

ESRP Storage Program
EMC CX-3-20 (700 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 (700 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 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.mspx>

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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 CX3-20 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, which 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 700 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 700 users is profiled using a value of 1 IOPS per user and a 250 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 of 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

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 700 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 — 250 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	700
Number of hosts	1
Number of mailboxes/host	700
Number of storage groups/host	2
Number of mailbox stores/storage group	1
Number of mailboxes/mailbox store	250
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*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	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 – 60AC
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	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)	584 GB
Disk slice size (GB)	N/A
Number of slices per LUN or number of disks per LUN	N/A
Number of Luns per Raid Group	2
LUN Size in GB	120
Raid level	Raid 1_0
Total formatted capacity	24 GB

Disk Configuration (Streaming Backup to disk)

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	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 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 * 64) 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 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.mspx>

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 a Reliability test which 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 event log file? None
- Any errors reported in during the database and log checksum process? 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 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.

Database I/O	
Average Database Disk Transfers/sec	389.604
Average Database Disk Reads/sec	197.673
Average Database Disk Writes/sec	191.931
Average Database Disk Read Latency (ms)	9
Average Database Disk Write Latency (ms)	5
Transaction Log I/O	
Average Log Disk Writes/sec	126.501
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	16.96
MB read/sec total	33.92
File size/sec taken	200149.54/11973

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)	0.457910458
---	-------------

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)	200.14954
Time taken to backup each storage group	3:19:33
Average MB backed up/sec per storage group	16.96

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

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:

United States: (800) 782-4362 (SVC-4EMC)
Canada: (800) 543-4782 (543-4SVC)
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

Performance Stress Test Result Report

Test Summary

Overall Test Result	Pass
Machine Name	72D77C1
Test Description	
Test Start Time	5/13/2007 11:23:16 PM
Test End Time	5/14/2007 11:30:03 PM
Jetstress Version	08.01.0112.000
Ese Version	08.00.0685.024
Operating System	Microsoft Windows Server 2003 Service Pack 1 (5.2.3790.65536)
Performance Log	C:\Jetstress\2SG\2t\stress\Stress_2007_5_13_23_23_17.blg C:\Jetstress\2SG\2t\stress\DBChecksum_2007_5_14_23_30_3.blg

Database Sizing and Throughput

Achieved I/O per Second	372.51
Capacity Percentage	100%
Throughput Percentage	100%
Initial database size	206155841536
Final database size	243175030784
Database files (count)	2

Jetstress System Parameters

Thread count	2 (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 (s:\sg1db)	0.010	0.005	97.166	88.877	(n/a)
Database (s:\sg2db)	0.010	0.005	97.539	88.927	(n/a)
Log (s:\sg1lg)	0.000	0.001	0.000	55.841	10591.789
Log (s:\sg2lg)	0.000	0.001	0.000	55.870	10592.342

Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	1.415	0.000	9.375
Available MBytes	14829.966	14798.000	14904.000
Free System Page Table Entries	16758534.576	16758514.000	16758554.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	48278983.210	47673344.000	48545792.000
Pool Paged Bytes	49158579.480	48009216.000	50184192.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log

5/13/2007 11:23:16 PM -- Command Line: "C:\PROGRA~1\EXCHAN~1\jetstresscmd.exe" /c "C:\Jetstress\2SG\2t\stress\stress.xml"

5/13/2007 11:23:16 PM -- Jetstress testing begins ...

5/13/2007 11:23:16 PM -- Prepare testing begins ...

5/13/2007 11:23:17 PM -- Attaching databases ...

5/13/2007 11:23:17 PM -- Prepare testing ends.

5/13/2007 11:23:17 PM -- Dispatching transactions begins ...

5/13/2007 11:23:17 PM -- Database cache settings: (minimum: 64.0 MB, maximum: 512.0 MB)

5/13/2007 11:23:17 PM -- Database flush thresholds: (start: 5.1 MB, stop: 10.2 MB)

5/13/2007 11:23:17 PM -- Database read latency thresholds: (average: 0.02 seconds/read, maximum: 0.1 seconds/read).

5/13/2007 11:23:17 PM -- Log write latency thresholds: (average: 0.01 seconds/write, maximum: 0.1 seconds/write).

5/13/2007 11:23:18 PM -- Operation mix: Sessions 2, Inserts 25%, Deletes 10%, Replaces 50%, Reads 15%, Lazy Commits 80%.

5/13/2007 11:23:18 PM -- Performance logging begins (interval: 15000 ms).

5/13/2007 11:23:18 PM -- Attaining prerequisites:

5/13/2007 11:29:59 PM -- \Database(JetstressCmd)\Database Cache Size, Last: 483688400.0 (lower bound: 483183800.0, upper bound: none)

5/14/2007 11:30:00 PM -- Performance logging ends.

