

ESRP Storage Program  
EMC CX-3-20 (900 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 CX3-20 (900 User) iSCSI 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 and 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 Exchange solutions around EMC's CLARiiON CX3-20 storage systems. Built on the innovative EMC CLARiiON CX3 UltraScale architecture, the EMC CX-3-20 offers exceptional performance, ease-of-use, and unmatched reliability. It meets the storage needs of a wide range of applications including:

- Mail/Messaging
- Databases
- File, Print, and Web Services
- Distributed Applications
- Remote Replication

In addition, the CX3-20 supports a wide range of server operating environments such as: Microsoft Windows, Linux, Solaris, AIX, HP-UX, and VMware ESX Server.

The CLARiiON CX3-20 Fibre Channel (FC)/iSCSI array offers both 4 Gb/s FC and 1 Gb/s iSCSI ports fully integrated in the same array, enabling the customers to leverage their networked storage investments over a broader range of servers and applications with complete flexibility and without additional hardware. A total of 8 iSCSI ports (4 per SP) and 4 Fibre Channel ports (2 per SP) are available on each CX3-20 array.

The CLARiiON CX3-20 Fibre Channel (FC)/iSCSI array gives customers an advantage, irrespective of whether or not they currently have iSCSI or FC deployed. For customers who are implementing networked storage for the first time and are considering iSCSI, the CLARiiON CX3-20 Fibre Channel(FC)/iSCSI

array provides scalable iSCSI storage as well as the flexibility and investment protection of integrated FC support, should the customers' business and application needs grow. For customers with existing FC deployments, the CLARiiON CX3-20 Fibre Channel (FC)/iSCSI array offers the opportunity to expand the reach of their networked storage environment economically with iSCSI, while maintaining complete flexibility with regard to how the incremental capacity is shared across server platforms and interconnects.

With the EMC CX3-20, you can choose the drive options that meet your specific needs, thereby providing the flexibility to offer multiple levels of performance in one system. The CX3-20 supports both high-performance and high-capacity disk drives in the same system, can scale from 365 GB to 59 TB, and supports 128 high-availability hosts. It supports 4 Gb/s (15k RPM) FC drives for demanding applications requiring maximum performance.

2 Gb/s FC (10k RPM) serves applications that require a balance between performance and costs. Alternatively, low-cost 2 Gb/s FC drives (7.2k RPM) can be chosen for Tier 2 applications such as disk-based backup, requiring high capacities and low cost.

The CX3-20 delivers tiered storage that enables you to provide the right level of performance to the right applications. The system also delivers exceptional 4 Gb/s performance throughout the entire system without compromises or bottlenecks. Performance boosting features include four front-end and two backend 4 Gb/s ports, along with the state-of-the-art low latency, high bandwidth I/O interconnect technologies.

The performance results and best practices discussed in this document provide tested guidelines for configuring the EMC CX3-20 for a high-performance Exchange environment. For this solution, a CX3-20 *EMC CLARiiON CX3-20 Storage Solution for Microsoft Exchange Server* storage system was used and configured for 900 Exchange 2007 users. The server was connected to the CX3-20 through iSCSI using dedicated NICs used for iSCSI with the Microsoft iSCSI software initiator (V2.0.4), and an iSCSI VLAN. Each of the 900 users is profiled using a value of 1 IOPS per user and a 200 MB mailbox requirement.

## Solution Description

The solution described is for utilizing a single CX3-20 and a single disk enclosure (DEA), utilizing 14 146 GB 15,000 RPM FC drives, thus giving the customer the most performance and fault tolerance utilizing Raid 10 for the Exchange Databases and Log files and Raid 5 for backup to disk volumes.

Log files are placed on the first four drives 0\_0-0\_3 in a Raid 1\_0 configuration, and Backup to Disk are placed on drives 0\_5-0\_9. Database Drives are then placed on drives 0\_10-0\_13 with drive 0\_14 left for a hot spare.

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.

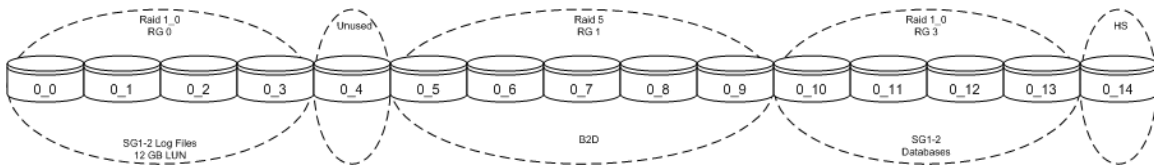
The method described in this ESRP submission is the building block method. The building block method is used to simplify the sizing and configuration when using low number of disks to ensure the highest performance while staying fault tolerant.

This unit of measure (or Building Block) is designed to be scalable based on IO and latency requirements of the customer. The building blocks are designed around the Exchange Database drives in 4 drive increments using Raid 1\_0, and the Exchange log files are placed onto a 4 drive Raid 1\_0 configuration which is capable of holding multiple building blocks SG log files.

The building block is designed with the ability to grow and expand into larger building block deployment models detailed in the EMC ESRP submissions for greater than 4000 users.

[http://www.emc.com/techlib/pdf/20084\\_CX3-20c\\_iSCSI\\_4000\\_Users\\_Storage\\_Solution\\_for\\_Microsoft\\_Exchange\\_Server.pdf](http://www.emc.com/techlib/pdf/20084_CX3-20c_iSCSI_4000_Users_Storage_Solution_for_Microsoft_Exchange_Server.pdf)

The building blocks help to simplify the design and configuration of a highly available, high performance configuration as a company grows and email requirements increase.



**Figure 1 – Building Block 1**

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 scale up 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 Microsoft's Troubleshooting Microsoft Exchange Server Performance, available at <http://go.microsoft.com/fwlink/?LinkId=23454>

## **Targeted Customer Profile**

This solution is intended for small and medium businesses hosting 900 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
- User mailbox size for testing — 200 MB
- Backup strategy for testing — Streaming Backup to Disk
- Time for Restore — Less than 2 hours 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	900
Number of hosts	1
Number of mailboxes/host	900
Number of storage groups/host	2
Number of mailbox stores/storage group	1
Number of mailboxes/mailbox store	200
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	120 GB
Log LUN size	12 GB
Backup LUN size/storage group	547 GB
Total database size for performance testing	100 GB
% Storage capacity used by Exchange database**	83%

\*\* 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	CX3-20 Flare .24
Storage cache	1 GB
Number of storage controllers	2
Number of storage ports	4 Tested – 8 possible
Maximum bandwidth of storage connectivity to host	4*1 Gb 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	14 (with HotSpare)
Maximum number of spindles that can be hosted in the storage	15

## Primary Storage Software

HBA driver	c:\windows\system32\drivers\le1g5132e.sys (8.4.21.0 built by: WinDDK, 220.25 KB (225,536 bytes), 3/14/2007 6:00 PM)
HBA QueueTarget Setting	Not Applicable
HBA QueueDepth Setting	Not Applicable
Multi-Pathing	Microsoft iSCSI Initiator v 2.0.4, PowerPath 4.6
Host OS	Microsoft® Windows® Server 2003, Enterprise Edition x64 SP1 5.2.3790 Service Pack 1 Build 3790
ESE.dll file version	08.00.0685.024
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 – 60 AC
Raw capacity per disk (GB)	146 GB
Number of physical disks in test	4
total raw storage capacity (GB)	584 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	120
Raid level	Raid 1_0
Total formatted capacity	240 GB
Storage capacity utilization	46%
Database capacity utilization	83 GB

