

ESRP Storage Program
EMC Celerra NS20 (1,500 User) Storage Solution for
Microsoft Exchange Server 2007 SP1

Tested with: ESRP – Storage Version 2.1
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Overview

This document provides information on an EMC® Celerra® NS20 storage solution for Microsoft Exchange Server 2007, which is based on the *Microsoft Exchange Solution Reviewed Program (ESRP) – Storage* program*. For any questions or comments regarding the contents of this document, see the [Contact Information](#) section.

*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 document describes an approach that can be used to configure Microsoft Exchange 2007 SP1 with an EMC Celerra NS20 storage system. The EMC Celerra NS20 meets the storage needs of a wide range of applications that include:

- Mail/Messaging
- Databases
- File/Print and Web services
- Distributed applications
- Remote replication

In addition, the NS20 supports a wide range of server operating environments such as Microsoft Windows, Linux, Solaris, AIX, and HP-UX.

The Celerra NS20 is a high-performance, full function IP storage platform. It delivers NAS and iSCSI capabilities to consolidate application storage and file servers. Easy to deploy and simple to manage, the Celerra NS20 is all-in-one IP storage for customers looking for enterprise-class capabilities packaged for specific applications, departments, or locations. The Celerra NS20FC provides customers the flexibility to combine Fibre Channel SAN connectivity with a NAS environment. The NS20FC is the most cost-effective way to add NAS and iSCSI to an existing SAN. Both offerings are available in single and dual-blade configurations.

Regardless of the configuration, Celerra platforms offer the following full suite of advanced functionality:

- Robust snap and replication capabilities for protection of data
- Celerra File Mover API enables automated policy-based movement of files between tiers of storage
- File-level retention provides disk-based Write Once Read Many (WORM) functionality, which is useful for archiving Exchange emails
- Automated Volume Management and Virtual Provisioning improve storage utilization

The performance results and best practices discussed in this document provide proven guidelines for configuring the Celerra NS20 for high-performance Exchange environments. For this solution, an integrated Celerra NS20 storage system was used and configured for 1,500 Exchange 2007 users. Each of the 1,500 users had a profile of 0.5 IOPS and a 250 MB mailbox.

Solution Description

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

One method often used to simplify the sizing and configuration of large amounts of EMC Celerra NS20 storage for use with Microsoft Exchange Server 2007 is to define a unit of measure. This unit of measure is known as a building block. The Microsoft Exchange Server 2007 building block is defined as six disk spindles, four spindles for Exchange database and two spindles for Exchange log.

The testing in this document proves that two building blocks (eight spindles for the databases and four spindles for logs) meet and exceed the Microsoft Exchange Server recommended metrics for reliability, scalability, and performance.

This unit of measure or building block needs to be scalable. In that way, an organization can simply take this block of work and multiply it by some factor until the desired number of Microsoft Exchange Server users has been properly met or configured to satisfy the Microsoft Exchange Server recommended performance metrics.

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

[Table 1](#) describes the characteristics of the storage configuration defined on the server.

Table 1: Server Characteristics

Number of users	1,500
Number of Exchange Servers	1
IOPS per user	0.5
Mailbox size	250 MB
Number of disks required for Logs and Database	12 (8 for database and 4 for log)
Disk type	300 GB 15k Fibre channel
RAID type	1

Using the performance characteristics of the Celerra NS20 architecture and the I/O capability of 300 GB, 15k disk drives, 12 spindles are required to provide the necessary performance to match the I/O requirements of 1,500 users; 0.5 IOPS users with a 1:1 read/write ratio.

[Figure 1 on page 7](#) illustrates a detailed view of the two building blocks disk layout on a Celerra NS20.