5/14/2007 11:30:00 PM -- JetInterop batch transaction stats: 450408, and 451283.

5/14/2007 11:30:00 PM -- Dispatching transactions ends.

5/14/2007 11:30:00 PM -- Shutting down databases ...

5/14/2007 11:30:03 PM -- Instance2240.1 (complete), and Instance2240.2 (complete)

5/14/2007 11:30:03 PM -- Performance logging begins (interval: 15000 ms).
 5/14/2007 11:30:03 PM -- Verifying database checksums ...
 5/15/2007 12:07:21 AM -- s:\sg1db (100% processed), and s:\sg2db (100% processed)
 5/15/2007 12:07:22 AM -- Performance logging ends.
 5/15/2007 12:07:22 AM -- C:\Jetstress\2SG\2t\stress\DBChecksum_2007_5_14_23_30_3.blg
 has 149 samples.
 5/15/2007 12:07:24 AM --
C:\Jetstress\2SG\2t\stress\DBChecksum_2007_5_14_23_30_3.html is saved.
 5/15/2007 12:07:24 AM -- Verifying log checksums ...
 5/15/2007 12:07:26 AM -- s:\sg1lg (22 logs passed), and s:\sg2lg (22 logs passed)
 5/15/2007 12:07:26 AM -- C:\Jetstress\2SG\2t\stress\Stress_2007_5_13_23_23_17.blg has
 5787 samples.
 5/15/2007 12:07:26 AM -- Creating test report ...
 5/15/2007 12:08:03 AM -- Volume s:\sg1db has 0.0095 for Avg. Disk sec/Read.
 5/15/2007 12:08:03 AM -- Volume s:\sg2db has 0.0097 for Avg. Disk sec/Read.
 5/15/2007 12:08:03 AM -- Volume s:\sg1lg has 0.0012 for Avg. Disk sec/Write.
 5/15/2007 12:08:03 AM -- Volume s:\sg1lg has 0.0000 for Avg. Disk sec/Read.
 5/15/2007 12:08:03 AM -- Volume s:\sg2lg has 0.0012 for Avg. Disk sec/Write.
 5/15/2007 12:08:03 AM -- Volume s:\sg2lg has 0.0000 for Avg. Disk sec/Read.
 5/15/2007 12:08:03 AM -- Test has 0 Maximum Database Page Fault Stalls/sec.
 5/15/2007 12:08:03 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
s:\sg1db\Jetstress1.edb	14841458	0	0	0	115948 MBytes / 2237 seconds
s:\sg2db\Jetstress1.edb	14842994	0	0	0	115960 MBytes / 2191 seconds
(Sum)	29684452	0	0	0	231909 MBytes / 2237 seconds

Disk Subsystem Performance (of checksum)

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec
s:\sg1db	0.082	0.001	830.944	0.002
s:\sg2db	0.082	0.000	849.485	0.001

Memory System Performance (of checksum)

Counter	Average	Minimum	Maximum
% Processor Time	10.646	3.044	13.800
Available MBytes	15229.208	15218.000	15292.000
Free System Page Table Entries	16758504.000	16758504.000	16758504.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	56315409.181	54845440.000	56545280.000
Pool Paged Bytes	51013618.255	50987008.000	51523584.000

Test Log

5/13/2007 11:23:16 PM -- Command Line: "C:\PROGRA~1\EXCHAN~1\jetstresscmd.exe" /c "C:\Jetstress\2SG\2t\stress\stress.xml"

5/13/2007 11:23:16 PM -- Jetstress testing begins ...

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5/13/2007 11:23:17 PM -- Database read latency thresholds: (average: 0.02 seconds/read, maximum: 0.1 seconds/read).

5/13/2007 11:23:17 PM -- Log write latency thresholds: (average: 0.01 seconds/write, maximum: 0.1 seconds/write).

5/13/2007 11:23:18 PM -- Operation mix: Sessions 2, Inserts 25%, Deletes 10%, Replaces 50%, Reads 15%, Lazy Commits 80%.

5/13/2007 11:23:18 PM -- Performance logging begins (interval: 15000 ms).

5/13/2007 11:23:18 PM -- Attaining prerequisites:

5/13/2007 11:29:59 PM -- \Database(JetstressCmd)\Database Cache Size, Last: 483688400.0 (lower bound: 483183800.0, upper bound: none)

5/14/2007 11:30:00 PM -- Performance logging ends.

5/14/2007 11:30:00 PM -- JetInterop batch transaction stats: 450408, and 451283.

5/14/2007 11:30:00 PM -- Dispatching transactions ends.

5/14/2007 11:30:00 PM -- Shutting down databases ...