## Primary Storage Disk Configuration (Transactional Log Disks)

Disk type, speed and firmware revision	4 Gbps FC SCSI 15,000 RPM – 60 AC
Raw capacity per disk (GB)	146 GB
Number of spindles in test	4
total raw storage capacity (GB)	584 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	12
Raid level	Raid 1_0
Total formatted capacity	24 GB

## Streaming Backup

### Disk Configuration (Streaming Backup to disk)

Disk type, speed and firmware revision	4 Gbps FC SCSI 15,000 RPM – 60 AC
Raw capacity per disk (GB)	146 GB
Number of spindles in test	5
Total raw storage capacity (GB)	730 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	1
Raid level	Raid 5
Total formatted capacity	532 GB

## Best Practices

Microsoft Exchange server is a disk-intensive application. Based on the testing that is 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 Microsoft Windows 2003 SP1 x64) to align all disks used with Microsoft Exchange, using a value of 64 for CLARiiON. This aligns all of the Exchange related NTFS partitions on a 64 KB boundary.
2. 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.

3. TcpAckFrequency = 1 for each iSCSI connection. Refer <http://support.microsoft.com/kb/328890>.
4. Size and configure the environment for spindle performance as a primary consideration, with storage capacity as secondary.
5. iSCSI configuration using PowerPath 4.6 utilizing a balanced path approach. Logging in with NIC0 into the A0(Spa) and B3(Spb), and NIC1 into B0(Spb) and A3(Spa).
6. Tuning the CX3-20 storage system parameters is important in obtaining 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

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.mspix>

Multi-site data replication support for Exchange

<http://support.microsoft.com/?kbid=895847>

## ***Backup strategy***

This solution utilized Raid 5 for the backup to disk LUNs to maximize space, and then, using EMC NetWorker or NTBackup for backup to CDL or Tape, for long term storage of databases.

## **Test Result Summary**

This section provides a high level summary of the test data from ESRP. The Appendix section has the detailed html reports that are generated by the ESRP testing framework.

## ***Reliability***

A number of tests in the framework are to check Reliability tests runs for 24 hours. The goal is to verify that the storage can handle high IO load for a long period of time. Both log and database files are analyzed for integrity after the stress test to ensure no database/log corruption.

The following list provides an overview:

- Any errors reported in the saved eventlog file? None
- Any errors reported in during the database and log? None
- If backup to disk test is done, any errors reported during the process? None
- Any errors during database checksum on the remote storage database? None

## Primary Storage Performance Results

The Primary Storage performance testing is designed to exercise the storage with maximum sustainable Exchange type of IO for 2 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	486.306
Average Database Disk Reads/sec	247.549
Average Database Disk Writes/sec	238.757
Average Database Disk Read Latency (ms)	11
Average Database Disk Write Latency (ms)	5
<b>Transaction Log I/O</b>	
Average Log Disk Writes/sec	148.16
Average Log Disk Write Latency (ms)	1

## Streaming Backup Performance

For the Version 1.0 release, only streaming backup type is supported for testing in the framework. There are two tests in this section. The first one is to measure the read IO performance metrics by running checksum on all the databases and log files. The second test is to measure the end to end performance when the databases are backed up to disks.

## Database Read-only Performance

The test is to measure the maximum rate at which databases could be streaming backed up. The following table shows the average rate for a single database file.

MB read/sec per storage group	15.925
MB read/sec total	31.85
File size/sec taken	200963.54/12802

## Log Read-only Performance

The 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)	0.472969297
---	-------------

## **Backup to Disk Performance**

This test runs backup on all the database files, and stores them on disks. The following table lists the average rate at which each storage group can be backed up:

Total database size per storage group (GB)	200.96354
Time taken to backup each storage group	1:46:41
Average MB backed up/sec per storage group	15.93069472

## **Conclusion**

This document is developed by storage solution providers, and reviewed by Microsoft Exchange Product team. The test results/data presented in this document is based on the tests introduced in the ESRP test framework. Customer should not quote the data directly for his/her pre-deployment verification. It is still necessary to go through the exercises to validate the storage design for a specific customer environment.

The ESRP program is not designed to be a benchmarking program; tests are not designed to getting the maximum throughput for a given solution. Rather, it is focused on producing recommendations from EMC for Exchange application. So, the data presented in this document should not be used for direct comparisons among the solutions.

## **Contact Information**

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Worldwide: (508) 497-7901

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>	72D77C1
<b>Test Description</b>	
<b>Test Start Time</b>	4/1/2007 6:59:41 PM
<b>Test End Time</b>	4/2/2007 7:05:01 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 Service Pack 1 (5.2.3790.65536)
<b>Performance Log</b>	<a href="#">C:\Jetstress Testing\REDO\3Thread</a> <a href="#">ESRP\stress\Stress_2007_4_1_18_59_42.blg</a> <a href="#">C:\Jetstress Testing\REDO\3Thread</a> <a href="#">ESRP\stress\DBChecksum_2007_4_2_19_5_1.blg</a>

#### Database Sizing and Throughput

<b>Achieved I/O per Second</b>	457.076
<b>Capacity Percentage</b>	100%
<b>Throughput Percentage</b>	100%
<b>Initial database size</b>	206155841536
<b>Final database size</b>	253742579712
<b>Database files (count)</b>	2

#### Jetstress System Parameters

<b>Thread count</b>	3 (per-storage group)
<b>Log buffers</b>	9000
<b>Minimum database cache</b>	64.0 MB
<b>Maximum database cache</b>	512.0 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 (c:\sg1db)	0.011	0.005	120.018	108.542	(n/a)
Database (c:\sg2db)	0.011	0.005	120.854	107.661	(n/a)
Log (c:\sg1lg)	0.000	0.001	0.000	63.943	11207.183
Log (c:\sg2lg)	0.000	0.001	0.000	63.863	11099.960

### Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	1.772	0.001	5.235
Available MBytes	14952.418	14929.000	15480.000
Free System Page Table Entries	16759518.000	16759518.000	16759518.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	50298464.464	50294784.000	50356224.000
Pool Paged Bytes	47728568.847	46780416.000	48300032.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

### Test Log

4/1/2007 6:59:41 PM -- Command Line: "C:\PROGRA~1\EXCHAN~1\jetstresscmd.exe" /c "C:\Jetstress Testing\REDO\3Thread ESRP\stress3t.xml"

4/1/2007 6:59:41 PM -- Jetstress testing begins ...

4/1/2007 6:59:41 PM -- Prepare testing begins ...

4/1/2007 6:59:41 PM -- Attaching databases ...

4/1/2007 6:59:41 PM -- Prepare testing ends.

4/1/2007 6:59:41 PM -- Dispatching transactions begins ...

4/1/2007 6:59:41 PM -- Database cache settings: (minimum: 64.0 MB, maximum: 512.0 MB)

4/1/2007 6:59:41 PM -- Database flush thresholds: (start: 5.1 MB, stop: 10.2 MB)

4/1/2007 6:59:42 PM -- Database read latency thresholds: (average: 0.02 seconds/read, maximum: 0.1 seconds/read).

4/1/2007 6:59:42 PM -- Log write latency thresholds: (average: 0.01 seconds/write, maximum: 0.1 seconds/write).

