



Dell™ PowerVault™ MD3000i
5000 Mailbox Single Copy Cluster
Microsoft® Exchange 2007 Storage
Solution



Tested with: ESRP – Storage Version 2.0
Tested Date: October 2, 2007

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Overview

This document provides information on Dell's PowerVault MD3000i Plus MD1000 storage solution for Microsoft Exchange Server 2007, based on *Microsoft Exchange Solution Reviewed Program (ESRP) – Storage* program. The *ESRP – Storage* program was developed by Microsoft Corporation to provide a common storage testing framework for vendors to provide information on its storage solutions for Microsoft Exchange Server software. For more details on the *Microsoft ESRP – Storage* program, please click <http://www.microsoft.com/technet/prodtechnol/exchange/2007/esrp.mspx>

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Features

This white paper describes a tested and validated storage solution for a 5000 mailbox Exchange 2007 environment with Single Copy Cluster (SCC) in a high availability clustering mechanism based on the Microsoft Cluster Service (MSCS) shared storage. It requires an active and a passive set of Exchange Mailbox server nodes sharing the mailbox databases. During normal operations, mail clients access the primary (active) server. In the event of a primary node failure, the passive or standby node will take over the functionality of the failed node. This process is termed as a fail-over and these types of clusters are also popularly termed as fail-over clusters. Compared with previous versions, Exchange Server 2007 provides improved deployment setup and management experience with this clustering model.

Dell PowerVault MD3000i is an iSCSI based intelligent storage cabinet with a SAS back-end. The major features of the storage system are:

- Modular array capable of housing up to fifteen 3.5-inch SAS disk drives in a single rack enclosure
- Support for additional daisy-chained PowerVault MD1000 storage enclosures in unified mode
- Connects to host system via supported 1 Gb Ethernet Network Interface Card (NIC)
- Support for up to 16 hosts via Gigabit Ethernet
- Management options: Out of band (via Ethernet) enclosure
- RAID and system management using Dell MD Storage Manger.

Each PowerVault MD3000i may be daisy-chained with up to two MD1000 enclosures each with up to 15 drives, for a maximum of 45 drives. However, the solution presented in this paper utilizes a total of 36 disks, 30 disks for Exchange information stores and 6 for transaction logs. One or more disks may be configured as a hot-spare. The remaining disks provide room for future growth.

Solution Description

The Dell™ PowerVault™ MD3000i enclosure can house up to 15 disks. Additional storage expansion can be achieved by adding up to two PowerVault MD1000 expansion units for a total of 45 drives.

[Dell PowerVault MD3000i Windows Server Catalog Listing](#)

[Dell PowerVault MD1000 Windows Server Catalog Listing](#)



Figure 1: Dell PowerVault MD3000i Storage system with 15 SAS drives – Front view

Maximum Cascading (Expansion) Configuration for the Duplex Array

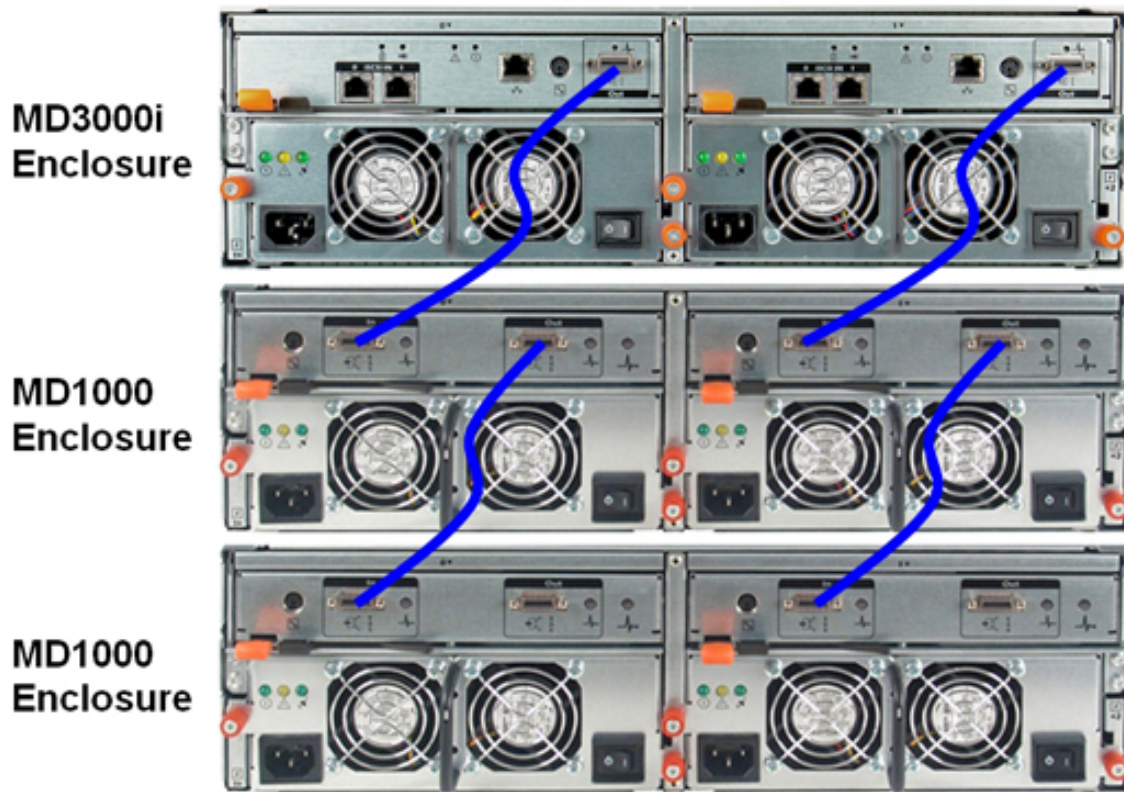


Figure 2: Dell PowerVault MD3000i Storage system with PowerVault MD1000 Expansion – Rear view

A supported GbE NIC is used to connect the Exchange server either directly or through an Ethernet switch to the PowerVault MD3000i storage system.

The presented solution is a Single Copy Cluster solution for up to 5000 mailboxes. It includes two PowerEdge 2950 servers attached to Dell PowerVault MD3000i storage system. Additional disk storage is provided by adding two PowerVault MD1000 expansion units behind the PowerVault MD3000i enclosure. The primary node or the *active* node provides client access to the exchange store. The secondary node or the *passive* node is configured to be identical to the active node. The storage is shared between the *active* and *passive* nodes as shown in Figure 3.

The tested user profile was 0.5 IOPS per user (0.42 IOPS per user with 20% headroom) with a 500 MB mailbox size.

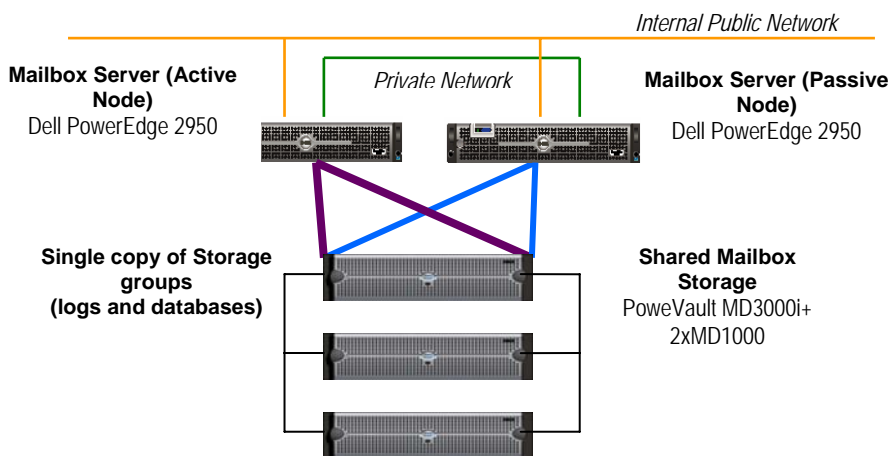


Figure 3: Test Set up Diagram

Microsoft Exchange Server System:

Server	Dell PowerEdge 2950
CPU	2 Intel® Xeon® CPU; 5160@3.00GHz
Memory	16 GB DDR2 ECC
NIC	Broadcom NeXtreme II GigE
RAID Controller	PERC 5i (FW Version 1.00.01-0088)
Internal Disks	2 Seagate 73 GB 15K RPM SAS (ST373454SS)

Storage System:

Storage System	Dell PowerVault MD3000i (Firmware version: 06.50.32.60) 2 Dell PowerVault MD1000 (Firmware version: A03) as expansion enclosures
Disks	15 Seagate 300GB 15K RPM SAS (ST33006555ss/Rev S512) Drives per enclosure 45 drives total for 3 enclosures
Interconnect	Broadcom Nextreme II GigE With TOE enabled Microsoft iSCSI Software Initiator Version 2.04

Storage Configuration:

The storage configuration was as follows:

- Three 10-disk RAID 10 volumes were created from physical disks 0 through 9 of the three storage enclosures. This was used for Exchange Information stores.
- Three 2-disk RAID 1 volumes were created from physical disks 10 and 11 of each of the three storage enclosures. This was used for the transaction logs.
- Disk 12 in each storage enclosure was left as a hot spare
- Disks 13 and 14 in each enclosure were left for additional head room for future growth

This solution is designed with future growth and scalability in mind. The presented solution can be scaled out by adding additional servers and storage building blocks similar to the one presented to this solution.