5/14/2007 11:30:03 PM -- Instance2240.1 (complete), and Instance2240.2 (complete)

5/14/2007 11:30:03 PM -- Performance logging begins (interval: 15000 ms).

5/14/2007 11:30:03 PM -- Verifying database checksums ...

5/15/2007 12:07:21 AM -- s:\sg1db (100% processed), and s:\sg2db (100% processed)

5/15/2007 12:07:22 AM -- Performance logging ends.

5/15/2007 12:07:22 AM -- C:\Jetstress\2SG\2t\stress\DBCchecksum_2007_5_14_23_30_3.blg has 149 samples.

Appendix B: Performance Testing

Performance Test Result Report

Test Summary

Overall Test Result	Pass
Machine Name	72D77C1
Test Description	
Test Start Time	3/29/2007 8:34:03 PM
Test End Time	3/29/2007 10:40:56 PM
Jetstress Version	08.01.0075.000
Ese Version	08.00.0685.024
Operating System	Microsoft Windows Server 2003 Service Pack 1 (5.2.3790.65536)
Performance Log	C:\Jetstress Testing\REDO\2Thread ESRP\Perf 2t\Performance 2007 3 29 20 34 17.blg C:\Jetstress Testing\REDO\2Thread ESRP\Perf 2t\DBChecksum 2007 3 29 22 40 56.blg

Database Sizing and Throughput

Achieved I/O per Second	389.605
Capacity Percentage	100%
Throughput Percentage	100%
Initial database size	206153744384
Final database size	209876189184
Database files (count)	2

Jetstress System Parameters

Thread count	2 (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)	0.009	0.005	99.192	95.871	(n/a)
Database (c:\sg2db)	0.009	0.005	98.481	96.060	(n/a)
Log (c:\sg1lg)	0.000	0.001	0.000	63.032	10665.141
Log (c:\sg2lg)	0.000	0.001	0.000	63.469	10689.363

Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	1.450	0.287	4.428
Available MBytes	14373.346	14349.000	14849.000
Free System Page Table Entries	16757283.000	16757283.000	16757283.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	52732883.478	51904512.000	52760576.000
Pool Paged Bytes	464528995.162	464408576.000	465629184.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log

3/29/2007 8:34:03 PM -- Command Line:
 "C:\PROGRA~1\EXCHAN~1\jetstresscmd.exe" /c "C:\Jetstress
 Testing\REDO\2Thread ESRP\Perf 2t\perf2t.xml"
 3/29/2007 8:34:03 PM -- Jetstress testing begins ...
 3/29/2007 8:34:03 PM -- Prepare testing begins ...
 3/29/2007 8:34:17 PM -- Attaching databases ...
 3/29/2007 8:34:17 PM -- Prepare testing ends.
 3/29/2007 8:34:17 PM -- Dispatching transactions begins ...
 3/29/2007 8:34:17 PM -- Database cache settings: (minimum: 64.0 MB, maximum:
 512.0 MB)
 3/29/2007 8:34:17 PM -- Database flush thresholds: (start: 5.1 MB, stop: 10.2 MB)
 3/29/2007 8:34:17 PM -- Database read latency thresholds: (average: 0.02
 seconds/read, maximum: 0.05 seconds/read).
 3/29/2007 8:34:17 PM -- Log write latency thresholds: (average: 0.01 seconds/write,
 maximum: 0.05 seconds/write).
 3/29/2007 8:34:18 PM -- Operation mix: Sessions 2, Inserts 25%, Deletes 10%,
 Replaces 50%, Reads 15%, Lazy Commits 80%.
 3/29/2007 8:34:18 PM -- Performance logging begins (interval: 15000 ms).
 3/29/2007 8:34:18 PM -- Attaining prerequisites:
 3/29/2007 8:40:53 PM -- \Database(JetstressCmd)\Database Cache Size, Last:

484835300.0 (lower bound: 483183800.0, upper bound: none)
 3/29/2007 10:40:54 PM -- Performance logging ends.
 3/29/2007 10:40:54 PM -- JetInterop batch transaction stats: 44712, and 44858.
 3/29/2007 10:40:54 PM -- Dispatching transactions ends.
 3/29/2007 10:40:54 PM -- Shutting down databases ...
 3/29/2007 10:40:56 PM -- Instance2632.1 (complete), and Instance2632.2 (complete)
 3/29/2007 10:40:56 PM -- Performance logging begins (interval: 15000 ms).
 3/29/2007 10:40:56 PM -- Verifying database checksums ...
 3/29/2007 11:12:35 PM -- c:\sg1db (100% processed), and c:\sg2db (100% processed)
 3/29/2007 11:12:36 PM -- Performance logging ends.
 3/29/2007 11:12:36 PM -- [C:\Jetstress Testing\REDO\2Thread ESRP\Perf 2t\DBChecksum 2007 3 29 22 40 56.blg](#) has 126 samples.
 3/29/2007 11:12:37 PM -- [C:\Jetstress Testing\REDO\2Thread ESRP\Perf 2t\DBChecksum 2007 3 29 22 40 56.html](#) is saved.
 3/29/2007 11:12:37 PM -- Verifying log checksums ...
 3/29/2007 11:12:39 PM -- c:\sg1lg (22 logs passed), and c:\sg2lg (21 logs passed)
 3/29/2007 11:12:39 PM -- [C:\Jetstress Testing\REDO\2Thread ESRP\Perf 2t\Performance 2007 3 29 20 34 17.blg](#) has 506 samples.
 3/29/2007 11:12:39 PM -- Creating test report ...
 3/29/2007 11:12:41 PM -- Volume c:\sg1db has 0.0091 for Avg. Disk sec/Read.
 3/29/2007 11:12:41 PM -- Volume c:\sg2db has 0.0093 for Avg. Disk sec/Read.
 3/29/2007 11:12:41 PM -- Volume c:\sg1lg has 0.0011 for Avg. Disk sec/Write.
 3/29/2007 11:12:41 PM -- Volume c:\sg1lg has 0.0000 for Avg. Disk sec/Read.
 3/29/2007 11:12:41 PM -- Volume c:\sg2lg has 0.0011 for Avg. Disk sec/Write.
 3/29/2007 11:12:41 PM -- Volume c:\sg2lg has 0.0000 for Avg. Disk sec/Read.
 3/29/2007 11:12:41 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.
 3/29/2007 11:12:41 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	12807266	0	0	0	1752 MBytes / 1897 seconds
c:\sg2db\Jetstress1.edb	12812386	0	0	0	1792 MBytes / 1898 seconds
(Sum)	25619652	0	0	0	3545 MBytes / 3795 seconds

Disk Subsystem Performance (of checksum)

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec
c:\sg1db	0.082	0.000	846.335	0.000
c:\sg2db	0.082	0.000	845.446	0.002

Memory System Performance (of checksum)

Counter	Average	Minimum	Maximum
% Processor Time	11.002	8.794	14.506
Available MBytes	14767.698	14762.000	14770.000
Free System Page Table Entries	16757213.000	16757213.000	16757213.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	55839760.254	55656448.000	56127488.000
Pool Paged Bytes	465648786.286	465563648.000	466112512.000

Test Log

3/29/2007 8:34:03 PM -- Command Line:
 "C:\PROGRA~1\EXCHAN~1\jetstresscmd.exe" /c "C:\Jetstress
 Testing\REDO\2Thread ESRP\Perf 2t\perf2t.xml"
 3/29/2007 8:34:03 PM -- Jetstress testing begins ...
 3/29/2007 8:34:03 PM -- Prepare testing begins ...
 3/29/2007 8:34:17 PM -- Attaching databases ...
 3/29/2007 8:34:17 PM -- Prepare testing ends.
 3/29/2007 8:34:17 PM -- Dispatching transactions begins ...
 3/29/2007 8:34:17 PM -- Database cache settings: (minimum: 64.0 MB, maximum:
 512.0 MB)
 3/29/2007 8:34:17 PM -- Database flush thresholds: (start: 5.1 MB, stop: 10.2 MB)
 3/29/2007 8:34:17 PM -- Database read latency thresholds: (average: 0.02
 seconds/read, maximum: 0.05 seconds/read).
 3/29/2007 8:34:17 PM -- Log write latency thresholds: (average: 0.01 seconds/write,
 maximum: 0.05 seconds/write).
 3/29/2007 8:34:18 PM -- Operation mix: Sessions 2, Inserts 25%, Deletes 10%,
 Replaces 50%, Reads 15%, Lazy Commits 80%.
 3/29/2007 8:34:18 PM -- Performance logging begins (interval: 15000 ms).
 3/29/2007 8:34:18 PM -- Attaining prerequisites:
 3/29/2007 8:40:53 PM -- \Database(JetstressCmd)\Database Cache Size, Last:
 484835300.0 (lower bound: 483183800.0, upper bound: none)
 3/29/2007 10:40:54 PM -- Performance logging ends.
 3/29/2007 10:40:54 PM -- JetInterop batch transaction stats: 44712, and 44858.
 3/29/2007 10:40:54 PM -- Dispatching transactions ends.
 3/29/2007 10:40:54 PM -- Shutting down databases ...
 3/29/2007 10:40:56 PM -- Instance2632.1 (complete), and Instance2632.2
 (complete)
 3/29/2007 10:40:56 PM -- Performance logging begins (interval: 15000 ms).
 3/29/2007 10:40:56 PM -- Verifying database checksums ...
 3/29/2007 11:12:35 PM -- c:\sg1db (100% processed), and c:\sg2db (100%
 processed)
 3/29/2007 11:12:36 PM -- Performance logging ends.
 3/29/2007 11:12:36 PM -- [C:\Jetstress Testing\REDO\2Thread ESRP\Perf
 2t\DBChecksum_2007_3_29_22_40_56.blg](#) has 126 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
Instance2588.1	100054.77	01:27:45	19.00
Instance2588.2	100094.77	01:51:48	14.92