4/1/2007 6:59:42 PM -- Operation mix: Sessions 3, Inserts 25%, Deletes 10%, Replaces 50%, Reads 15%, Lazy Commits 80%.

4/1/2007 6:59:42 PM -- Performance logging begins (interval: 15000 ms).

4/1/2007 6:59:43 PM -- Attaining prerequisites:

4/1/2007 7:04:58 PM -- \Database(JetstressCmd)\Database Cache Size, Last: 483295200.0 (lower bound: 483183800.0, upper bound: none)

4/2/2007 7:04:59 PM -- Performance logging ends.

4/2/2007 7:04:59 PM -- JetInterop batch transaction stats: 577192, and 577410.

4/2/2007 7:05:00 PM -- Dispatching transactions ends.

4/2/2007 7:05:00 PM -- Shutting down databases ...  
 4/2/2007 7:05:01 PM -- Instance3052.1 (complete), and Instance3052.2 (complete)  
 4/2/2007 7:05:02 PM -- Performance logging begins (interval: 15000 ms).  
 4/2/2007 7:05:02 PM -- Verifying database checksums ...  
 4/2/2007 7:43:25 PM -- c:\sg1db (100% processed), and c:\sg2db (100% processed)  
 4/2/2007 7:43:26 PM -- Performance logging ends.  
 4/2/2007 7:43:26 PM -- [C:\Jetstress Testing\REDO\3ThreadESRP\stress\DBChecksum\\_2007\\_4\\_2\\_19\\_5\\_1.blg](#) has 153 samples.  
 4/2/2007 7:43:27 PM -- [C:\Jetstress Testing\REDO\3ThreadESRP\stress\DBChecksum\\_2007\\_4\\_2\\_19\\_5\\_1.html](#) is saved.  
 4/2/2007 7:43:27 PM -- Verifying log checksums ...  
 4/2/2007 7:43:29 PM -- c:\sg1lg (22 logs passed), and c:\sg2lg (22 logs passed)  
 4/2/2007 7:43:29 PM -- [C:\Jetstress Testing\REDO\3ThreadESRP\stress\Stress\\_2007\\_4\\_1\\_18\\_59\\_42.blg](#) has 6021 samples.  
 4/2/2007 7:43:29 PM -- Creating test report ...  
 4/2/2007 7:44:06 PM -- Volume c:\sg1db has 0.0112 for Avg. Disk sec/Read.  
 4/2/2007 7:44:06 PM -- Volume c:\sg2db has 0.0112 for Avg. Disk sec/Read.  
 4/2/2007 7:44:06 PM -- Volume c:\sg1lg has 0.0013 for Avg. Disk sec/Write.  
 4/2/2007 7:44:06 PM -- Volume c:\sg1lg has 0.0000 for Avg. Disk sec/Read.  
 4/2/2007 7:44:06 PM -- Volume c:\sg2lg has 0.0013 for Avg. Disk sec/Write.  
 4/2/2007 7:44:06 PM -- Volume c:\sg2lg has 0.0000 for Avg. Disk sec/Read.  
 4/2/2007 7:44:06 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.  
 4/2/2007 7:44:06 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
c:\sg1db\Jetstress1.edb	15532402	0	0	0	2562 MBytes / 2303 seconds
c:\sg2db\Jetstress1.edb	15442034	0	0	0	1856 MBytes / 2266 seconds
(Sum)	30974436	0	0	0	323 MBytes / 4569 seconds

Disk Subsystem Performance (of checksum)

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec
c:\sg1db	0.086	0.000	840.506	0.000
c:\sg2db	0.080	0.000	843.812	0.001

Memory System Performance (of checksum)

Counter	Average	Minimum	Maximum
% Processor Time	11.106	0.053	13.464
Available MBytes	15348.379	15342.000	15413.000
Free System Page Table Entries	16759518.000	16759518.000	16759518.000

Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	56561396.288	56172544.000	57516032.000
Pool Paged Bytes	49095994.562	49070080.000	49598464.000

## Test Log

4/1/2007 6:59:41 PM -- Command Line: "C:\PROGRA~1\EXCHAN~1\jetstresscmd.exe" /c "C:\Jetstress Testing\REDO\3Thread ESRP\stress\stress3t.xml"

4/1/2007 6:59:41 PM -- Jetstress testing begins ...

4/1/2007 6:59:41 PM -- Prepare testing begins ...

4/1/2007 6:59:41 PM -- Attaching databases ...

4/1/2007 6:59:41 PM -- Prepare testing ends.

4/1/2007 6:59:41 PM -- Dispatching transactions begins ...

4/1/2007 6:59:41 PM -- Database cache settings: (minimum: 64.0 MB, maximum: 512.0 MB)

4/1/2007 6:59:41 PM -- Database flush thresholds: (start: 5.1 MB, stop: 10.2 MB)

4/1/2007 6:59:42 PM -- Database read latency thresholds: (average: 0.02 seconds/read, maximum: 0.1 seconds/read).

4/1/2007 6:59:42 PM -- Log write latency thresholds: (average: 0.01 seconds/write, maximum: 0.1 seconds/write).

4/1/2007 6:59:42 PM -- Operation mix: Sessions 3, Inserts 25%, Deletes 10%, Replaces 50%, Reads 15%, Lazy Commits 80%.

4/1/2007 6:59:42 PM -- Performance logging begins (interval: 15000 ms).

4/1/2007 6:59:43 PM -- Attaining prerequisites:

4/1/2007 7:04:58 PM -- \Database(JetstressCmd)\Database Cache Size, Last: 483295200.0 (lower bound: 483183800.0, upper bound: none)

4/2/2007 7:04:59 PM -- Performance logging ends.

4/2/2007 7:04:59 PM -- JetInterop batch transaction stats: 577192, and 577410.

4/2/2007 7:05:00 PM -- Dispatching transactions ends.

4/2/2007 7:05:00 PM -- Shutting down databases ...

4/2/2007 7:05:01 PM -- Instance3052.1 (complete), and Instance3052.2 (complete)

4/2/2007 7:05:02 PM -- Performance logging begins (interval: 15000 ms).

4/2/2007 7:05:02 PM -- Verifying database checksums ...

4/2/2007 7:43:25 PM -- c:\sg1db (100% processed), and c:\sg2db (100% processed)

4/2/2007 7:43:26 PM -- Performance logging ends.

4/2/2007 7:43:26 PM -- [C:\Jetstress Testing\REDO\3Thread ESRP\stress\DBChecksum\\_2007\\_4\\_2\\_19\\_5\\_1.blg](#) has 153 samples.