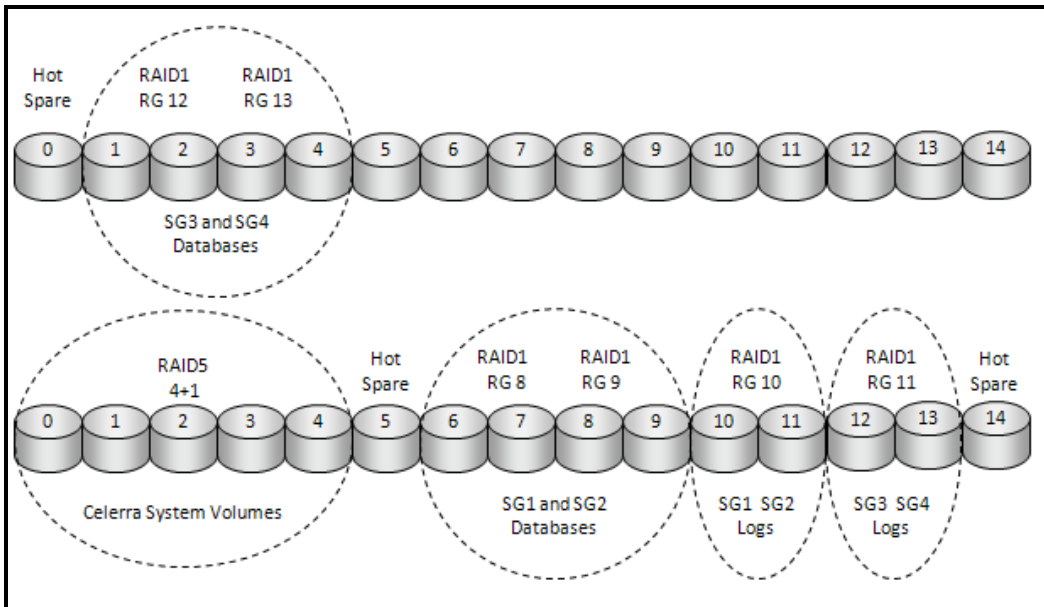


Figure 1: Disk Configuration

The Exchange databases for SG1 and SG2 are striped over four disk spindles from two 1+1 RAID 1 groups. The Exchange databases for SG3 and SG4 are striped over another four disk spindles from an additional two 1+1 RAID 1 groups. The logs for SG1 and SG2 will be stored on a single 1+1 RAID 1 group. The logs for SG3 and SG4 will be stored on another single 1+1 RAID 1 group.

The ESRP-Storage program focuses on storage solutions testing to address performance and reliability issues with storage design. However, storage is not the only factor to be taken into consideration while designing a scalable Exchange solution.

The other factors that 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

Due to such variables, 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, refer to Microsoft's Troubleshooting Microsoft Exchange Server Performance page, available at <http://go.microsoft.com/fwlink/?LinkId=23454>

Targeted Customer Profile

The solution is intended for medium-to-large Enterprise Exchange customers who would like to consolidate their Exchange users on a high-performance, highly available storage platform. This configuration is designed to support 1,500 Exchange users, with the following assumptions:

- One Exchange Jetstress Server
- 1,500 users per Exchange Server
- User I/O profile for testing – 0.42 (0.5 IOPs tested)
- User mailbox size for testing – 250 MB
- Four Exchange storage groups
- One Mailbox database per storage group

Tested Deployment

The tables in this section summarize the testing environment.

Simulated Exchange Configuration

[Table 2](#) lists the simulated Exchange configuration details.

Table 2: Simulated Exchange Configuration

Number of Exchange mailboxes simulated	1500
Number of hosts	1
Number of mailboxes/host	1500
Number of storage groups/host	4
Number of mailbox stores/storage group	1
Number of mailboxes/mailbox store	375
Number of mailbox store LUNs/storage group	1
Simulated profile: IOs per second per mailbox (IOPS, includes 20% headroom)	0.5
Database LUN size	237.8 GB
Log LUN size	119 GB
Backup LUN size/storage group	N/A

Total database size for performance testing	761.13
% formatted storage capacity used by Exchange database**	80%

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

Primary Storage Hardware

Table 3 lists the Primary Storage Hardware used in the environment.

Table 3: Hardware (list of all hardware used for the test)

Storage Connectivity (Fibre Channel, SAS, SATA, iSCSI)	iSCSI
Storage model and OS/firmware revision	EMC Celerra Version 5.6.39.5
Storage cache	2 GB Spilt for write/read
Number of storage controllers	4 (two Frontend, two Backend)
Number of storage ports	4 (of the total 8 ports, 4 are passive/redundant)
Maximum bandwidth of storage connectivity to host	4x1 Gb iSCSI Total bandwidth 4 Gb/s
Switch type/model/firmware revision	CISCO/ 6509E/IOS-12.2
HBA model and firmware	Intel PRO/1000 PT Dual Core
Number of HBAs/host	2 Quad port HBAs
Host server type	Processor(s):2 Processors(s) Installed
Total number of disks tested in solution	12
Maximum number of spindles can be hosted in the storage	60

Primary Storage Software

Table 4 lists the software used in the environment.