Jetstress System Parameters

Thread count	2 (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	0.000	119.465	0.012	(n/a)
Database (c:\sg2db)	0.005	0	119.439	0.003	(n/a)
Log (c:\sg1lg)	0.000	0.000	0.000	0.016	198.635
Log (c:\sg2lg)	0.000	0	0.000	0.007	80.827

Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	34.418	9.428	60.603
Available MBytes	15158.659	14815.000	15378.000
Free System Page Table Entries	16757023.000	16757023.000	16757023.000
Transition Pages RePurposed/sec	7101.348	0.000	15940.929
Pool Nonpaged Bytes	55713764.448	53121024.000	58867712.000
Pool Paged Bytes	317122155.910	92844032.000	495382528.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log

3/30/2007 9:23:04 AM -- Command Line:
"C:\PROGRA~1\EXCHAN~1\jetstresscmd.exe" /c "C:\Jetstress
Testing\REDO\2Thread ESRP\b2d\b2d2t.xml"
3/30/2007 9:23:04 AM -- Jetstress testing begins ...
3/30/2007 9:23:04 AM -- Prepare testing begins ...
3/30/2007 9:23:04 AM -- Attaching databases ...
3/30/2007 9:23:04 AM -- Prepare testing ends.
3/30/2007 9:23:05 AM -- Performance logging begins (interval: 15000 ms).
3/30/2007 9:23:05 AM -- Streaming backup databases ...
3/30/2007 11:14:56 AM -- Performance logging ends.
3/30/2007 11:14:56 AM -- Instance2588.1 (100% processed), and Instance2588.2
(100% processed)
3/30/2007 11:14:57 AM -- [C:\Jetstress Testing\REDO\2Thread
ESRP\b2d\StreamingBackup_2007_3_30_9_23_4.blg](#) has 446 samples.
3/30/2007 11:14:58 AM -- Creating test report ...

Appendix D: Soft Recovery Testing

SoftRecovery Test Result Report

Soft-Recovery Statistics - All

Database Instance	Log files replayed	Elapsed seconds
Instance1416.1	500	239.5171579
Instance1416.2	503	219.7670315

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)	0.099	0.036	563.408	8.501	(n/a)
Database (c:\sg2db)	0.077	0.027	558.430	8.730	(n/a)
Log (c:\sg1lg)	0.001	0.001	69.647	2.119	3544.081
Log (c:\sg2lg)	0.001	0.001	70.346	2.335	4095.698

Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	4.927	0.001	14.258
Available MBytes	14711.756	14626.000	15158.000
Free System Page Table Entries	16757023.000	16757023.000	16757023.000
Transition Pages RePurposed/sec	57.556	0.000	2606.631
Pool Nonpaged Bytes	59258449.748	58867712.000	61366272.000
Pool Paged Bytes	261093049.008	260820992.000	261365760.000
Database Page Fault Stalls/sec	0.004	0.000	0.500

Test Log

3/30/2007 11:48:13 AM -- Command Line:
"C:\PROGRA~1\EXCHAN~1\jetstresscmd.exe" /c "C:\Jetstress
Testing\REDO\2Thread ESRP\Soft\soft2t.xml"
3/30/2007 11:48:13 AM -- Jetstress testing begins ...
3/30/2007 11:48:13 AM -- Prepare testing begins ...
3/30/2007 11:48:14 AM -- Attaching databases ...
3/30/2007 11:48:14 AM -- Prepare testing ends.
3/30/2007 11:48:14 AM -- Dispatching transactions begins ...
3/30/2007 11:48:14 AM -- Database cache settings: (minimum: 64.0 MB, maximum:
512.0 MB)