## Appendix B: Performance Testing

### Performance Test Result Report

Test Summary

<b>Overall Test Result</b>	Pass
<b>Machine Name</b>	72D77C1
<b>Test Description</b>	
<b>Test Start Time</b>	3/30/2007 2:45:47 PM
<b>Test End Time</b>	3/30/2007 4:51:07 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 Service Pack 1 (5.2.3790.65536)
<b>Performance Log</b>	<a href="C:\Jetstress Testing\REDO\3ThreadESRP\perf\Performance_2007_3_30_14_45_48.blg">C:\Jetstress Testing\REDO\3ThreadESRP\perf\Performance_2007_3_30_14_45_48.blg</a> <a href="C:\Jetstress Testing\REDO\3ThreadESRP\perf\DBChecksum_2007_3_30_16_51_7.blg">C:\Jetstress Testing\REDO\3ThreadESRP\perf\DBChecksum_2007_3_30_16_51_7.blg</a>

Database Sizing and Throughput

<b>Achieved I/O per Second</b>	486.306
<b>Capacity Percentage</b>	100%
<b>Throughput Percentage</b>	100%
<b>Initial database size</b>	206155841536
<b>Final database size</b>	210729730048
<b>Database files (count)</b>	2

Jetstress System Parameters

<b>Thread count</b>	3 (per-storage group)
<b>Log buffers</b>	9000
<b>Minimum database cache</b>	64.0 MB
<b>Maximum database cache</b>	512.0 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 (c:\sg1db)	0.011	0.005	124.572	119.876	(n/a)
Database (c:\sg2db)	0.011	0.005	122.977	118.881	(n/a)
Log (C:\SG1LG)	0.000	0.001	0.000	74.152	11291.351
Log (C:\SG2LG)	0.000	0.001	0.000	74.008	11268.294

## Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	1.858	0.365	9.480
Available MBytes	14680.562	14666.000	15146.000
Free System Page Table Entries	16757023.000	16757023.000	16757023.000
Transition Pages RePurposed/sec	6.518	0.000	763.320
Pool Nonpaged Bytes	59480842.240	58859520.000	59506688.000
Pool Paged Bytes	262248865.792	262193152.000	262746112.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

## Test Log

3/30/2007 2:45:47 PM -- Command Line: "C:\PROGRA~1\EXCHAN~1\jetstresscmd.exe" /c "C:\Jetstress Testing\REDO\3Thread ESRP\perf\3tperf.xml"

3/30/2007 2:45:47 PM -- Jetstress testing begins ...

3/30/2007 2:45:47 PM -- Prepare testing begins ...

3/30/2007 2:45:48 PM -- Attaching databases ...

3/30/2007 2:45:48 PM -- Prepare testing ends.

3/30/2007 2:45:48 PM -- Dispatching transactions begins ...

3/30/2007 2:45:48 PM -- Database cache settings: (minimum: 64.0 MB, maximum: 512.0 MB)

3/30/2007 2:45:48 PM -- Database flush thresholds: (start: 5.1 MB, stop: 10.2 MB)

3/30/2007 2:45:48 PM -- Database read latency thresholds: (average: 0.02 seconds/read, maximum: 0.05 seconds/read).

3/30/2007 2:45:48 PM -- Log write latency thresholds: (average: 0.01 seconds/write, maximum: 0.05 seconds/write).

3/30/2007 2:45:49 PM -- Operation mix: Sessions 3, Inserts 25%, Deletes 10%, Replaces 50%, Reads 15%, Lazy Commits 80%.

3/30/2007 2:45:49 PM -- Performance logging begins (interval: 15000 ms).

3/30/2007 2:45:49 PM -- Attaining prerequisites:

3/30/2007 2:51:04 PM -- \Database(JetstressCmd)\Database Cache Size, Last: 483721200.0 (lower bound: 483183800.0, upper bound: none)

3/30/2007 4:51:05 PM -- Performance logging ends.

3/30/2007 4:51:05 PM -- JetInterop batch transaction stats: 55528, and 55218.

3/30/2007 4:51:05 PM -- Dispatching transactions ends.

3/30/2007 4:51:05 PM -- Shutting down databases ...

3/30/2007 4:51:07 PM -- Instance3336.1 (complete), and Instance3336.2 (complete)

3/30/2007 4:51:07 PM -- Performance logging begins (interval: 15000 ms).  
 3/30/2007 4:51:07 PM -- Verifying database checksums ...  
 3/30/2007 5:23:04 PM -- c:\sg1db (100% processed), and c:\sg2db (100% processed)  
 3/30/2007 5:23:05 PM -- Performance logging ends.  
 3/30/2007 5:23:05 PM -- [C:\Jetstress Testing\REDO\3Thread ESRP\perf\DBChecksum\\_2007\\_3\\_30\\_16\\_51\\_7.blg](#) has 127 samples.  
 3/30/2007 5:23:06 PM -- [C:\Jetstress Testing\REDO\3Thread ESRP\perf\DBChecksum\\_2007\\_3\\_30\\_16\\_51\\_7.html](#) is saved.  
 3/30/2007 5:23:06 PM -- Verifying log checksums ...  
 3/30/2007 5:23:08 PM -- C:\SG1LG (22 logs passed), and C:\SG2LG (22 logs passed)  
 3/30/2007 5:23:08 PM -- [C:\Jetstress Testing\REDO\3Thread ESRP\perf\Performance\\_2007\\_3\\_30\\_14\\_45\\_48.blg](#) has 500 samples.  
 3/30/2007 5:23:08 PM -- Creating test report ...  
 3/30/2007 5:23:10 PM -- Volume c:\sg1db has 0.0105 for Avg. Disk sec/Read.  
 3/30/2007 5:23:10 PM -- Volume c:\sg2db has 0.0108 for Avg. Disk sec/Read.  
 3/30/2007 5:23:10 PM -- Volume C:\SG1LG has 0.0013 for Avg. Disk sec/Write.  
 3/30/2007 5:23:10 PM -- Volume C:\SG1LG has 0.0000 for Avg. Disk sec/Read.  
 3/30/2007 5:23:10 PM -- Volume C:\SG2LG has 0.0013 for Avg. Disk sec/Write.  
 3/30/2007 5:23:10 PM -- Volume C:\SG2LG has 0.0000 for Avg. Disk sec/Read.  
 3/30/2007 5:23:10 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.  
 3/30/2007 5:23:10 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
c:\sg1db\Jetstress1.edb	12861538	0	0	0	2176 MBytes / 1888 seconds
c:\sg2db\Jetstress1.edb	12862306	0	0	0	2182 MBytes / 1916 seconds
(Sum)	25723844	0	0	0	263 MBytes / 3805 seconds

Disk Subsystem Performance (of checksum)

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec
c:\sg1db	0.081	0.001	846.570	0.002
c:\sg2db	0.084	0.001	837.097	0.002

Memory System Performance (of checksum)

Counter	Average	Minimum	Maximum
% Processor Time	10.854	0.938	13.334
Available MBytes	15083.157	15078.000	15146.000
Free System Page Table Entries	16757023.000	16757023.000	16757023.000
Transition Pages RePurposed/sec	0.000	0.000	0.000

Pool Nonpaged Bytes	64317069.102	63578112.000	65114112.000
Pool Paged Bytes	262245625.953	262189056.000	262733824.000

## Test Log

3/30/2007 2:45:47 PM -- Command Line: "C:\PROGRA~1\EXCHAN~1\jetstresscmd.exe" /c "C:\Jetstress Testing\REDO\3Thread ESRP\perf\3tperf.xml"

3/30/2007 2:45:47 PM -- Jetstress testing begins ...

3/30/2007 2:45:47 PM -- Prepare testing begins ...

3/30/2007 2:45:48 PM -- Attaching databases ...

3/30/2007 2:45:48 PM -- Prepare testing ends.

3/30/2007 2:45:48 PM -- Dispatching transactions begins ...

3/30/2007 2:45:48 PM -- Database cache settings: (minimum: 64.0 MB, maximum: 512.0 MB)

3/30/2007 2:45:48 PM -- Database flush thresholds: (start: 5.1 MB, stop: 10.2 MB)

3/30/2007 2:45:48 PM -- Database read latency thresholds: (average: 0.02 seconds/read, maximum: 0.05 seconds/read).