Table 4: Primary Storage Software

HBA driver	Microsoft iSCSI Initiator 2.07
HBA QueueTarget Setting	N/A
HBA QueueDepth Setting	N/A
Multi-Pathing	Multiple connections per session
Host OS	Microsoft Windows Server 2008 Enterprise 6.0.6001 Service Pack1 Build 6001
ESE.dll file version	08.01.0240.005
Replication solution name/version	N/A

Primary Storage Disk Configuration (Mailbox Store Disks)

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

Table 5: Storage Disk Configuration (mailbox store)

Disk type, speed, and firmware revision	4 GB/s FC 15k rpm – 60 AC
Raw capacity per disk (GB)	300 GB
Number of physical disks in test	8
total raw storage capacity (GB)	2400 GB
Disk slice size (GB)	N/A
Number of slices per LUN or number of disks per LUN	2 disks per LUN
Raid level	RAID 1
Total formatted capacity	951.2 GB
Storage capacity utilization	39.63%
Database capacity utilization	31.71%

Primary Storage Disk Configuration (Transactional Log Disks)

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

Table 6: Storage Disk Configuration (Transactional Log Disks)

Disk type, speed, and firmware revision	4 GB/s FC 15k rpm – 60 AC
Raw capacity per disk (GB)	300 GB

Number of spindles in test	4
total raw storage capacity (GB)	1200 GB
Disk slice size (GB)	N/A
Number of slices per LUN or number of disks per LUN	2 disks per LUN
Raid level	RAID 1
Total formatted capacity	476 GB

Streaming Backup

N/A

Replication Configuration

N/A

Best Practices

Exchange Server is a disk-intensive application. Based on the testing run using the ESRP framework, EMC recommends to improve the storage performance using the Exchange 2007 SP1 best practices.

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

Core Storage

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

Based on the testing run using an ESRP framework, EMC recommends the following best practices to improve the storage performance with Exchange solutions.

1. Isolate the Microsoft Exchange Server database workload from other I/O-intensive applications or workloads. This ensures highest levels of performance for Microsoft Exchange and simplifies troubleshooting in the event of a disk-related Microsoft Exchange performance problem.

2. The Microsoft Exchange Server logs and databases should be separated onto different physical disks and in different RAID groups.
3. Size and configure the environment based on disk spindle performance as a primary consideration and spindle or storage capacity as a secondary consideration. In other words, size the disk for performance first and make the capacity requirements work.

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

Backup Strategy

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

Test Results Summary

This section provides a high level summary of the test data from ESRP, and links to the detailed reports, which are generated by the ESRP testing framework.

Reliability

A number of the tests in the framework are designed to test reliability over a 24-hour period. The goal of these tests is to verify that the storage can handle high I/O load for a long period of time. Following the stress test, both the log and database are analyzed for integrity to ensure that there is no database or log corruption.

The following are the results of the reliability tests executed on Celerra NS20:

- No errors were reported in the event log file for the storage reliability testing
- No errors were reported for database and log checksum

The following tests are out-of-scope of this tested scenario:

- Back-to-disk test
- Database checksum on the remote storage database

The Jetstress performance results (24-hour performance test), refer to [Appendix A: Stress Test Reports \(24 hrs Performance Test\) on page 16](#).

Primary Storage Performance Results

The Primary Storage performance testing is designed to exercise the storage with maximum sustainable Exchange-type I/O for two hours. The test is used to show how long it takes for the storage to respond to an I/O under load. The data included in the following tables is a sample taken from each of the attached hosts. It is the average of all the logical disks in the 2-hour test duration.

Table 5: Performance Results

Database I/O	
Average Database Disk Transfers/sec	776.095
Average Database Disk Reads/sec	409.361
Average Database Disk Writes/sec	333.153
Average Database Disk Read Latency (ms)	13
Average Database Disk Write Latency (ms)	4
Transaction Log I/O	
Average Log Disk Writes/sec	234.311
Average Log Disk Write Latency (ms)	2

To view the Jetstress performance results (2-hour performance test), refer to [Appendix B: Performance Test Reports \(2 Hrs\) on page 21](#).