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 for ESRP-Storage. Therefore, the number of mailboxes hosted per server as part of the tested configuration may not necessarily be viable for some customer deployment.

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 organizations hosting up to 5000 Exchange 2007 mailboxes. The configuration used for testing was as follows:

- Number of mailboxes : 5000
- Number of hosts attached to the storage system: 2
- User IO profile: 0.42 I/O Operation per second with 20% headroom (Tested 0.5 IOPS)
- 500 MB Mailbox quota per mailbox
- Single Copy Clustering for High Availability

Tested Deployment

The following tables summarize the testing environment:

Simulated Exchange Configuration

Number of Exchange mailboxes simulated	5000
Number of hosts	1
Number of mailboxes/host	5000
Number of storage groups/host	15
Number of mailbox stores/storage group	1
Number of mailboxes/mailbox store	333
Number of mailbox store LUNs/storage group	5 Storage Groups per LUN (Total 15 Storage Groups on 3 LUN's)
Simulated profile: I/O's per second per mailbox (IOPS, include 20% headroom)	0.42 IOPS/user (Tested 0.5)
Database LUN size	1392 GB per LUN Total = 1392 x 3 = 4176 GB
Log LUN size	278 GB per LUN Total = 278 x 3 = 834 GB
Total database size for performance testing	181GB x 15 = 2717GB
% storage capacity used by Exchange database**	2717 / 4176 = 65%

**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.

Storage Hardware

Storage Connectivity (Fiber Channel, SAS, SATA, iSCSI)	iSCSI
Storage model and OS/firmware revision	Dell PowerVault MD3000i expanded with 2 Dell PowerVault MD1000 Hosts connect to storage ports on PowerVault MD3000i Dell PowerVault MD3000i firmware version: 06.50.32.60 Dell PowerVault MD1000 firmware version: A03
Storage cache	512 MB per controller (1 GB total)
Number of storage controllers	2
Number of storage ports	4
Maximum bandwidth of storage connectivity to host	1GBit
Switch type/model/firmware revision	N/A
HBA model and firmware	Broadcom BCM5708 Nextreme II GigE
Number of HBA's/host	2
Host server type	Dell PowerEdge 2950 2 Intel® Xeon® CPU; 5160@3.00GHz
Total number of disks tested in solution	36
Maximum number of spindles can be hosted in the storage	Total 45 disks: 15 per PowerVault MD3000i and MD1000 enclosures; Up to 45 in a daisy chain configuration of PowerVault MD3000i with two PowerVault MD1000

Storage Software

HBA driver	Broadcom bxbvda.sys 3.0.9.0
HBA QueueDepth Setting	16
Multi-Pathing	MD Storage Manager MPIO Driver 01.01.36.53
Host OS	Windows Server 2003 Enterprise X64 Edition SP2
ESE.dll file version	8.0.685.24
Replication solution name/version	N/A

Storage Disk Configuration (Mailbox Store Disks)

Disk type, speed and firmware revision	Seagate SAS 15K (ST33006555ss/Rev S512) 300 GB Drives
Raw capacity per disk (GB)	300 GB
Number of physical disks in test	30
Total raw storage capacity (GB)	9000GB
Number of disks per LUN	10
Raid level	RAID 10
Total formatted capacity	4176 GB
Storage capacity utilization	4176 GB/ 9000 GB = 46%
Database capacity utilization	2717 GB / 9000 GB= 30%

Storage Disk Configuration (Transactional Log Disks)

Disk type, speed and firmware revision	Seagate SAS 15K (ST33006555ss/Rev S512) 300 GB Drives
Raw capacity per disk (GB)	300 GB
Number of Spindles in test	6
total raw storage capacity (GB)	1800 GB
Number of disks per LUN	2
Raid level	RAID 1
Total formatted capacity	834 GB

Best Practices

The older versions of Exchange including Exchange Server 2003 are 32-bit applications and are limited by the amount of addressable memory. Roughly 3GB of user mode virtual memory can be utilized for Exchange Server 2003 and the remaining 1GB is required for the kernel.

Exchange Server 2007 overcomes the memory limitations by providing support as a 64-bit application capable of running on supported x64 platforms. On Windows Server 2003 x64 Editions about 8TB of addressable memory is available for the kernel mode and the user mode applications. Support for up to 1TB of physical RAM is provided on Windows Server 2003 Enterprise x64 Editions. Both the application and kernel can have sufficient memory for operations, allowing the Extensible Storage Engine (EXE) in Exchange Server 2007 to utilize more memory to buffer data pages. The result is a reduction in the number of I/Os, specifically the read operations, required to the disk sub-system. The total number of database disk I/O operations for a given user load is dependent on the available system memory. For a given load, the total database disk I/O operations required per second (IOPS) decreases over a period with increase in system memory. This decrease in database IOPS is primarily caused by a decrease in database reads.

Even with the decrease in database IOPS using larger server memory, Exchange server remains a disk I/O intensive application. The disk subsystem should be capable to support both the capacity and I/O throughput demands of the application. Here are some best practices to help improve the I/O subsystem performance:

- Exchange Server can benefit from having the disk partitions track-aligned. For Windows 2003 Server SP1 or above use DiskPart to verify that your disk tracks are sector-aligned. Use a value of 64 to align the Exchange disks to a 64 KB boundary. In Exchange Server 2007, the data page size is increased from 4KB to 8KB and can provide I/O optimization in certain scenarios by containing larger messages within a page and holding internal data structures within one page due to the larger page size.
- Exchange Server 2007 also provides support for more storage groups to host mailbox database stores or databases – up to 50 storage groups per server, compared to 4 in Exchange 2003. This enables splitting user mailboxes across multiple available storage groups, providing ease of management for administrative operations such as backup/restore. Besides management ease, splitting mailboxes across multiple storage groups provides increased log checkpoint depth available for user data operations. In certain scenarios dirty data pages can be optimized to reside in memory for a longer period of time

and reduce the number of write I/O operations required to the disk sub-system. The solution described in this paper contains five storage groups with 400 users per storage group.

- Due to the high I/O demand, it is best to have dedicated disks for Exchange 2007. This will isolate the Exchange I/O's to dedicated set of disks and prevent other applications from competing for I/O throughput with Exchange disks. This will also help troubleshoot any disk latency issues as Exchange will have its own set of dedicated spindles.
- It is also recommended to place the database and transaction logs onto separate set of disks. The transaction logs generate 100% serial write I/O's to disk while the database generates 100% random read/writes. Isolating the transaction log and database I/O's onto separate disks will prevent mixing of serial and random I/O's and help improve performance.

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

The PowerVault MD3000i modular disk storage array features a redundant architecture and delivers high performance and availability for critical applications. It has been architected to maximize performance in a highly available solution by including two RAID controllers within the storage device. The two RAID controllers provide for redundancy and better performance. To take advantage of the two dual RAID controllers it is recommended that host load be balanced between the two RAID controllers. This can be achieved by assigning approximately equal number of database and log LUN's to the two RAID controllers. This will balance the amount of traffic that is handled by each controller and help improve overall performance of the storage array. The PowerVault MD3000i storage system can be expanded with up to two PowerVault MD1000 enclosures daisy chained behind it.

For other detailed PowerVault MD3000i documentation please refer to [PowerVault MD3000i Documentation](#)

For other detailed PowerVault MD1000 documentation please refer to [PowerVault MD1000 Documentation](#)

Backup strategy

To protect e-mail data from potential disasters having a well designed and implemented backup solution is critical. Depending on the requirements of an environment different backup strategies may be implemented such as:

- Backup to disk
- Backup to tape
- LAN/SAN based backup etc.