3/30/2007 2:45:48 PM -- Log write latency thresholds: (average: 0.01 seconds/write, maximum: 0.05 seconds/write).

3/30/2007 2:45:49 PM -- Operation mix: Sessions 3, Inserts 25%, Deletes 10%, Replaces 50%, Reads 15%, Lazy Commits 80%.

3/30/2007 2:45:49 PM -- Performance logging begins (interval: 15000 ms).

3/30/2007 2:45:49 PM -- Attaining prerequisites:

3/30/2007 2:51:04 PM -- \Database(JetstressCmd)\Database Cache Size, Last: 483721200.0 (lower bound: 483183800.0, upper bound: none)

3/30/2007 4:51:05 PM -- Performance logging ends.

3/30/2007 4:51:05 PM -- JetInterop batch transaction stats: 55528, and 55218.

3/30/2007 4:51:05 PM -- Dispatching transactions ends.

3/30/2007 4:51:05 PM -- Shutting down databases ...

3/30/2007 4:51:07 PM -- Instance3336.1 (complete), and Instance3336.2 (complete)

3/30/2007 4:51:07 PM -- Performance logging begins (interval: 15000 ms).

3/30/2007 4:51:07 PM -- Verifying database checksums ...

3/30/2007 5:23:04 PM -- c:\sg1db (100% processed), and c:\sg2db (100% processed)

3/30/2007 5:23:05 PM -- Performance logging ends.

3/30/2007 5:23:05 PM -- [C:\Jetstress Testing\REDO\3Thread ESRP\perf\DBChecksum\\_2007\\_3\\_30\\_16\\_51\\_7.blg](#) has 127 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
Instance3848.1	100478.77	01:33:47	17.85
Instance3848.2	100484.77	01:59:35	14.00

Jetstress System Parameters

Thread count	3 (per-storage group)
Log buffers	9000
Minimum database cache	64.0 MB
Maximum database cache	512.0 MB
Insert operations	25%
Delete operations	10%
Replace operations	50%
Read operations	15%
Lazy commits	80%

Disk Subsystem Performance

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec	Avg. Disk Bytes/Write
Database (c:\sg1db)	0.003	0	112.039	0.012	(n/a)
Database (c:\sg2db)	0.006	0	112.094	0.005	(n/a)
Log (c:\sg1lg)	0.000	0.000	0.000	0.015	186.445
Log (c:\sg2lg)	0.000	0.000	0.000	0.006	76.190

Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	32.954	11.172	69.404
Available MBytes	15143.939	14994.000	15359.000
Free System Page Table Entries	16757023.000	16757023.000	16757023.000
Transition Pages RePurposed/sec	6670.133	0.000	14037.479
Pool Nonpaged Bytes	59896666.700	59830272.000	60477440.000

Pool Paged Bytes	289137782.071	58847232.000	451317760.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

## Test Log

3/30/2007 5:29:00 PM -- Command Line: "C:\PROGRA~1\EXCHAN~1\jetstresscmd.exe" /c "C:\Jetstress Testing\REDO\3Thread ESRP\b2d\b2d3t.xml"

3/30/2007 5:29:00 PM -- Jetstress testing begins ...

3/30/2007 5:29:00 PM -- Prepare testing begins ...

3/30/2007 5:29:00 PM -- Attaching databases ...

3/30/2007 5:29:00 PM -- Prepare testing ends.

3/30/2007 5:29:01 PM -- Performance logging begins (interval: 15000 ms).

3/30/2007 5:29:01 PM -- Streaming backup databases ...

3/30/2007 7:28:37 PM -- Performance logging ends.

3/30/2007 7:28:37 PM -- Instance3848.1 (100% processed), and Instance3848.2 (100% processed)

3/30/2007 7:28:37 PM -- [C:\Jetstress Testing\REDO\3Thread ESRP\b2d\StreamingBackup\\_2007\\_3\\_30\\_17\\_29\\_0.blg](#) has 477 samples.

3/30/2007 7:28:38 PM -- Creating test report ...

## Appendix D: Soft Recovery Testing

### SoftRecovery Test Result Report

Soft-Recovery Statistics - All

Database Instance	Log files replayed	Elapsed seconds
Instance1720.1	508	252.2516144
Instance1720.2	500	224.5014368

Disk Subsystem Performance

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec	Avg. Disk Bytes/Write
Database (c:\sg1db)	0.129	0.047	546.237	8.174	(n/a)
Database (c:\sg2db)	0.073	0.026	558.050	8.181	(n/a)
Log (c:\sg1lg)	0.001	0.001	66.937	2.061	4019.712
Log (c:\sg2lg)	0.001	0.001	65.611	2.237	4207.126

Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	4.636	0.196	7.813
Available MBytes	14696.325	14614.000	15140.000
Free System Page Table Entries	16757013.000	16757013.000	16757013.000
Transition Pages RePurposed/sec	44.816	0.000	1751.923
Pool Nonpaged Bytes	61889162.159	61145088.000	63221760.000
Pool Paged Bytes	261734855.111	261480448.000	262008832.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log

```

3/30/2007 7:59:39 PM -- Command Line: "C:\PROGRA~1\EXCHAN~1\jetstresscmd.exe" /c
"C:\Jetstress Testing\REDO\3Thread ESRP\soft\Soft3t.xml"
3/30/2007 7:59:39 PM -- Jetstress testing begins ...
3/30/2007 7:59:39 PM -- Prepare testing begins ...
3/30/2007 7:59:40 PM -- Attaching databases ...
3/30/2007 7:59:40 PM -- Prepare testing ends.
3/30/2007 7:59:40 PM -- Dispatching transactions begins ...
3/30/2007 7:59:40 PM -- Database cache settings: (minimum: 64.0 MB, maximum: 512.0 MB)
3/30/2007 7:59:40 PM -- Database flush thresholds: (start: 5.1 MB, stop: 10.2 MB)
3/30/2007 7:59:40 PM -- Database read latency thresholds: (average: 0.02 seconds/read,
maximum: 0.05 seconds/read).

```

3/30/2007 7:59:40 PM -- Log write latency thresholds: (average: 0.01 seconds/write, maximum: 0.05 seconds/write).

3/30/2007 7:59:41 PM -- Operation mix: Sessions 3, Inserts 25%, Deletes 10%, Replaces 50%, Reads 15%, Lazy Commits 80%.

3/30/2007 7:59:41 PM -- Performance logging begins (interval: 15000 ms).

3/30/2007 7:59:41 PM -- Generating log files ...

3/30/2007 8:23:12 PM -- c:\sg1lg (101.6% generated), and c:\sg2lg (100.2% generated)

3/30/2007 8:23:13 PM -- Performance logging ends.

3/30/2007 8:23:13 PM -- JetInterop batch transaction stats: 9971, and 10148.

3/30/2007 8:23:13 PM -- Dispatching transactions ends.

3/30/2007 8:23:13 PM -- Shutting down databases ...

3/30/2007 8:23:15 PM -- Instance1720.1 (complete), and Instance1720.2 (complete)

3/30/2007 8:23:16 PM -- Performance logging begins (interval: 15000 ms).

3/30/2007 8:23:16 PM -- Verifying database checksums ...

3/30/2007 8:55:08 PM -- c:\sg1db (100% processed), and c:\sg2db (100% processed)

3/30/2007 8:55:09 PM -- Performance logging ends.