3/30/2007 11:48:14 AM -- Database flush thresholds: (start: 5.1 MB, stop: 10.2 MB)
 3/30/2007 11:48:14 AM -- Database read latency thresholds: (average: 0.02
 seconds/read, maximum: 0.05 seconds/read).
 3/30/2007 11:48:14 AM -- Log write latency thresholds: (average: 0.01
 seconds/write, maximum: 0.05 seconds/write).
 3/30/2007 11:48:15 AM -- Operation mix: Sessions 2, Inserts 25%, Deletes 10%,
 Replaces 50%, Reads 15%, Lazy Commits 80%.
 3/30/2007 11:48:15 AM -- Performance logging begins (interval: 15000 ms).
 3/30/2007 11:48:15 AM -- Generating log files ...
 3/30/2007 12:17:27 PM -- c:\sg1lg (100.2% generated), and c:\sg2lg (100.8%
 generated)
 3/30/2007 12:17:28 PM -- Performance logging ends.
 3/30/2007 12:17:28 PM -- JetInterop batch transaction stats: 9679, and 9901.
 3/30/2007 12:17:28 PM -- Dispatching transactions ends.
 3/30/2007 12:17:28 PM -- Shutting down databases ...
 3/30/2007 12:17:30 PM -- Instance1416.1 (complete), and Instance1416.2
 (complete)
 3/30/2007 12:17:30 PM -- Performance logging begins (interval: 15000 ms).
 3/30/2007 12:17:30 PM -- Verifying database checksums ...
 3/30/2007 12:49:24 PM -- c:\sg1db (100% processed), and c:\sg2db (100%
 processed)
 3/30/2007 12:49:25 PM -- Performance logging ends.
 3/30/2007 12:49:25 PM -- [C:\Jetstress Testing\REDO\2Thread
 ESRP\Soft\DBChecksum 2007 3 30 12 17 30.blg](#) has 127 samples.
 3/30/2007 12:49:26 PM -- [C:\Jetstress Testing\REDO\2Thread
 ESRP\Soft\DBChecksum 2007 3 30 12 17 30.html](#) is saved.
 3/30/2007 12:49:26 PM -- Verifying log checksums ...
 3/30/2007 12:49:35 PM -- c:\sg1lg (100 logs passed), and c:\sg2lg (100 logs
 passed)
 3/30/2007 12:49:35 PM -- [C:\Jetstress Testing\REDO\2Thread
 ESRP\Soft\Performance 2007 3 30 11 48 14.blg](#) has 116 samples.
 3/30/2007 12:49:35 PM -- Creating test report ...
 3/30/2007 12:49:36 PM -- Volume c:\sg1db has 0.0087 for Avg. Disk sec/Read.
 3/30/2007 12:49:36 PM -- Volume c:\sg2db has 0.0092 for Avg. Disk sec/Read.
 3/30/2007 12:49:36 PM -- Volume c:\sg1lg has 0.0011 for Avg. Disk sec/Write.
 3/30/2007 12:49:36 PM -- Volume c:\sg1lg has 0.0009 for Avg. Disk sec/Read.
 3/30/2007 12:49:36 PM -- Volume c:\sg2lg has 0.0011 for Avg. Disk sec/Write.
 3/30/2007 12:49:36 PM -- Volume c:\sg2lg has 0.0006 for Avg. Disk sec/Read.
 3/30/2007 12:49:36 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.
 3/30/2007 12:49:36 PM -- Test has 0 Database Page Fault Stalls/sec samples higher
 than 0.
 3/30/2007 12:49:36 PM -- [C:\Jetstress Testing\REDO\2Thread
 ESRP\Soft\Performance 2007 3 30 11 48 14.html](#) is saved.
 3/30/2007 12:49:37 PM -- Performance logging begins (interval: 2000 ms).
 3/30/2007 12:49:37 PM -- Recovering databases ...
 3/30/2007 12:53:37 PM -- Performance logging ends.
 3/30/2007 12:53:37 PM -- Instance1416.1 (239.5171579), and Instance1416.2
 (219.7670315)
 3/30/2007 12:53:37 PM -- [C:\Jetstress Testing\REDO\2Thread
 ESRP\Soft\SoftRecovery 2007 3 30 12 49 36.blg](#) has 119 samples.
 3/30/2007 12:53:37 PM -- Creating test report ...

Performance Result Report

Test Summary

Overall Test Result	Pass
Machine Name	72D77C1
Test Description	
Test Start Time	3/30/2007 11:48:13 AM
Test End Time	3/30/2007 12:17:30 PM
Jetstress Version	08.01.0075.000
Ese Version	08.00.0685.024
Operating System	Microsoft Windows Server 2003 Service Pack 1 (5.2.3790.65536)
Performance Log	C:\Jetstress Testing\REDO\2Thread ESRP\Soft\Performance_2007_3_30_11_48_14.blg C:\Jetstress Testing\REDO\2Thread ESRP\Soft\DBChecksum_2007_3_30_12_17_30.blg

Database Sizing and Throughput

Achieved I/O per Second	384.29
Capacity Percentage	100%
Throughput Percentage	100%
Initial database size	209876189184
Final database size	210687787008
Database files (count)	2