The tests performed for backup include: backup-to-disk (read only) and log replay. The backup-to-disk test measures the read I/O performance by running a checksum on all the databases and log files. This test can help determine what kind of database read throughput can be achieved during backups. The backup speed and throughput achieved will depend upon the backup device used. The log replay test was used to measure the maximum rate at which the log files can be played against the databases. This is used to determine the restore times and also database write throughput can be achieved during a log recovery.

Contact for Additional Information

For additional information please visit <http://www.dell.com/exchange2007>

Test Result Summary

This section provides a high level summary of the test data from ESRP and the link to the detailed html reports which are generated by ESRP testing framework. Please click on the underlined headings below to view the html report for each test.

Reliability

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

The following list provides an overview: (click on the underlined word will show the html report after the reliability tests run)

- Any errors reported in the saved eventlog file?
No errors were reported in the eventlog file.
- Any errors reported in during the database and log checksum process?
 - No errors were reported in the [database](#) and [log](#) checksum process.
- If backup to disk test is done, any errors reported during the process?
 - Backup to disk was not tested

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 of 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	2600
Average Database Disk Reads/sec	1406
Average Database Disk Writes/sec	1197
Average Database Disk Read Latency (ms)	17
Average Database Disk Write Latency (ms)	32
Transaction Log I/O	
Average Log Disk Writes/sec	655
Average Log Disk Write Latency (ms)	5

Streaming Backup/Recovery Performance

ESRP Version 2.0 release supports only streaming backup type for testing. There are three tests in this section. The first two tests measure the database and log read I/O performance metrics by running a checksum on all the databases and log files. A third test to measure the end-to-end performance when the databases are backed up to disks was not performed.

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	14.8 (Average)
MB read/sec total	224

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)	0.67 Seconds
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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.

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 vendors for Exchange application. So the data presented in this document should not be used for direct comparisons among the solutions.

Appendix A: Performance Testing

Performance Test Result Report

Test Summary

Overall Test Result **Pass**

Machine Name M34-SCC

Test Description 3 R10 of 10 DISKS DB
3 R1 LOGS
15 SG : 5 PER R10 LUN
5000 Users
500 MB Mailbox
0.5 IOPS

Test Start Time 9/27/2007 9:52:36 AM

Test End Time 9/27/2007 10:41:06 PM

Jetstress Version 08.01.0136.000

Ese Version 08.00.0685.024

Operating System Microsoft Windows Server 2003 R2 Service Pack 2, v.2825 (5.2.3790.131072)

Performance Log C:\Program Files\Exchange\Jetstress\iSCSI_SCC\5000Users\15SGs\8ThreadPerSGNewFirmware_Loadbalanced\ance_2007_9_27_20_32_22.blg
C:\Program Files\Exchange\Jetstress\iSCSI_SCC\5000Users\15SGs\8ThreadPerSGNewFirmware_Loadbalanced\ksum_2007_9_27_22_41_6.blg

Database Sizing and Throughput

Achieved I/O per Second 2601.954

Planned I/O per Second 2500

Initial database size 2621480878080

Final database size 2646374072320

Database files (count) 15

Jetstress System Parameters

Thread count 8 (per-storage group)

Log buffers 9000

Minimum database cache 480.0 MB

Maximum database cache 3840.0 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 (D:)	0.017	0.043	467.429	396.027	(n/a)
Database (E:)	0.019	0.042	467.057	397.308	(n/a)
Database (F:)	0.014	0.013	472.630	401.502	(n/a)
Log (J:)	0.000	0.004	0.005	217.136	12994.708
Log (K:)	0.000	0.004	0.006	219.110	12982.218
Log (L:)	8.8500347947112E-05	0.004	0.005	219.890	12846.210

Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	13.671	7.865	19.141
Available MBytes	11203.719	11198.000	11526.000
Free System Page Table Entries	16754549.396	16754509.000	16754579.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	65977634.133	65724416.000	66215936.000
Pool Paged Bytes	50678698.667	50601984.000	51183616.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log9/27/2007 9:52:36 AM -- Jetstress testing begins ...

9/27/2007 9:52:36 AM -- Prepare testing begins ...

9/27/2007 9:52:36 AM -- Creating D:\SG1\Jetstress1.edb.

9/27/2007 9:52:36 AM -- Database cache settings: (minimum: 32.0 MB, maximum: 256.0 MB)

9/27/2007 9:52:36 AM -- Database flush thresholds: (start: 2.6 MB, stop: 5.1 MB)

9/27/2007 11:07:08 AM -- 60.0% of 162.8 GB complete (5950891 records inserted).

9/27/2007 12:02:37 PM -- 100.0% of 162.8 GB complete (9972462 records inserted).

9/27/2007 12:02:41 PM -- Duplicating 15 databases:

9/27/2007 8:31:49 PM -- 100.0% of 2.4 TB complete (2.4 TB duplicated).

9/27/2007 8:32:04 PM -- Attaching databases ...

9/27/2007 8:32:04 PM -- Prepare testing ends.

9/27/2007 8:32:04 PM -- Dispatching transactions begins ...

9/27/2007 8:32:04 PM -- Database cache settings: (minimum: 480.0 MB, maximum: 3.8 GB)

9/27/2007 8:32:04 PM -- Database flush thresholds: (start: 38.4 MB, stop: 76.8 MB)

9/27/2007 8:32:22 PM -- Database read latency thresholds: (average: 0.02 seconds/read, maximum: 0.05 seconds/read).

9/27/2007 8:32:22 PM -- Log write latency thresholds: (average: 0.01 seconds/write, maximum: 0.05 seconds/write).

9/27/2007 8:32:23 PM -- Operation mix: Sessions 8, Inserts 25%, Deletes 10%, Replaces 50%, Reads 15%, Lazy Commits 80%.

9/27/2007 8:32:23 PM -- Performance logging begins (interval: 15000 ms).

9/27/2007 8:32:23 PM -- Attaining prerequisites:

9/27/2007 8:39:29 PM -- \Database(JetstressWin)\Database Cache Size, Last: 3626713000.0 (lower bound: 3623879000.0, upper bound: none)

9/27/2007 10:39:31 PM -- Performance logging ends.

9/27/2007 10:39:31 PM -- JetInterop batch transaction stats: 37861, 38084, 38169, 38108, 38527, 38078, 37928, 38276, 38492, 38359, 38363, 38497, 38251, 38423, and 38316.
9/27/2007 10:39:32 PM -- Dispatching transactions ends.
9/27/2007 10:39:32 PM -- Shutting down databases ...
9/27/2007 10:41:06 PM -- Instance2988.1 (complete), Instance2988.2 (complete), Instance2988.3 (complete), Instance2988.4 (complete), Instance2988.5 (complete), Instance2988.6 (complete), Instance2988.7 (complete), Instance2988.8 (complete), Instance2988.9 (complete), Instance2988.10 (complete), Instance2988.11 (complete), Instance2988.12 (complete), Instance2988.13 (complete), Instance2988.14 (complete), and Instance2988.15 (complete)
9/27/2007 10:41:07 PM -- Performance logging begins (interval: 30000 ms).
9/27/2007 10:41:07 PM -- Verifying database checksums ...
9/28/2007 2:50:43 AM -- D: (100% processed), E: (100% processed), and F: (100% processed)
9/28/2007 2:50:44 AM -- Performance logging ends.
9/28/2007 2:50:44 AM -- [C:\Program Files\Exchange Jetstress\iSCSI_SCC\5000Users\15SGs\8ThreadPerSGNewFirmware_Loadbalanced\DBCchecksum_2007_9_27_22_41_6.blg](#) has 499 samples.
9/28/2007 2:50:47 AM -- [C:\Program Files\Exchange Jetstress\iSCSI_SCC\5000Users\15SGs\8ThreadPerSGNewFirmware_Loadbalanced\DBCchecksum_2007_9_27_22_41_6.html](#) is saved.
9/28/2007 2:50:47 AM -- Verifying log checksums ...
9/28/2007 2:52:29 AM -- J:\LOG1 (77 logs passed), J:\LOG2 (72 logs passed), J:\LOG3 (72 logs passed), J:\LOG4 (64 logs passed), J:\LOG5 (71 logs passed), K:\LOG6 (73 logs passed), K:\LOG7 (73 logs passed), K:\LOG8 (76 logs passed), K:\LOG9 (69 logs passed), K:\LOG10 (79 logs passed), L:\LOG11 (74 logs passed), L:\LOG12 (52 logs passed), L:\LOG13 (43 logs passed), L:\LOG14 (44 logs passed), and L:\LOG15 (52 logs passed)
9/28/2007 2:52:29 AM -- [C:\Program Files\Exchange Jetstress\iSCSI_SCC\5000Users\15SGs\8ThreadPerSGNewFirmware_Loadbalanced\Performance_2007_9_27_20_32_22.blg](#) has 508 samples.
9/28/2007 2:52:29 AM -- Creating test report ...
9/28/2007 2:52:32 AM -- Volume D: has 0.0175 for Avg. Disk sec/Read.
9/28/2007 2:52:32 AM -- Volume E: has 0.0185 for Avg. Disk sec/Read.
9/28/2007 2:52:32 AM -- Volume F: has 0.0137 for Avg. Disk sec/Read.
9/28/2007 2:52:32 AM -- Volume J: has 0.0037 for Avg. Disk sec/Write.
9/28/2007 2:52:32 AM -- Volume J: has 0.0001 for Avg. Disk sec/Read.
9/28/2007 2:52:32 AM -- Volume K: has 0.0037 for Avg. Disk sec/Write.
9/28/2007 2:52:32 AM -- Volume K: has 0.0002 for Avg. Disk sec/Read.
9/28/2007 2:52:32 AM -- Volume L: has 0.0037 for Avg. Disk sec/Write.
9/28/2007 2:52:32 AM -- Volume L: has 0.0001 for Avg. Disk sec/Read.
9/28/2007 2:52:32 AM -- Test has 0 Maximum Database Page Fault Stalls/sec.
9/28/2007 2:52:32 AM -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.
9/28/2007 2:52:32 AM -- [C:\Program Files\Exchange Jetstress\iSCSI_SCC\5000Users\15SGs\8ThreadPerSGNewFirmware_Loadbalanced\Performance_2007_9_27_20_32_22.xml](#) has 479 samples queried.