3/30/2007 8:55:09 PM -- [C:\Jetstress Testing\REDO\3Thread ESRP\soft\DBChecksum 2007\\_3\\_30\\_20\\_23\\_15.blg](#) has 127 samples.

3/30/2007 8:55:10 PM -- [C:\Jetstress Testing\REDO\3Thread ESRP\soft\DBChecksum 2007\\_3\\_30\\_20\\_23\\_15.html](#) is saved.

3/30/2007 8:55:10 PM -- Verifying log checksums ...

3/30/2007 8:55:20 PM -- c:\sg1lg (100 logs passed), and c:\sg2lg (100 logs passed)

3/30/2007 8:55:20 PM -- [C:\Jetstress Testing\REDO\3Thread ESRP\soft\Performance 2007\\_3\\_30\\_19\\_59\\_40.blg](#) has 94 samples.

3/30/2007 8:55:20 PM -- Creating test report ...

3/30/2007 8:55:20 PM -- Volume c:\sg1db has 0.0099 for Avg. Disk sec/Read.

3/30/2007 8:55:20 PM -- Volume c:\sg2db has 0.0100 for Avg. Disk sec/Read.

3/30/2007 8:55:20 PM -- Volume c:\sg1lg has 0.0013 for Avg. Disk sec/Write.

3/30/2007 8:55:20 PM -- Volume c:\sg1lg has 0.0001 for Avg. Disk sec/Read.

3/30/2007 8:55:20 PM -- Volume c:\sg2lg has 0.0013 for Avg. Disk sec/Write.

3/30/2007 8:55:20 PM -- Volume c:\sg2lg has 0.0000 for Avg. Disk sec/Read.

3/30/2007 8:55:20 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.

3/30/2007 8:55:20 PM -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.

3/30/2007 8:55:20 PM -- [C:\Jetstress Testing\REDO\3Thread ESRP\soft\Performance 2007\\_3\\_30\\_19\\_59\\_40.html](#) is saved.

3/30/2007 8:55:21 PM -- Performance logging begins (interval: 2000 ms).

3/30/2007 8:55:21 PM -- Recovering databases ...

3/30/2007 8:59:34 PM -- Performance logging ends.

3/30/2007 8:59:34 PM -- Instance1720.1 (252.2516144), and Instance1720.2 (224.5014368)

3/30/2007 8:59:34 PM -- [C:\Jetstress Testing\REDO\3Thread ESRP\soft\SoftRecovery 2007\\_3\\_30\\_20\\_55\\_20.blg](#) has 126 samples.

3/30/2007 8:59:34 PM -- Creating test report ...

## Performance Test Result Report

### Test Summary

<b>Overall Test Result</b>	Pass
<b>Machine Name</b>	72D77C1
<b>Test Description</b>	
<b>Test Start Time</b>	3/30/2007 7:59:39 PM
<b>Test End Time</b>	3/30/2007 8:23:15 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 Service Pack 1 (5.2.3790.65536)
<b>Performance Log</b>	<a href="C:\Jetstress Testing\REDO\3ThreadESRP\soft\Performance_2007_3_30_19_59_40.blg">C:\Jetstress Testing\REDO\3ThreadESRP\soft\Performance_2007_3_30_19_59_40.blg</a> <a href="C:\Jetstress Testing\REDO\3ThreadESRP\soft\DBChecksum_2007_3_30_20_23_15.blg">C:\Jetstress Testing\REDO\3ThreadESRP\soft\DBChecksum_2007_3_30_20_23_15.blg</a>

### Database Sizing and Throughput

<b>Achieved I/O per Second</b>	490.367
<b>Capacity Percentage</b>	100%
<b>Throughput Percentage</b>	100%
<b>Initial database size</b>	210729730048
<b>Final database size</b>	211516162048
<b>Database files (count)</b>	2

### Jetstress System Parameters

<b>Thread count</b>	3 (per-storage group)
<b>Log buffers</b>	9000
<b>Minimum database cache</b>	64.0 MB
<b>Maximum database cache</b>	512.0 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 (c:\sg1db)	0.010	0.005	130.656	115.110	(n/a)
Database (c:\sg2db)	0.010	0.005	131.425	113.177	(n/a)
Log (c:\sg1lg)	0	0.001	0.001	71.517	11207.977
Log (c:\sg2lg)	0.000	0.001	0.000	73.071	10864.168

## Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	1.930	0.834	4.636
Available MBytes	14694.543	14635.000	15116.000
Free System Page Table Entries	16757023.000	16757023.000	16757023.000
Transition Pages RePurposed/sec	90.283	0.000	507.485
Pool Nonpaged Bytes	60002521.872	59133952.000	60047360.000
Pool Paged Bytes	261438180.766	261398528.000	261922816.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

## Test Log

3/30/2007 7:59:39 PM -- Command Line: "C:\PROGRA~1\EXCHAN~1\jetstresscmd.exe" /c "C:\Jetstress Testing\REDO\3Thread ESRP\soft\Soft3t.xml"

3/30/2007 7:59:39 PM -- Jetstress testing begins ...

3/30/2007 7:59:39 PM -- Prepare testing begins ...

3/30/2007 7:59:40 PM -- Attaching databases ...

3/30/2007 7:59:40 PM -- Prepare testing ends.

3/30/2007 7:59:40 PM -- Dispatching transactions begins ...

3/30/2007 7:59:40 PM -- Database cache settings: (minimum: 64.0 MB, maximum: 512.0 MB)

3/30/2007 7:59:40 PM -- Database flush thresholds: (start: 5.1 MB, stop: 10.2 MB)

3/30/2007 7:59:40 PM -- Database read latency thresholds: (average: 0.02 seconds/read, maximum: 0.05 seconds/read).

3/30/2007 7:59:40 PM -- Log write latency thresholds: (average: 0.01 seconds/write, maximum: 0.05 seconds/write).

3/30/2007 7:59:41 PM -- Operation mix: Sessions 3, Inserts 25%, Deletes 10%, Replaces 50%, Reads 15%, Lazy Commits 80%.

3/30/2007 7:59:41 PM -- Performance logging begins (interval: 15000 ms).

3/30/2007 7:59:41 PM -- Generating log files ...

3/30/2007 8:23:12 PM -- c:\sg1lg (101.6% generated), and c:\sg2lg (100.2% generated)

3/30/2007 8:23:13 PM -- Performance logging ends.

3/30/2007 8:23:13 PM -- JetInterop batch transaction stats: 9971, and 10148.

3/30/2007 8:23:13 PM -- Dispatching transactions ends.

3/30/2007 8:23:13 PM -- Shutting down databases ...

3/30/2007 8:23:15 PM -- Instance1720.1 (complete), and Instance1720.2 (complete)

3/30/2007 8:23:16 PM -- Performance logging begins (interval: 15000 ms).

3/30/2007 8:23:16 PM -- Verifying database checksums ...