To view the results that characterizes the maximum performance of the disk layout, refer to [Appendix E: Maximum Solution IOPS Testing on page 31](#).

Streaming Backup/Recovery Performance

There are two tests in this section. The first test is to measure the read I/O 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.

Table 6: Database Read-Only Performance

MB read/sec per storage group	37.12
MB read/sec total	148.48

To view the Jetstress Streaming Backup Test results, refer to the section [Appendix C: Database Read-only Performance on page 26](#).

Log Read-Only Performance

To view the Jetstress Soft Recovery Test results, refer to the section [Appendix D: Log Read-only Performance Test Reports on page 28](#).

Log Read-only Performance test measures the log replay rate for each Storage group. The test also exercises the log file checksum performance, DB checksum performance, and log generation performance. After the Log Read-only Performance Test, all databases will be cleanly shutdown, and the log files are deleted.

The following table shows the average rate for 500 log files played in a single storage group for each server. Each Log file is 1 MB in size.

Table 7: Log Read-Only Performance

Average time to play one log file (sec)	1.76
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Conclusion

As this document illustrates, EMC's Celerra NS20 is more than capable of supporting deployments of up to 1,500 users at 0.5 IOPs per user. A careful analysis of each environment must be performed to understand the specific requirements of the architecture and to adapt a solution that best fits those needs. The information included in this document verifies that NS20 can support a high-performance Exchange configuration. This solution does not include local or remote replication. The addition of those features may affect performance.

Note that neither local nor remote replication were part of the solution.

This document is developed by EMC, and reviewed by the Microsoft Exchange Product team. The test results/data presented in this document are based on the tests introduced in the ESRP framework. The customer should not quote

the data directly for 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 benchmark program; tests are not designed to get the maximum throughput for a given solution. Rather, it is focused on producing recommendations from vendors for the exchange application. Therefore, the data presented in this document should not be used for direct comparisons among the solutions.

Contact Information

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

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Appendix A: Stress Test Reports (24 hrs Performance Test)

Microsoft Exchange Server Jetstress

Stress Test Result Report

Test Summary

Overall Test Pass
Result

Machine Name RTPSOL395

Test

Description

Test Start 9/25/2008 1:09:28 PM
Time

Test End Time 9/26/2008 1:18:43 PM

Jetstress 08.02.0060.000

Version

Ese Version 08.01.0240.005

Operating Windows Server (R) 2008 Enterprise Service Pack 1
System (6.0.6001.65536)

Performance C:\Program Files\Exchange
Log Jetstress\Stress_2008_9_25_13_9_39.blg
C:\Program Files\Exchange
Jetstress\DBChecksum_2008_9_26_13_18_43.blg

Database Sizing and Throughput

Achieved I/O per Second 757.413

Capacity Percentage 100%

Throughput Percentage 100%

Initial database size 817257578496

Final database size 845078921216

Database files (count) 4

Jetstress System Parameters

Thread count 5 (per-storage group)

Log buffers 9000

Minimum database cache 128.0 MB

Maximum database cache 1024.0 MB

Insert operations 40%

Delete operations 30%

Replace operations 5%

Read operations 25%
 Lazy commits 55%

Disk Subsystem Performance

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec	Avg. Disk Bytes/Write
Database (E:)	0.013	0.004	101.340	88.241	(n/a)
Database (F:)	0.013	0.004	101.371	88.090	(n/a)
Database (G:)	0.013	0.004	101.309	87.869	(n/a)
Database (H:)	0.013	0.004	101.193	88.000	(n/a)
Log (K:)	0.003	0.002	0.823	56.604	4428.027
Log (L:)	0.003	0.002	0.820	56.414	4436.252
Log (M:)	0.003	0.002	0.823	56.223	4451.372
Log (N:)	0.003	0.002	0.820	56.446	4425.923

Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	2.143	0.859	23.364
Available MBytes	29595.379	29565.000	29700.000
Free System Page Table Entries	33560305.409	33559805.000	33560559.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	68728851.566	67825664.000	69718016.000
Pool Paged Bytes	113547243.723	112926720.000	143138816.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log 9/25/2008 1:09:28 PM -- Jetstress testing begins ...

9/25/2008 1:09:28 PM -- Prepare testing begins ...

9/25/2008 1:09:33 PM -- Attaching databases ...

9/25/2008 1:09:33 PM -- Prepare testing ends.