Database Checksum Test Result Report

Checksum Statistics - All

Database	Seen pages	Bad pages	Correctable pages	Wrong page no pages	File length / seconds taken
D:\SG1\Jetstress1.edb	21535394	0	0	0	168245 MBytes / 2926 seconds

D:\SG2\Jetstress1.edb	21534882	0	0	0	168241 MBytes / 2282 seconds
D:\SG3\Jetstress1.edb	21534370	0	0	0	168237 MBytes / 3025 seconds
D:\SG4\Jetstress1.edb	21537442	0	0	0	168261 MBytes / 3032 seconds
D:\SG5\Jetstress1.edb	21538722	0	0	0	168271 MBytes / 3034 seconds
E:\SG6\Jetstress1.edb	21535650	0	0	0	168247 MBytes / 3786 seconds
E:\SG7\Jetstress1.edb	21538722	0	0	0	168271 MBytes / 2962 seconds
E:\SG8\Jetstress1.edb	21537186	0	0	0	168259 MBytes / 2965 seconds
E:\SG9\Jetstress1.edb	21539234	0	0	0	168275 MBytes / 2953 seconds
E:\SG10\Jetstress1.edb	21543074	0	0	0	168305 MBytes / 2306 seconds
F:\SG11\Jetstress1.edb	21533090	0	0	0	168227 MBytes / 1531 seconds
F:\SG12\Jetstress1.edb	21533346	0	0	0	168229 MBytes / 1501 seconds
F:\SG13\Jetstress1.edb	21538210	0	0	0	168267 MBytes / 1508 seconds
F:\SG14\Jetstress1.edb	21534114	0	0	0	168235 MBytes / 1505 seconds
F:\SG15\Jetstress1.edb	21530274	0	0	0	168205 MBytes / 1503 seconds
(Sum)	323043710	0	0	0	2523778 MBytes / 14975 seconds

Disk Subsystem Performance (of checksum)

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec
D:	0.898	0.014	941.839	0.002
E:	0.838	0.014	898.904	0.002
F:	0.467	0.011	1783.286	0.003

Memory System Performance (of checksum)

Counter	Average	Minimum	Maximum
% Processor Time	9.967	5.286	15.182
Available MBytes	15086.727	15043.000	15179.000
Free System Page Table Entries	16754439.000	16754439.000	16754439.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	74576783.134	74067968.000	75747328.000
Pool Paged Bytes	50310708.329	50278400.000	51343360.000

Test Log9/27/2007 9:52:36 AM -- Jetstress testing begins ...
 9/27/2007 9:52:36 AM -- Prepare testing begins ...
 9/27/2007 9:52:36 AM -- Creating D:\SG1\Jetstress1.edb.
 9/27/2007 9:52:36 AM -- Database cache settings: (minimum: 32.0 MB, maximum: 256.0 MB)
 9/27/2007 9:52:36 AM -- Database flush thresholds: (start: 2.6 MB, stop: 5.1 MB)
 9/27/2007 11:07:08 AM -- 60.0% of 162.8 GB complete (5950891 records inserted).
 9/27/2007 12:02:37 PM -- 100.0% of 162.8 GB complete (9972462 records inserted).
 9/27/2007 12:02:41 PM -- Duplicating 15 databases:
 9/27/2007 8:31:49 PM -- 100.0% of 2.4 TB complete (2.4 TB duplicated).
 9/27/2007 8:32:04 PM -- Attaching databases ...
 9/27/2007 8:32:04 PM -- Prepare testing ends.
 9/27/2007 8:32:04 PM -- Dispatching transactions begins ...
 9/27/2007 8:32:04 PM -- Database cache settings: (minimum: 480.0 MB, maximum: 3.8 GB)
 9/27/2007 8:32:04 PM -- Database flush thresholds: (start: 38.4 MB, stop: 76.8 MB)
 9/27/2007 8:32:22 PM -- Database read latency thresholds: (average: 0.02 seconds/read, maximum: 0.05 seconds/read).
 9/27/2007 8:32:22 PM -- Log write latency thresholds: (average: 0.01 seconds/write, maximum: 0.05 seconds/write).
 9/27/2007 8:32:23 PM -- Operation mix: Sessions 8, Inserts 25%, Deletes 10%, Replaces 50%, Reads 15%, Lazy Commits 80%.
 9/27/2007 8:32:23 PM -- Performance logging begins (interval: 15000 ms).
 9/27/2007 8:32:23 PM -- Attaining prerequisites:
 9/27/2007 8:39:29 PM -- \Database(JetstressWin)\Database Cache Size, Last: 3626713000.0 (lower bound: 3623879000.0, upper bound: none)
 9/27/2007 10:39:31 PM -- Performance logging ends.
 9/27/2007 10:39:31 PM -- JetInterop batch transaction stats: 37861, 38084, 38169, 38108, 38527, 38078, 37928, 38276, 38492, 38359, 38363, 38497, 38251, 38423, and 38316.
 9/27/2007 10:39:32 PM -- Dispatching transactions ends.
 9/27/2007 10:39:32 PM -- Shutting down databases ...
 9/27/2007 10:41:06 PM -- Instance2988.1 (complete), Instance2988.2 (complete), Instance2988.3 (complete), Instance2988.4 (complete), Instance2988.5 (complete), Instance2988.6 (complete), Instance2988.7 (complete), Instance2988.8 (complete), Instance2988.9 (complete), Instance2988.10 (complete), Instance2988.11 (complete), Instance2988.12 (complete), Instance2988.13 (complete), Instance2988.14 (complete), and Instance2988.15 (complete)
 9/27/2007 10:41:07 PM -- Performance logging begins (interval: 30000 ms).
 9/27/2007 10:41:07 PM -- Verifying database checksums ...
 9/28/2007 2:50:43 AM -- D: (100% processed), E: (100% processed), and F: (100% processed)
 9/28/2007 2:50:44 AM -- Performance logging ends.
 9/28/2007 2:50:44 AM -- [C:\Program Files\Exchange Jetstress\iSCSI_SCC\5000Users\15SGs\8ThreadPerSGNewFirmware_Loadbalanced\DBChecksum_2007_9_27_22_41_6.blg](#) has 499 samples.