3/30/2007 8:55:08 PM -- c:\sg1db (100% processed), and c:\sg2db (100% processed)

3/30/2007 8:55:09 PM -- Performance logging ends.  
3/30/2007 8:55:09 PM -- [C:\Jetstress Testing\REDO\3Thread  
ESRP\soft\DBChecksum\\_2007\\_3\\_30\\_20\\_23\\_15.blg](#) has 127 samples.  
3/30/2007 8:55:10 PM -- [C:\Jetstress Testing\REDO\3Thread  
ESRP\soft\DBChecksum\\_2007\\_3\\_30\\_20\\_23\\_15.html](#) is saved.  
3/30/2007 8:55:10 PM -- Verifying log checksums ...  
3/30/2007 8:55:20 PM -- c:\sg1lg (100 logs passed), and c:\sg2lg (100 logs passed)  
3/30/2007 8:55:20 PM -- [C:\Jetstress Testing\REDO\3Thread  
ESRP\soft\Performance\\_2007\\_3\\_30\\_19\\_59\\_40.blg](#) has 94 samples.  
3/30/2007 8:55:20 PM -- Creating test report ...  
3/30/2007 8:55:20 PM -- Volume c:\sg1db has 0.0099 for Avg. Disk sec/Read.  
3/30/2007 8:55:20 PM -- Volume c:\sg2db has 0.0100 for Avg. Disk sec/Read.  
3/30/2007 8:55:20 PM -- Volume c:\sg1lg has 0.0013 for Avg. Disk sec/Write.  
3/30/2007 8:55:20 PM -- Volume c:\sg1lg has 0.0001 for Avg. Disk sec/Read.  
3/30/2007 8:55:20 PM -- Volume c:\sg2lg has 0.0013 for Avg. Disk sec/Write.  
3/30/2007 8:55:20 PM -- Volume c:\sg2lg has 0.0000 for Avg. Disk sec/Read.  
3/30/2007 8:55:20 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.  
3/30/2007 8:55:20 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
c:\sg1db\Jetstress1.edb	12910434	0	0	0	2558 MBytes / 1873 seconds
c:\sg2db\Jetstress1.edb	12909410	0	0	0	2550 MBytes / 1911 seconds
(Sum)	25819844	0	0	0	1013 MBytes / 3784 seconds

Disk Subsystem Performance (of checksum)

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec
c:\sg1db	0.080	0	850.010	0.002
c:\sg2db	0.084	0.000	841.117	0.006

Memory System Performance (of checksum)

Counter	Average	Minimum	Maximum
% Processor Time	12.451	0.339	15.756
Available MBytes	15054.118	15047.000	15117.000
Free System Page Table Entries	16757013.000	16757013.000	16757013.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	65640044.850	64630784.000	66674688.000
Pool Paged Bytes	261351407.874	261320704.000	261849088.000

Test Log

3/30/2007 7:59:39 PM -- Command Line: "C:\PROGRA~1\EXCHAN~1\jetstresscmd.exe" /c "C:\Jetstress Testing\REDO\3Thread ESRP\soft\Soft3t.xml"  
 3/30/2007 7:59:39 PM -- Jetstress testing begins ...  
 3/30/2007 7:59:39 PM -- Prepare testing begins ...  
 3/30/2007 7:59:40 PM -- Attaching databases ...  
 3/30/2007 7:59:40 PM -- Prepare testing ends.  
 3/30/2007 7:59:40 PM -- Dispatching transactions begins ...  
 3/30/2007 7:59:40 PM -- Database cache settings: (minimum: 64.0 MB, maximum: 512.0 MB)  
 3/30/2007 7:59:40 PM -- Database flush thresholds: (start: 5.1 MB, stop: 10.2 MB)  
 3/30/2007 7:59:40 PM -- Database read latency thresholds: (average: 0.02 seconds/read, maximum: 0.05 seconds/read).  
 3/30/2007 7:59:40 PM -- Log write latency thresholds: (average: 0.01 seconds/write, maximum: 0.05 seconds/write).  
 3/30/2007 7:59:41 PM -- Operation mix: Sessions 3, Inserts 25%, Deletes 10%, Replaces 50%, Reads 15%, Lazy Commits 80%.

3/30/2007 7:59:41 PM -- Performance logging begins (interval: 15000 ms).  
3/30/2007 7:59:41 PM -- Generating log files ...  
3/30/2007 8:23:12 PM -- c:\sg1lg (101.6% generated), and c:\sg2lg (100.2% generated)  
3/30/2007 8:23:13 PM -- Performance logging ends.  
3/30/2007 8:23:13 PM -- JetInterop batch transaction stats: 9971, and 10148.  
3/30/2007 8:23:13 PM -- Dispatching transactions ends.  
3/30/2007 8:23:13 PM -- Shutting down databases ...  
3/30/2007 8:23:15 PM -- Instance1720.1 (complete), and Instance1720.2 (complete)  
3/30/2007 8:23:16 PM -- Performance logging begins (interval: 15000 ms).  
3/30/2007 8:23:16 PM -- Verifying database checksums ...  
3/30/2007 8:55:08 PM -- c:\sg1db (100% processed), and c:\sg2db (100% processed)  
3/30/2007 8:55:09 PM -- Performance logging ends.  
3/30/2007 8:55:09 PM -- [C:\Jetstress Testing\REDO\3Thread](#)  
[ESRP\soft\DBChecksum\\_2007\\_3\\_30\\_20\\_23\\_15.blg](#) has 127 samples.

## Appendix E: Maximum Solution IOPS Testing

The purpose of this test is to verify the storage configuration which the customer is planning to deploy. The test run has been successful, which means that the database read latency and log write latency are below 20ms; Database page fault stalls/sec is 0. However, Microsoft strongly recommends that you perform further validation of this storage solution (additional task listed below).

You should refer to the table below to determine if the actual disk IO (achieved IO) has exceeded the targeted IO (expected IO). If not, you may want to increase the thread count to increase the load, provided that the disk latency will not exceed the threshold.

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

#### Test Summary

<b>Overall Test Result</b>	<b>Pass</b>
<b>Machine Name</b>	72D77C1
<b>Test Description</b>	
<b>Test Start Time</b>	3/18/2007 12:01:17 PM
<b>Test End Time</b>	3/18/2007 2:05:10 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 Service Pack 1 (5.2.3790.65536)
<b>Performance Log</b>	<a href="#">C:\Documents and Settings\Administrator.E2K71\Desktop\Jestress Testing\OFFICIAL\Perf Storage 9t\Performance 2007 3 18 12 1 18.blg</a> <a href="#">C:\Documents and Settings\Administrator.E2K71\Desktop\Jestress Testing\OFFICIAL\Perf Storage 9t\DBChecksum 2007 3 18 14 5 10.blg</a>

#### Database Sizing and Throughput

<b>Achieved I/O per Second</b>	755.069
<b>Capacity Percentage</b>	100%
<b>Throughput Percentage</b>	100%
<b>Initial database size</b>	252784181248
<b>Final database size</b>	257540096000
<b>Database files (count)</b>	2

## Jetstress System Parameters

<b>Thread count</b>	9 (per-storage group)
<b>Log buffers</b>	9000
<b>Minimum database cache</b>	64.0 MB
<b>Maximum database cache</b>	512.0 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 (C:\SG1DB)	0.017	0.005	158.350	233.341	(n/a)
Database (c:\sg2db)	0.018	0.006	158.717	204.661	(n/a)
Log (C:\SG1LG)	0.000	0.002	0.000	71.013	12049.289
Log (C:\SG2LG)	0.000	0.002	0.000	71.708	12081.771

## Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	2.834	0.680	8.518
Available MBytes	14933.221	14912.000	15373.000
Free System Page Table Entries	16758835.000	16758835.000	16758835.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	90517213.798	89858048.000	90767360.000
Pool Paged Bytes	45685871.935	45662208.000	46489600.000
Database Page Fault Stalls/sec	0.000	0.000	0.133