Jetstress System Parameters

Thread count	2 (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)	0.009	0.005	101.906	90.851	(n/a)
Database (c:\sg2db)	0.009	0.005	100.565	90.967	(n/a)
Log (c:\sg1lg)	0.001	0.001	0.068	60.160	10505.983
Log (c:\sg2lg)	0.001	0.001	0.069	60.733	10661.620

Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	1.505	0.209	4.063
Available MBytes	14712.440	14648.000	15139.000
Free System Page Table Entries	16757023.000	16757023.000	16757023.000
Transition Pages RePurposed/sec	75.608	0.000	526.316
Pool Nonpaged Bytes	58802670.345	57946112.000	58851328.000
Pool Paged Bytes	260811140.414	260775936.000	261324800.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log

3/30/2007 11:48:13 AM -- Command Line:
 "C:\PROGRA~1\EXCHAN~1\jetstresscmd.exe" /c "C:\Jetstress
 Testing\REDO\2Thread ESRP\Soft\soft2t.xml"
 3/30/2007 11:48:13 AM -- Jetstress testing begins ...
 3/30/2007 11:48:13 AM -- Prepare testing begins ...
 3/30/2007 11:48:14 AM -- Attaching databases ...
 3/30/2007 11:48:14 AM -- Prepare testing ends.
 3/30/2007 11:48:14 AM -- Dispatching transactions begins ...
 3/30/2007 11:48:14 AM -- Database cache settings: (minimum: 64.0 MB, maximum:
 512.0 MB)
 3/30/2007 11:48:14 AM -- Database flush thresholds: (start: 5.1 MB, stop: 10.2 MB)
 3/30/2007 11:48:14 AM -- Database read latency thresholds: (average: 0.02
 seconds/read, maximum: 0.05 seconds/read).
 3/30/2007 11:48:14 AM -- Log write latency thresholds: (average: 0.01
 seconds/write, maximum: 0.05 seconds/write).
 3/30/2007 11:48:15 AM -- Operation mix: Sessions 2, Inserts 25%, Deletes 10%,
 Replaces 50%, Reads 15%, Lazy Commits 80%.
 3/30/2007 11:48:15 AM -- Performance logging begins (interval: 15000 ms).
 3/30/2007 11:48:15 AM -- Generating log files ...
 3/30/2007 12:17:27 PM -- c:\sg1lg (100.2% generated), and c:\sg2lg (100.8%

generated)
 3/30/2007 12:17:28 PM -- Performance logging ends.
 3/30/2007 12:17:28 PM -- JetInterop batch transaction stats: 9679, and 9901.
 3/30/2007 12:17:28 PM -- Dispatching transactions ends.
 3/30/2007 12:17:28 PM -- Shutting down databases ...
 3/30/2007 12:17:30 PM -- Instance1416.1 (complete), and Instance1416.2 (complete)
 3/30/2007 12:17:30 PM -- Performance logging begins (interval: 15000 ms).
 3/30/2007 12:17:30 PM -- Verifying database checksums ...
 3/30/2007 12:49:24 PM -- c:\sg1db (100% processed), and c:\sg2db (100% processed)
 3/30/2007 12:49:25 PM -- Performance logging ends.
 3/30/2007 12:49:25 PM -- [C:\Jetstress Testing\REDO\2Thread ESRP\Soft\DBCchecksum 2007_3_30_12_17_30.blg](#) has 127 samples.
 3/30/2007 12:49:26 PM -- [C:\Jetstress Testing\REDO\2Thread ESRP\Soft\DBCchecksum 2007_3_30_12_17_30.html](#) is saved.
 3/30/2007 12:49:26 PM -- Verifying log checksums ...
 3/30/2007 12:49:35 PM -- c:\sg1lg (100 logs passed), and c:\sg2lg (100 logs passed)
 3/30/2007 12:49:35 PM -- [C:\Jetstress Testing\REDO\2Thread ESRP\Soft\Performance 2007_3_30_11_48_14.blg](#) has 116 samples.
 3/30/2007 12:49:35 PM -- Creating test report ...
 3/30/2007 12:49:36 PM -- Volume c:\sg1db has 0.0087 for Avg. Disk sec/Read.
 3/30/2007 12:49:36 PM -- Volume c:\sg2db has 0.0092 for Avg. Disk sec/Read.
 3/30/2007 12:49:36 PM -- Volume c:\sg1lg has 0.0011 for Avg. Disk sec/Write.
 3/30/2007 12:49:36 PM -- Volume c:\sg1lg has 0.0009 for Avg. Disk sec/Read.
 3/30/2007 12:49:36 PM -- Volume c:\sg2lg has 0.0011 for Avg. Disk sec/Write.
 3/30/2007 12:49:36 PM -- Volume c:\sg2lg has 0.0006 for Avg. Disk sec/Read.
 3/30/2007 12:49:36 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.
 3/30/2007 12:49:36 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	12855906	0	0	0	2132 MBytes / 1885 seconds
c:\sg2db\Jetstress1.edb	12862818	0	0	0	2186 MBytes / 1913 seconds
(Sum)	25718724	0	0	0	223 MBytes / 3799 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	847.847	0.000
c:\sg2db	0.083	0.001	838.215	0.002