Appendix B: Stress Testing

Stress Test Result Report

Test Summary

Overall Test Result Pass

Result

Machine Name M34-SCC

Test Description 3 R10 of 10 DISKS DB
3 R1 LOGS
15 SG : 5 PER R10 LUN
5000 Users
500 MB Mailbox
0.5 IOPS

Test Start Time 9/28/2007 3:28:25 PM

Test End Time 9/29/2007 3:36:50 PM

Jetstress Version 08.01.0136.000

Ese Version 08.00.0685.024

Operating System Microsoft Windows Server 2003 R2 Service Pack 2, v.2825 (5.2.3790.131072)

Performance Log C:\Program Files\Exchange\Jetstress\iSCSI_SCC\5000Users\15SGs\8ThreadPerSGNewFirmware_Loadbalanced\Stres
C:\Program Files\Exchange\Jetstress\iSCSI_SCC\5000Users\15SGs\8ThreadPerSGNewFirmware_Loadbalanced\Stres

Database Sizing and Throughput

Achieved I/O per Second 2712.818

Planned I/O per Second 2500

Initial database size 2646374072320

Final database size 2912202637312

Database files (count) 15

Jetstress System Parameters

Thread count 8 (per-storage group)

Log buffers 9000

Minimum database cache 480.0 MB

Maximum database cache 3840.0 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 (D:)	0.017	0.028	490.494	412.655	(n/a)
Database (E:)	0.018	0.030	491.047	412.301	(n/a)
Database (F:)	0.014	0.013	492.100	414.220	(n/a)
Log (J:)	0.000	0.004	0.000	214.849	12973.244
Log (K:)	0.000	0.004	0.000	214.841	12968.867
Log (L:)	0.000	0.004	0.000	215.775	12907.808

Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	12.890	5.469	21.016
Available MBytes	11197.002	11172.000	11595.000
Free System Page Table Entries	16754427.031	16754419.000	16754439.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	71021852.444	70971392.000	71782400.000
Pool Paged Bytes	57203064.889	55615488.000	57958400.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log 9/28/2007 3:28:24 PM -- Jetstress testing begins ...

9/28/2007 3:28:25 PM -- Prepare testing begins ...

9/28/2007 3:28:40 PM -- Attaching databases ...

9/28/2007 3:28:40 PM -- Prepare testing ends.

9/28/2007 3:28:40 PM -- Dispatching transactions begins ...

9/28/2007 3:28:40 PM -- Database cache settings: (minimum: 480.0 MB, maximum: 3.8 GB)

9/28/2007 3:28:40 PM -- Database flush thresholds: (start: 38.4 MB, stop: 76.8 MB)

9/28/2007 3:28:58 PM -- Database read latency thresholds: (average: 0.02 seconds/read, maximum: 0.1 seconds/read).

9/28/2007 3:28:58 PM -- Log write latency thresholds: (average: 0.01 seconds/write, maximum: 0.1 seconds/write).

9/28/2007 3:28:59 PM -- Operation mix: Sessions 8, Inserts 25%, Deletes 10%, Replaces 50%, Reads 15%, Lazy Commits 80%.

9/28/2007 3:28:59 PM -- Performance logging begins (interval: 15000 ms).

9/28/2007 3:28:59 PM -- Attaining prerequisites:

9/28/2007 3:35:42 PM -- \Database(JetstressWin)\Database Cache Size, Last: 3641901000.0 (lower bound: 3623879000.0, upper bound: none)

9/29/2007 3:35:43 PM -- Performance logging ends.

9/29/2007 3:35:43 PM -- JetInterop batch transaction stats: 425883, 425693, 427569, 427353, 425927, 426750, 426396, 426272, 425695, 426887, 427211, 426408, 427080, 427462, and 427055.

9/29/2007 3:35:44 PM -- Dispatching transactions ends.

9/29/2007 3:35:44 PM -- Shutting down databases ...

9/29/2007 3:36:50 PM -- Instance2684.1 (complete), Instance2684.2 (complete), Instance2684.3 (complete), Instance2684.4 (complete), Instance2684.5 (complete), Instance2684.6 (complete), Instance2684.7 (complete), Instance2684.8 (complete),

Instance2684.9 (complete), Instance2684.10 (complete), Instance2684.11 (complete), Instance2684.12 (complete), Instance2684.13 (complete), Instance2684.14 (complete), and Instance2684.15 (complete)

9/29/2007 3:36:51 PM -- Performance logging begins (interval: 30000 ms).

9/29/2007 3:36:51 PM -- Verifying database checksums ...

9/29/2007 8:11:28 PM -- D: (100% processed), E: (100% processed), and F: (100% processed)

9/29/2007 8:11:29 PM -- Performance logging ends.

9/29/2007 8:11:29 PM -- [C:\Program Files\Exchange Jetstress\iSCSI_SCC\5000Users\15SGs\8ThreadPerSGNewFirmware_Loadbalanced\Stress\DB Checksum_2007_9_29_15_36_50.blg](#) has 549 samples.

9/29/2007 8:11:31 PM -- [C:\Program Files\Exchange Jetstress\iSCSI_SCC\5000Users\15SGs\8ThreadPerSGNewFirmware_Loadbalanced\Stress\DB Checksum_2007_9_29_15_36_50.html](#) is saved.

9/29/2007 8:11:31 PM -- Verifying log checksums ...

9/29/2007 8:12:38 PM -- J:\LOG1 (41 logs passed), J:\LOG2 (45 logs passed), J:\LOG3 (38 logs passed), J:\LOG4 (49 logs passed), J:\LOG5 (58 logs passed), K:\LOG6 (50 logs passed), K:\LOG7 (57 logs passed), K:\LOG8 (50 logs passed), K:\LOG9 (54 logs passed), K:\LOG10 (55 logs passed), L:\LOG11 (46 logs passed), L:\LOG12 (27 logs passed), L:\LOG13 (31 logs passed), L:\LOG14 (30 logs passed), and L:\LOG15 (26 logs passed)

9/29/2007 8:12:38 PM -- [C:\Program Files\Exchange Jetstress\iSCSI_SCC\5000Users\15SGs\8ThreadPerSGNewFirmware_Loadbalanced\Stress\Stress_2007_9_28_15_28_58.blg](#) has 5786 samples.

9/29/2007 8:12:38 PM -- Creating test report ...

9/29/2007 8:13:33 PM -- Volume D: has 0.0169 for Avg. Disk sec/Read.

9/29/2007 8:13:33 PM -- Volume E: has 0.0176 for Avg. Disk sec/Read.

9/29/2007 8:13:33 PM -- Volume F: has 0.0135 for Avg. Disk sec/Read.

9/29/2007 8:13:33 PM -- Volume J: has 0.0038 for Avg. Disk sec/Write.

9/29/2007 8:13:33 PM -- Volume J: has 0.0000 for Avg. Disk sec/Read.

9/29/2007 8:13:33 PM -- Volume K: has 0.0038 for Avg. Disk sec/Write.

9/29/2007 8:13:33 PM -- Volume K: has 0.0000 for Avg. Disk sec/Read.

9/29/2007 8:13:33 PM -- Volume L: has 0.0037 for Avg. Disk sec/Write.

9/29/2007 8:13:33 PM -- Volume L: has 0.0000 for Avg. Disk sec/Read.

9/29/2007 8:13:33 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.

9/29/2007 8:13:33 PM -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.

9/29/2007 8:13:33 PM -- [C:\Program Files\Exchange Jetstress\iSCSI_SCC\5000Users\15SGs\8ThreadPerSGNewFirmware_Loadbalanced\Stress\Stress_2007_9_28_15_28_58.xml](#) has 5759 samples queries

Stress Test - Database Checksum Result Report

Checksum Statistics - All

Database	Seen pages	Bad pages	Correctable pages	Wrong page no pages	File length / seconds taken
D:\SG1\Jetstress1.edb	23688370	0	0	0	185065 MBytes / 3237 seconds
D:\SG2\Jetstress1.edb	23694258	0	0	0	185111 MBytes / 2707 seconds
D:\SG3\Jetstress1.edb	23707826	0	0	0	185217 MBytes / 3330 seconds
D:\SG4\Jetstress1.edb	23711154	0	0	0	185243 MBytes