## Test Log

3/18/2007 12:01:17 PM -- Jetstress testing begins ...  
 3/18/2007 12:01:17 PM -- Prepare testing begins ...  
 3/18/2007 12:01:17 PM -- Attaching databases ...  
 3/18/2007 12:01:17 PM -- Prepare testing ends.  
 3/18/2007 12:01:17 PM -- Dispatching transactions begins ...  
 3/18/2007 12:01:17 PM -- Database cache settings: (minimum: 64.0 MB, maximum: 512.0 MB)

3/18/2007 12:01:17 PM -- Database flush thresholds: (start: 5.1 MB, stop: 10.2 MB)  
3/18/2007 12:01:18 PM -- Database read latency thresholds: (average: 0.02 seconds/read, maximum: 0.05 seconds/read).  
3/18/2007 12:01:18 PM -- Log write latency thresholds: (average: 0.01 seconds/write, maximum: 0.05 seconds/write).  
3/18/2007 12:01:18 PM -- Operation mix: Sessions 9, Inserts 25%, Deletes 10%, Replaces 50%, Reads 15%, Lazy Commits 80%.  
3/18/2007 12:01:18 PM -- Performance logging begins (interval: 15000 ms).  
3/18/2007 12:01:18 PM -- Attaining prerequisites:  
3/18/2007 12:04:53 PM -- \Database(JetstressWin)\Database Cache Size, Last: 485351400.0 (lower bound: 483183800.0, upper bound: none)  
3/18/2007 2:04:54 PM -- Performance logging ends.  
3/18/2007 2:04:54 PM -- JetInterop batch transaction stats: 59875, and 59830.  
3/18/2007 2:05:07 PM -- Dispatching transactions ends.  
3/18/2007 2:05:07 PM -- Shutting down databases ...  
3/18/2007 2:05:10 PM -- Instance768.1 (complete), and Instance768.2 (complete)  
3/18/2007 2:05:11 PM -- Performance logging begins (interval: 15000 ms).  
3/18/2007 2:05:11 PM -- Verifying database checksums ...  
3/18/2007 2:44:12 PM -- C:\SG1DB (100% processed), and c:\sg2db (100% processed)  
3/18/2007 2:44:13 PM -- Performance logging ends.  
3/18/2007 2:44:13 PM -- [C:\Documents and Settings\Administrator.E2K71\Desktop\Jestress Testing\OFFICIAL\Perf Storage 9t\DBChecksum 2007\\_3\\_18\\_14\\_5\\_10.blg](#) has 156 samples.  
3/18/2007 2:44:14 PM -- [C:\Documents and Settings\Administrator.E2K71\Desktop\Jestress Testing\OFFICIAL\Perf Storage 9t\DBChecksum 2007\\_3\\_18\\_14\\_5\\_10.html](#) is saved.  
3/18/2007 2:44:14 PM -- Verifying log checksums ...  
3/18/2007 2:44:16 PM -- C:\SG1LG (22 logs passed), and C:\SG2LG (22 logs passed)  
3/18/2007 2:44:16 PM -- [C:\Documents and Settings\Administrator.E2K71\Desktop\Jestress Testing\OFFICIAL\Perf Storage 9t\Performance 2007\\_3\\_18\\_12\\_1\\_18.blg](#) has 494 samples.  
3/18/2007 2:44:16 PM -- Creating test report ...  
3/18/2007 2:44:17 PM -- Volume C:\SG1DB has 0.0175 for Avg. Disk sec/Read.  
3/18/2007 2:44:17 PM -- Volume c:\sg2db has 0.0177 for Avg. Disk sec/Read.  
3/18/2007 2:44:17 PM -- Volume C:\SG1LG has 0.0019 for Avg. Disk sec/Write.  
3/18/2007 2:44:17 PM -- Volume C:\SG1LG has 0.0000 for Avg. Disk sec/Read.  
3/18/2007 2:44:17 PM -- Volume C:\SG2LG has 0.0019 for Avg. Disk sec/Write.  
3/18/2007 2:44:17 PM -- Volume C:\SG2LG has 0.0000 for Avg. Disk sec/Read.  
3/18/2007 2:44:17 PM -- Test has 0.133248685625249 Maximum Database Page Fault Stalls/sec.

## Database Checksum Results

Checksum Statistics - All

Database	Seen pages	Bad pages	Correctable pages	Wrong page no pages	File length / seconds taken
C:\SG1DB\Jetstress1.edb	15719000	0	0	0	4020 MBytes / 2310 seconds
c:\sg2db\Jetstress1.edb	15719000	0	0	0	4020 MBytes / 2340 seconds
(Sum)	31438000	0	0	0	3945 MBytes / 4651 seconds

### Disk Subsystem Performance (of checksum)

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec
C:\SG1DB	0.080	0.000	839.994	0.001
c:\sg2db	0.082	0.001	838.973	0.003

### Memory System Performance (of checksum)

Counter	Average	Minimum	Maximum
% Processor Time	11.157	2.034	13.466
Available MBytes	15340.385	15334.000	15404.000
Free System Page Table Entries	16758834.192	16758793.000	16758835.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	93574564.103	92676096.000	94560256.000
Pool Paged Bytes	45696236.308	45670400.000	46198784.000

### Test Log

3/18/2007 12:01:17 PM -- Jetstress testing begins ...  
 3/18/2007 12:01:17 PM -- Prepare testing begins ...  
 3/18/2007 12:01:17 PM -- Attaching databases ...  
 3/18/2007 12:01:17 PM -- Prepare testing ends.  
 3/18/2007 12:01:17 PM -- Dispatching transactions begins ...  
 3/18/2007 12:01:17 PM -- Database cache settings: (minimum: 64.0 MB, maximum: 512.0 MB)  
 3/18/2007 12:01:17 PM -- Database flush thresholds: (start: 5.1 MB, stop: 10.2 MB)  
 3/18/2007 12:01:18 PM -- Database read latency thresholds: (average: 0.02 seconds/read, maximum: 0.05 seconds/read).  
 3/18/2007 12:01:18 PM -- Log write latency thresholds: (average: 0.01 seconds/write, maximum: 0.05 seconds/write).  
 3/18/2007 12:01:18 PM -- Operation mix: Sessions 9, Inserts 25%, Deletes 10%, Replaces 50%, Reads 15%, Lazy Commits 80%.  
 3/18/2007 12:01:18 PM -- Performance logging begins (interval: 15000 ms).  
 3/18/2007 12:01:18 PM -- Attaining prerequisites:  
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 3/18/2007 2:05:07 PM -- Dispatching transactions ends.  
 3/18/2007 2:05:07 PM -- Shutting down databases ...  
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 3/18/2007 2:05:11 PM -- Performance logging begins (interval: 15000 ms).  
 3/18/2007 2:05:11 PM -- Verifying database checksums ...  
 3/18/2007 2:44:12 PM -- C:\SG1DB (100% processed), and c:\sg2db (100% processed)  
 3/18/2007 2:44:13 PM -- Performance logging ends.  
 3/18/2007 2:44:13 PM -- [C:\Documents and Settings\Administrator.E2K71\Desktop\Jestress Testing\OFFICIAL\Perf Storage 9t\DBChecksum 2007\\_3\\_18\\_14\\_5\\_10.blg](#) has 156 samples.