), Instance2012.3 (complete), and Instance2012.4 (complete)  
 5/2/2007 6:07:10 PM -- Performance logging begins (interval: 15000 ms).  
 5/2/2007 6:07:10 PM -- Verifying database checksums ...  
 5/2/2007 7:37:49 PM -- G: (100% processed), H: (100% processed), I: (100% processed), and J: (100% processed)  
 5/2/2007 7:37:50 PM -- Performance logging ends.  
 5/2/2007 7:37:50 PM -- [C:\Jetstress\8disk\10t\perf\\_rr\DBChecksum\\_2007\\_5\\_2\\_18\\_7\\_9.blg](C:\Jetstress\8disk\10t\perf_rr\DBChecksum_2007_5_2_18_7_9.blg) has 362 samples.  
 5/2/2007 7:37:54 PM -- [C:\Jetstress\8disk\10t\perf\\_rr\DBChecksum\\_2007\\_5\\_2\\_18\\_7\\_9.html](C:\Jetstress\8disk\10t\perf_rr\DBChecksum_2007_5_2_18_7_9.html) is saved.  
 5/2/2007 7:37:54 PM -- Verifying log checksums ...  
 5/2/2007 7:38:00 PM -- K:\ (21 logs passed), L:\ (21 logs passed), M:\ (22 logs passed), and N:\ (22 logs passed)  
 5/2/2007 7:38:00 PM -- [C:\Jetstress\8disk\10t\perf\\_rr\Performance\\_2007\\_5\\_2\\_16\\_3\\_6.blg](C:\Jetstress\8disk\10t\perf_rr\Performance_2007_5_2_16_3_6.blg) has 495 samples.  
 5/2/2007 7:38:00 PM -- Creating test report ...  
 5/2/2007 7:38:02 PM -- Volume G: has 0.0180 for Avg. Disk sec/Read.  
 5/2/2007 7:38:02 PM -- Volume H: has 0.0200 for Avg. Disk sec/Read.  
 5/2/2007 7:38:02 PM -- Volume I: has 0.0187 for Avg. Disk sec/Read.  
 5/2/2007 7:38:02 PM -- Volume J: has 0.0187 for Avg. Disk sec/Read.  
 5/2/2007 7:38:02 PM -- Volume K: has 0.0023 for Avg. Disk sec/Write.  
 5/2/2007 7:38:02 PM -- Volume K: has 0.0000 for Avg. Disk sec/Read.  
 5/2/2007 7:38:02 PM -- Volume L: has 0.0023 for Avg. Disk sec/Write.  
 5/2/2007 7:38:02 PM -- Volume L: has 0.0000 for Avg. Disk sec/Read.

5/2/2007 7:38:02 PM -- Volume M: has 0.0023 for Avg. Disk sec/Write.  
5/2/2007 7:38:02 PM -- Volume M: has 0.0000 for Avg. Disk sec/Read.  
5/2/2007 7:38:02 PM -- Volume N: has 0.0023 for Avg. Disk sec/Write.  
5/2/2007 7:38:02 PM -- Volume N: has 0.0000 for Avg. Disk sec/Read.  
5/2/2007 7:38:02 PM -- Test has 0.266233454844433 Maximum Database Page Fault Stalls/sec.  
5/2/2007 7:38:02 PM -- Test has 2 Database Page Fault Stalls/sec samples higher than 0.