					/ 3337 seconds
D:\SG5\Jetstress1.edb	23709618	0	0	0	185231 MBytes / 3329 seconds
E:\SG6\Jetstress1.edb	23708338	0	0	0	185221 MBytes / 3970 seconds
E:\SG7\Jetstress1.edb	23707826	0	0	0	185217 MBytes / 3264 seconds
E:\SG8\Jetstress1.edb	23696818	0	0	0	185131 MBytes / 3260 seconds
E:\SG9\Jetstress1.edb	23681458	0	0	0	185011 MBytes / 3244 seconds
E:\SG10\Jetstress1.edb	23704754	0	0	0	185193 MBytes / 2736 seconds
F:\SG11\Jetstress1.edb	23696818	0	0	0	185131 MBytes / 1696 seconds
F:\SG12\Jetstress1.edb	23680946	0	0	0	185007 MBytes / 1655 seconds
F:\SG13\Jetstress1.edb	23710642	0	0	0	185239 MBytes / 1662 seconds
F:\SG14\Jetstress1.edb	23702450	0	0	0	185175 MBytes / 1664 seconds
F:\SG15\Jetstress1.edb	23692210	0	0	0	185095 MBytes / 1663 seconds
(Sum)	355493486	0	0	0	2777292 MBytes / 16476 seconds

Disk Subsystem Performance (of checksum)

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec
D:	0.908	0.011	931.626	0.002
E:	0.856	0.013	901.494	0.002
F:	0.468	0.007	1780.413	0.002

Memory System Performance (of checksum)

Counter	Average	Minimum	Maximum
% Processor Time	9.814	5.169	14.831
Available MBytes	15059.785	15018.000	15153.000
Free System Page Table Entries	16754419.000	16754419.000	16754419.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	76131650.681	75616256.000	77008896.000
Pool Paged Bytes	59378025.851	58990592.000	60112896.000

Test Log9/28/2007 3:28:24 PM -- Jetstress testing begins ...

9/28/2007 3:28:25 PM -- Prepare testing begins ...

9/28/2007 3:28:40 PM -- Attaching databases ...

9/28/2007 3:28:40 PM -- Prepare testing ends.

9/28/2007 3:28:40 PM -- Dispatching transactions begins ...

9/28/2007 3:28:40 PM -- Database cache settings: (minimum: 480.0 MB, maximum: 3.8 GB)
9/28/2007 3:28:40 PM -- Database flush thresholds: (start: 38.4 MB, stop: 76.8 MB)
9/28/2007 3:28:58 PM -- Database read latency thresholds: (average: 0.02 seconds/read, maximum: 0.1 seconds/read).
9/28/2007 3:28:58 PM -- Log write latency thresholds: (average: 0.01 seconds/write, maximum: 0.1 seconds/write).
9/28/2007 3:28:59 PM -- Operation mix: Sessions 8, Inserts 25%, Deletes 10%, Replaces 50%, Reads 15%, Lazy Commits 80%.
9/28/2007 3:28:59 PM -- Performance logging begins (interval: 15000 ms).
9/28/2007 3:28:59 PM -- Attaining prerequisites:
9/28/2007 3:35:42 PM -- \Database(JetstressWin)\Database Cache Size, Last: 3641901000.0 (lower bound: 3623879000.0, upper bound: none)
9/29/2007 3:35:43 PM -- Performance logging ends.
9/29/2007 3:35:43 PM -- JetInterop batch transaction stats: 425883, 425693, 427569, 427353, 425927, 426750, 426396, 426272, 425695, 426887, 427211, 426408, 427080, 427462, and 427055.
9/29/2007 3:35:44 PM -- Dispatching transactions ends.
9/29/2007 3:35:44 PM -- Shutting down databases ...
9/29/2007 3:36:50 PM -- Instance2684.1 (complete), Instance2684.2 (complete), Instance2684.3 (complete), Instance2684.4 (complete), Instance2684.5 (complete), Instance2684.6 (complete), Instance2684.7 (complete), Instance2684.8 (complete), Instance2684.9 (complete), Instance2684.10 (complete), Instance2684.11 (complete), Instance2684.12 (complete), Instance2684.13 (complete), Instance2684.14 (complete), and Instance2684.15 (complete)
9/29/2007 3:36:51 PM -- Performance logging begins (interval: 30000 ms).
9/29/2007 3:36:51 PM -- Verifying database checksums ...
9/29/2007 8:11:28 PM -- D: (100% processed), E: (100% processed), and F: (100% processed)
9/29/2007 8:11:29 PM -- Performance logging ends.
9/29/2007 8:11:29 PM -- [C:\Program Files\Exchange Jetstress\iSCSI_SCC\5000Users\15SGs\8ThreadPerSGNewFirmware_Loadbalanced\Stress\DB Checksum 2007_9_29_15_36_50.blg](#) has 549 samples.

Appendix C: Streaming Backup Testing

Streaming Backup Statistics - All

Database Instance	Database Size (MBytes)	Elapsed Backup Time	MBytes Transferred/sec
Instance4680.1	185457.40	04:36:48	11.17
Instance4680.2	185505.40	04:36:50	11.17
Instance4680.3	185619.40	04:36:27	11.19
Instance4680.4	185645.40	04:37:08	11.16
Instance4680.5	185627.40	04:37:29	11.15
Instance4680.6	185573.40	04:36:47	11.17
Instance4680.7	185615.40	04:37:02	11.17
Instance4680.8	185549.40	04:35:54	11.21
Instance4680.9	185407.40	04:37:02	11.15
Instance4680.10	185597.40	04:37:36	11.14
Instance4680.11	185533.40	02:20:10	22.06
Instance4680.12	185389.40	02:20:09	22.05
Instance4680.13	185633.40	02:20:09	22.08
Instance4680.14	185549.40	02:20:09	22.06
Instance4680.15	185457.40	02:19:47	22.11

Jetstress System Parameters

Thread count	8 (per-storage group)
Log buffers	9000
Minimum database cache	480.0 MB
Maximum database cache	3840.0 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 (D:)	0.011	4.48413449931471E-05	448.349	0.009	(n/a)
Database (E:)	0.011	7.38502475366038E-05	448.112	0.007	(n/a)
Database (F:)	0.003	3.47188717077768E-05	447.356	0.009	(n/a)
Log (J:)	0.000	9.67132846213036E-06	0.000	0.012	161.977
Log (K:)	0.000	1.46640612709792E-06	0.000	0.010	173.421

05

Log (L:)	0.000	2.04810006479682E-05	0.000	0.012	119.795
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Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	8.814	3.932	13.607
Available MBytes	15213.598	15174.000	15276.000
Free System Page Table Entries	16754419.000	16754419.000	16754419.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	73887146.205	73830400.000	73973760.000
Pool Paged Bytes	60673708.512	59576320.000	62119936.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log10/1/2007 2:46:52 PM -- Jetstress testing begins ...

10/1/2007 2:46:52 PM -- Prepare testing begins ...

10/1/2007 2:47:09 PM -- Attaching databases ...

10/1/2007 2:47:09 PM -- Prepare testing ends.

10/1/2007 2:47:26 PM -- Performance logging begins (interval: 30000 ms).

10/1/2007 2:47:26 PM -- Streaming backup databases ...

10/1/2007 7:25:03 PM -- Performance logging ends.

10/1/2007 7:25:03 PM -- Instance4680.1 (100% processed), Instance4680.2 (100% processed), Instance4680.3 (100% processed), Instance4680.4 (100% processed), Instance4680.5 (100% processed), Instance4680.6 (100% processed), Instance4680.7 (100% processed), Instance4680.8 (100% processed), Instance4680.9 (100% processed), Instance4680.10 (100% processed), Instance4680.11 (100% processed), Instance4680.12 (100% processed), Instance4680.13 (100% processed), Instance4680.14 (100% processed), and Instance4680.15 (100% processed)

10/1/2007 7:25:04 PM -- [C:\Program Files\Exchange](#)

[Jetstress\iSCSI_SCC\5000Users\15SGs\8ThreadPerSGNewFirmware_Loadbalanced\Backup\StreamingBackup_2007_10_1_14_47_9.blg](#) has 555 samples.

10/1/2007 7:25:04 PM -- Creating test report ...