Memory System Performance (of checksum)

Counter	Average	Minimum	Maximum
% Processor Time	11.009	1.824	13.646
Available MBytes	15064.921	15059.000	15128.000
Free System Page Table Entries	16757021.961	16756979.000	16757023.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	63563437.354	62881792.000	64577536.000
Pool Paged Bytes	260667891.906	260636672.000	261165056.000

Test Log

3/30/2007 11:48:13 AM -- Command Line:
 "C:\PROGRA~1\EXCHAN~1\jetstresscmd.exe" /c "C:\Jetstress
 Testing\REDO\2Thread ESRP\Soft\soft2t.xml"
 3/30/2007 11:48:13 AM -- Jetstress testing begins ...
 3/30/2007 11:48:13 AM -- Prepare testing begins ...
 3/30/2007 11:48:14 AM -- Attaching databases ...
 3/30/2007 11:48:14 AM -- Prepare testing ends.
 3/30/2007 11:48:14 AM -- Dispatching transactions begins ...
 3/30/2007 11:48:14 AM -- Database cache settings: (minimum: 64.0 MB, maximum:
 512.0 MB)
 3/30/2007 11:48:14 AM -- Database flush thresholds: (start: 5.1 MB, stop: 10.2 MB)
 3/30/2007 11:48:14 AM -- Database read latency thresholds: (average: 0.02
 seconds/read, maximum: 0.05 seconds/read).
 3/30/2007 11:48:14 AM -- Log write latency thresholds: (average: 0.01
 seconds/write, maximum: 0.05 seconds/write).
 3/30/2007 11:48:15 AM -- Operation mix: Sessions 2, Inserts 25%, Deletes 10%,
 Replaces 50%, Reads 15%, Lazy Commits 80%.
 3/30/2007 11:48:15 AM -- Performance logging begins (interval: 15000 ms).
 3/30/2007 11:48:15 AM -- Generating log files ...
 3/30/2007 12:17:27 PM -- c:\sg1lg (100.2% generated), and c:\sg2lg (100.8%
 generated)
 3/30/2007 12:17:28 PM -- Performance logging ends.
 3/30/2007 12:17:28 PM -- JetInterop batch transaction stats: 9679, and 9901.
 3/30/2007 12:17:28 PM -- Dispatching transactions ends.
 3/30/2007 12:17:28 PM -- Shutting down databases ...
 3/30/2007 12:17:30 PM -- Instance1416.1 (complete), and Instance1416.2
 (complete)
 3/30/2007 12:17:30 PM -- Performance logging begins (interval: 15000 ms).
 3/30/2007 12:17:30 PM -- Verifying database checksums ...
 3/30/2007 12:49:24 PM -- c:\sg1db (100% processed), and c:\sg2db (100%
 processed)

3/30/2007 12:49:25 PM -- Performance logging ends.
3/30/2007 12:49:25 PM -- [C:\Jetstress Testing\REDO\2Thread
ESRP\Soft\DBChecksum_2007_3_30_12_17_30.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

Overall Test Result	Pass
Machine Name	72D77C1
Test Description	
Test Start Time	3/18/2007 12:01:17 PM
Test End Time	3/18/2007 2:05:10 PM
Jetstress Version	08.01.0075.000
Ese Version	08.00.0685.024
Operating System	Microsoft Windows Server 2003 Service Pack 1 (5.2.3790.65536)
Performance Log	C:\Documents and Settings\Administrator.E2K71\Desktop\Jestress Testing\OFFICIAL\Perf Storage 9t\Performance_2007_3_18_12_1_18.blg C:\Documents and Settings\Administrator.E2K71\Desktop\Jestress Testing\OFFICIAL\Perf Storage 9t\DBChecksum_2007_3_18_14_5_10.blg

Database Sizing and Throughput

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

Jetstress System Parameters

Thread count	9 (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)	0.017	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.
3/18/2007 2:44:17 PM -- Test has 1 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	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:
3/18/2007 12:04:53 PM -- \Database(JetstressWin)\Database Cache Size, Last:
485351400.0 (lower bound: 483183800.0, upper bound: none)
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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 9\\DBChecksum_2007_3_18_14_5_10.blg](#) has 156 samples.