Appendix D: Soft Recovery Testing

SoftRecovery Test Result Report

Soft-Recovery Statistics - All

Database Instance	Log files replayed	Elapsed seconds
Instance3868.1	512	355.015625
Instance3868.2	506	353.265625
Instance3868.3	517	345.015625
Instance3868.4	519	350.015625
Instance3868.5	518	353.265625
Instance3868.6	500	352.515625
Instance3868.7	512	355.515625
Instance3868.8	529	355.265625
Instance3868.9	514	354.765625
Instance3868.10	526	353.265625
Instance3868.11	519	350.765625
Instance3868.12	514	335.265625
Instance3868.13	522	344.265625
Instance3868.14	512	339.265625
Instance3868.15	503	338.015625

Disk Subsystem Performance

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec	Avg. Disk Bytes/Write
Database (D:)	0.059	0.011	2216.079	29.446	(n/a)
Database (E:)	0.061	0.012	2248.795	29.270	(n/a)
Database (F:)	0.045	0.010	2347.742	29.888	(n/a)
Log (J:)	0.005	0.011	241.245	11.220	5036.524
Log (K:)	0.005	0.011	240.850	10.769	4784.641
Log (L:)	0.004	0.011	242.395	11.401	4941.200

Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	24.301	18.457	41.504
Available MBytes	11761.784	11166.000	14978.000
Free System Page Table Entries	16754419.000	16754419.000	16754419.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	75030341.818	74678272.000	76333056.000

Pool Paged Bytes	61372276.364	60612608.000	61763584.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log10/1/2007 9:12:40 AM -- Jetstress testing begins ...
10/1/2007 9:12:40 AM -- Prepare testing begins ...
10/1/2007 9:12:55 AM -- Attaching databases ...
10/1/2007 9:12:55 AM -- Prepare testing ends.
10/1/2007 9:12:55 AM -- Dispatching transactions begins ...
10/1/2007 9:12:55 AM -- Database cache settings: (minimum: 480.0 MB, maximum: 3.8 GB)
10/1/2007 9:12:55 AM -- Database flush thresholds: (start: 38.4 MB, stop: 76.8 MB)
10/1/2007 9:13:13 AM -- Database read latency thresholds: (average: 0.02 seconds/read, maximum: 0.05 seconds/read).
10/1/2007 9:13:13 AM -- Log write latency thresholds: (average: 0.01 seconds/write, maximum: 0.05 seconds/write).
10/1/2007 9:13:15 AM -- Operation mix: Sessions 8, Inserts 25%, Deletes 10%, Replaces 50%, Reads 15%, Lazy Commits 80%.
10/1/2007 9:13:15 AM -- Performance logging begins (interval: 15000 ms).
10/1/2007 9:13:15 AM -- Generating log files ...
10/1/2007 9:50:44 AM -- J:\LOG1 (102.4% generated), J:\LOG2 (101.4% generated), J:\LOG3 (103.6% generated), J:\LOG4 (104.0% generated), J:\LOG5 (103.6% generated), K:\LOG6 (100.2% generated), K:\LOG7 (102.6% generated), K:\LOG8 (106.0% generated), K:\LOG9 (103.0% generated), K:\LOG10 (105.2% generated), L:\LOG11 (103.8% generated), L:\LOG12 (103.0% generated), L:\LOG13 (104.4% generated), L:\LOG14 (102.6% generated), and L:\LOG15 (100.8% generated)
10/1/2007 9:50:45 AM -- Performance logging ends.
10/1/2007 9:50:45 AM -- JetInterop batch transaction stats: 10060, 10001, 10160, 9952, 10005, 9956, 9933, 10170, 9974, 10273, 10130, 10078, 10122, 10128, and 9947.
10/1/2007 9:50:46 AM -- Dispatching transactions ends.
10/1/2007 9:50:46 AM -- Shutting down databases ...
10/1/2007 9:52:24 AM -- Instance3868.1 (complete), Instance3868.2 (complete), Instance3868.3 (complete), Instance3868.4 (complete), Instance3868.5 (complete), Instance3868.6 (complete), Instance3868.7 (complete), Instance3868.8 (complete), Instance3868.9 (complete), Instance3868.10 (complete), Instance3868.11 (complete), Instance3868.12 (complete), Instance3868.13 (complete), Instance3868.14 (complete), and Instance3868.15 (complete)
10/1/2007 9:52:25 AM -- Performance logging begins (interval: 30000 ms).
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10/1/2007 2:27:39 PM -- D: (100% processed), E: (100% processed), and F: (100% processed)
10/1/2007 2:27:40 PM -- Performance logging ends.
10/1/2007 2:27:40 PM -- C:\Program Files\Exchange Jetstress\iSCSI_SCC\5000Users\15SGs\8ThreadPerSGNewFirmware_Loadbalanced\Recovery\DBChecksum_2007_10_1_9_52_24.blg has 550 samples.
10/1/2007 2:27:43 PM -- C:\Program Files\Exchange Jetstress\iSCSI_SCC\5000Users\15SGs\8ThreadPerSGNewFirmware_Loadbalanced\Recovery\DBChecksum_2007_10_1_9_52_24.html is saved.
10/1/2007 2:27:43 PM -- Verifying log checksums ...
10/1/2007 2:30:19 PM -- J:\LOG1 (100 logs passed), J:\LOG2 (100 logs passed), J:\LOG3 (100 logs passed), J:\LOG4 (100 logs passed), J:\LOG5 (100 logs passed), K:\LOG6 (100 logs passed), K:\LOG7 (100 logs passed), K:\LOG8 (100 logs passed), K:\LOG9 (100 logs passed), K:\LOG10 (100 logs passed), L:\LOG11 (100 logs passed), L:\LOG12 (100 logs passed), L:\LOG13 (100 logs passed), L:\LOG14 (100 logs passed), and L:\LOG15 (100 logs passed)
10/1/2007 2:30:19 PM -- C:\Program Files\Exchange Jetstress\iSCSI_SCC\5000Users\15SGs\8ThreadPerSGNewFirmware_Loadbalanced\Recovery\Performance_2007_10_1_9_13_13.blg has 149 samples.
10/1/2007 2:30:19 PM -- Creating test report ...
10/1/2007 2:30:20 PM -- Volume D: has 0.0174 for Avg. Disk sec/Read.
10/1/2007 2:30:20 PM -- Volume E: has 0.0178 for Avg. Disk sec/Read.

10/1/2007 2:30:20 PM -- Volume F: has 0.0134 for Avg. Disk sec/Read.
10/1/2007 2:30:20 PM -- Volume J: has 0.0034 for Avg. Disk sec/Write.
10/1/2007 2:30:20 PM -- Volume J: has 0.0010 for Avg. Disk sec/Read.
10/1/2007 2:30:20 PM -- Volume K: has 0.0034 for Avg. Disk sec/Write.
10/1/2007 2:30:20 PM -- Volume K: has 0.0010 for Avg. Disk sec/Read.
10/1/2007 2:30:20 PM -- Volume L: has 0.0033 for Avg. Disk sec/Write.
10/1/2007 2:30:20 PM -- Volume L: has 0.0008 for Avg. Disk sec/Read.
10/1/2007 2:30:20 PM -- Test has 1.46693771803725 Maximum Database Page Fault Stalls/sec.
10/1/2007 2:30:20 PM -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.
10/1/2007 2:30:20 PM -- C:\Program Files\Exchange Jetstress\iSCSI_SCC\5000Users\15SGs\8ThreadPerSGNewFirmware_Loadbalanced\Recovery\Performance_2007_10_1_9_13_13.xml has 148 samples queried.
10/1/2007 2:30:20 PM -- C:\Program Files\Exchange Jetstress\iSCSI_SCC\5000Users\15SGs\8ThreadPerSGNewFirmware_Loadbalanced\Recovery\Performance_2007_10_1_9_13_13.html is saved.
10/1/2007 2:30:27 PM -- Performance logging begins (interval: 4000 ms).
10/1/2007 2:30:27 PM -- Recovering databases ...
10/1/2007 2:36:23 PM -- Performance logging ends.
10/1/2007 2:36:23 PM -- Instance3868.1 (355.015625), Instance3868.2 (353.265625), Instance3868.3 (345.015625), Instance3868.4 (350.015625), Instance3868.5 (353.265625), Instance3868.6 (352.515625), Instance3868.7 (355.515625), Instance3868.8 (355.265625), Instance3868.9 (354.765625), Instance3868.10 (353.265625), Instance3868.11 (350.765625), Instance3868.12 (335.265625), Instance3868.13 (344.265625), Instance3868.14 (339.265625), and Instance3868.15 (338.015625)
10/1/2007 2:36:23 PM -- C:\Program Files\Exchange Jetstress\iSCSI_SCC\5000Users\15SGs\8ThreadPerSGNewFirmware_Loadbalanced\Recovery\SoftRecovery_2007_10_1_14_30_20.blg has 88 samples.
10/1/2007 2:36:23 PM -- Creating test report ...

SoftRecovery Performance Test Result Report

Test Summary

Overall Test Result **Pass**

Machine Name M34-SCC

Test Description 3 R10 of 10 DISKS DB
3 R1 LOGS
15 SG : 5 PER R10 LUN
5000 Users
500 MB Mailbox
0.5 IOPS

Test Start Time 10/1/2007 9:12:40 AM

Test End Time 10/1/2007 9:52:24 AM

Jetstress Version 08.01.0136.000

Ese Version 08.00.0685.024

Operating System Microsoft Windows Server 2003 R2 Service Pack 2, v.2825 (5.2.3790.131072)

Performance Log C:\Program Files\Exchange\Jetstress\iSCSI_SCC\5000Users\15SGs\8ThreadPerSGNewFirmware_Loadbalanced\Recd
C:\Program Files\Exchange\Jetstress\iSCSI_SCC\5000Users\15SGs\8ThreadPerSGNewFirmware_Loadbalanced\Recd

Database Sizing and Throughput

Achieved I/O per Second 2527.858

Planned I/O per Second 2500

Initial database size 2912202637312

Final database size 2918387138560

Database files (count) 15

Jetstress System Parameters

Thread count 8 (per-storage group)

Log buffers 9000

Minimum database cache 480.0 MB

Maximum database cache 3840.0 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 (D:)	0.017	0.049	502.430	329.899	(n/a)
Database (E:)	0.018	0.047	509.885	332.072	(n/a)
Database (F:)	0.013	0.013	517.452	336.119	(n/a)
Log (J:)	0.001	0.003	0.228	203.396	12422.324
Log (K:)	0.001	0.003	0.228	202.437	12522.853
Log (L:)	0.001	0.003	0.228	204.401	12364.010

Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	17.525	10.000	41.927
Available MBytes	11552.872	11175.000	14923.000
Free System Page Table Entries	16754419.000	16754419.000	16754419.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	73310702.819	73097216.000	74178560.000
Pool Paged Bytes	60586630.013	59768832.000	61124608.000
Database Page Fault Stalls/sec	0.015	0.000	1.467

Test Log 10/1/2007 9:12:40 AM -- Jetstress testing begins ...

10/1/2007 9:12:40 AM -- Prepare testing begins ...
 10/1/2007 9:12:55 AM -- Attaching databases ...
 10/1/2007 9:12:55 AM -- Prepare testing ends.
 10/1/2007 9:12:55 AM -- Dispatching transactions begins ...
 10/1/2007 9:12:55 AM -- Database cache settings: (minimum: 480.0 MB, maximum: 3.8 GB)
 10/1/2007 9:12:55 AM -- Database flush thresholds: (start: 38.4 MB, stop: 76.8 MB)
 10/1/2007 9:13:13 AM -- Database read latency thresholds: (average: 0.02 seconds/read, maximum: 0.05 seconds/read).
 10/1/2007 9:13:13 AM -- Log write latency thresholds: (average: 0.01 seconds/write, maximum: 0.05 seconds/write).
 10/1/2007 9:13:15 AM -- Operation mix: Sessions 8, Inserts 25%, Deletes 10%, Replaces 50%, Reads 15%, Lazy Commits 80%.
 10/1/2007 9:13:15 AM -- Performance logging begins (interval: 15000 ms).
 10/1/2007 9:13:15 AM -- Generating log files ...
 10/1/2007 9:50:44 AM -- J:\LOG1 (102.4% generated), J:\LOG2 (101.4% generated), J:\LOG3 (103.6% generated), J:\LOG4 (104.0% generated), J:\LOG5 (103.6% generated), K:\LOG6 (100.2% generated), K:\LOG7 (102.6% generated), K:\LOG8 (106.0% generated), K:\LOG9 (103.0% generated), K:\LOG10 (105.2% generated), L:\LOG11 (103.8% generated), L:\LOG12 (103.0% generated), L:\LOG13 (104.4% generated), L:\LOG14 (102.6% generated), and L:\LOG15 (100.8% generated)
 10/1/2007 9:50:45 AM -- Performance logging ends.
 10/1/2007 9:50:45 AM -- JetInterop batch transaction stats: 10060, 10001, 10160, 9952, 10005, 9956, 9933, 10170, 9974, 10273, 10130, 10078, 10122, 10128, and 9947.
 10/1/2007 9:50:46 AM -- Dispatching transactions ends.
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10/1/2007 9:52:25 AM -- Performance logging begins (interval: 30000 ms).

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10/1/2007 2:27:40 PM -- Performance logging ends.

10/1/2007 2:27:40 PM -- [C:\Program Files\Exchange Jetstress\iSCSI_SCC\5000Users\15SGs\8ThreadPerSGNewFirmware_Loadbalanced\Recovery\DBChecksum_2007_10_1_9_52_24.blg](#) has 550 samples.

10/1/2007 2:27:43 PM -- [C:\Program Files\Exchange Jetstress\iSCSI_SCC\5000Users\15SGs\8ThreadPerSGNewFirmware_Loadbalanced\Recovery\DBChecksum_2007_10_1_9_52_24.html](#) is saved.

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10/1/2007 2:30:19 PM -- [C:\Program Files\Exchange Jetstress\iSCSI_SCC\5000Users\15SGs\8ThreadPerSGNewFirmware_Loadbalanced\Recovery\Performance_2007_10_1_9_13_13.blg](#) has 149 samples.

10/1/2007 2:30:19 PM -- Creating test report ...

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10/1/2007 2:30:20 PM -- Volume J: has 0.0034 for Avg. Disk sec/Write.

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10/1/2007 2:30:20 PM -- Test has 1.46693771803725 Maximum Database Page Fault Stalls/sec.

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10/1/2007 2:30:20 PM -- [C:\Program Files\Exchange Jetstress\iSCSI_SCC\5000Users\15SGs\8ThreadPerSGNewFirmware_Loadbalanced\Recovery\Performance_2007_10_1_9_13_13.xml](#) has 148 samples queried.

Database Checksum Test Result Report

Checksum Statistics - All

Database	Seen pages	Bad pages	Correctable pages	Wrong page no pages	File length / seconds taken
D:\SG1\Jetstress1.edb	23738802	0	0	0	185459 MBytes / 3247 seconds
D:\SG2\Jetstress1.edb	23744946	0	0	0	185507 MBytes / 2769 seconds
D:\SG3\Jetstress1.edb	23759538	0	0	0	185621 MBytes

D:\SG4\Jetstress1.edb	23762866	0	0	0	185647 MBytes / 3337 seconds
D:\SG5\Jetstress1.edb	23760562	0	0	0	185629 MBytes / 3342 seconds
E:\SG6\Jetstress1.edb	23753650	0	0	0	185575 MBytes / 3339 seconds
E:\SG7\Jetstress1.edb	23759026	0	0	0	185617 MBytes / 3926 seconds
E:\SG8\Jetstress1.edb	23750578	0	0	0	185551 MBytes / 3264 seconds
E:\SG9\Jetstress1.edb	23732402	0	0	0	185409 MBytes / 3254 seconds
E:\SG10\Jetstress1.edb	23756722	0	0	0	185599 MBytes / 2799 seconds
F:\SG11\Jetstress1.edb	23748530	0	0	0	185535 MBytes / 1705 seconds
F:\SG12\Jetstress1.edb	23730098	0	0	0	185391 MBytes / 1658 seconds
F:\SG13\Jetstress1.edb	23761330	0	0	0	185635 MBytes / 1667 seconds
F:\SG14\Jetstress1.edb	23750578	0	0	0	185551 MBytes / 1661 seconds
F:\SG15\Jetstress1.edb	23738802	0	0	0	185459 MBytes / 1658 seconds
(Sum)	356248430	0	0	0	2783190 MBytes / 16514 seconds

Disk Subsystem Performance (of checksum)

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec
D:	0.911	0.011	928.450	0.002
E:	0.862	0.012	900.825	0.002
F:	0.467	0.008	1782.049	0.002

Memory System Performance (of checksum)

Counter	Average	Minimum	Maximum
% Processor Time	9.795	5.130	14.870
Available MBytes	15065.640	15024.000	15159.000
Free System Page Table Entries	16754419.000	16754419.000	16754419.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	76630537.309	76308480.000	77701120.000
Pool Paged Bytes	59279330.211	58830848.000	60067840.000

Test Log10/1/2007 9:12:40 AM -- Jetstress testing begins ...

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10/1/2007 9:12:55 AM -- Attaching databases ...
10/1/2007 9:12:55 AM -- Prepare testing ends.
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10/1/2007 9:12:55 AM -- Database cache settings: (minimum: 480.0 MB, maximum: 3.8 GB)
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