9/25/2008 1:09:33 PM -- Dispatching transactions begins ...

9/25/2008 1:09:33 PM -- Database cache settings: (minimum: 128.0 MB, maximum: 1.0 GB)

9/25/2008 1:09:33 PM -- Database flush thresholds: (start: 10.2 MB, stop: 20.5 MB)

9/25/2008 1:09:39 PM -- Database read latency thresholds: (average: 0.02 seconds/read, maximum: 0.1 seconds/read).

9/25/2008 1:09:39 PM -- Log write latency thresholds: (average: 0.01 seconds/write, maximum: 0.1 seconds/write).

9/25/2008 1:09:41 PM -- Operation mix: Sessions 5, Inserts 40%, Deletes 30%,

Replaces 5%, Reads 25%, Lazy Commits 55%.
9/25/2008 1:09:41 PM -- Performance logging begins (interval: 15000 ms).
9/25/2008 1:09:41 PM -- Attaining prerequisites:
9/25/2008 1:18:38 PM -- \MSEExchange Database(JetstressWin)\Database Cache Size, Last: 968114200.0 (lower bound: 966367600.0, upper bound: none)
9/26/2008 1:18:39 PM -- Performance logging ends.
9/26/2008 1:18:39 PM -- JetInterop batch transaction stats: 244364, 244649, 244104, and 243852.
9/26/2008 1:18:41 PM -- Dispatching transactions ends.
9/26/2008 1:18:41 PM -- Shutting down databases ...
9/26/2008 1:18:43 PM -- Instance4168.1 (complete), Instance4168.2 (complete), Instance4168.3 (complete), and Instance4168.4 (complete)
9/26/2008 1:18:44 PM -- Performance logging begins (interval: 30000 ms).
9/26/2008 1:18:44 PM -- Verifying database checksums ...
9/26/2008 3:10:19 PM -- E: (100% processed), F: (100% processed), G: (100% processed), and H: (100% processed)
9/26/2008 3:10:20 PM -- Performance logging ends.
9/26/2008 3:10:20 PM -- C:\Program Files\Exchange Jetstress\DBChecksum_2008_9_26_13_18_43.blg has 223 samples.
9/26/2008 3:10:22 PM -- C:\Program Files\Exchange Jetstress\DBChecksum_2008_9_26_13_18_43.html is saved.
9/26/2008 3:10:22 PM -- Verifying log checksums ...
9/26/2008 3:10:22 PM -- K:\ (2 logs passed), L:\ (2 logs passed), M:\ (2 logs passed), and N:\ (2 logs passed)
9/26/2008 3:10:22 PM -- C:\Program Files\Exchange Jetstress\Stress_2008_9_25_13_9_39.blg has 5792 samples.
9/26/2008 3:10:22 PM -- Creating test report ...
9/26/2008 3:10:47 PM -- Volume E: has 0.0130 for Avg. Disk sec/Read.
9/26/2008 3:10:47 PM -- Volume F: has 0.0129 for Avg. Disk sec/Read.
9/26/2008 3:10:47 PM -- Volume G: has 0.0129 for Avg. Disk sec/Read.
9/26/2008 3:10:47 PM -- Volume H: has 0.0133 for Avg. Disk sec/Read.
9/26/2008 3:10:47 PM -- Volume K: has 0.0022 for Avg. Disk sec/Write.
9/26/2008 3:10:47 PM -- Volume K: has 0.0031 for Avg. Disk sec/Read.
9/26/2008 3:10:47 PM -- Volume L: has 0.0022 for Avg. Disk sec/Write.
9/26/2008 3:10:47 PM -- Volume L: has 0.0031 for Avg. Disk sec/Read.
9/26/2008 3:10:47 PM -- Volume M: has 0.0022 for Avg. Disk sec/Write.
9/26/2008 3:10:47 PM -- Volume M: has 0.0031 for Avg. Disk sec/Read.
9/26/2008 3:10:47 PM -- Volume N: has 0.0022 for Avg. Disk sec/Write.
9/26/2008 3:10:47 PM -- Volume N: has 0.0030 for Avg. Disk sec/Read.
9/26/2008 3:10:47 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.
9/26/2008 3:10:47 PM -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.
9/26/2008 3:10:47 PM -- C:\Program Files\Exchange Jetstress\Stress_2008_9_25_13_9_39.xml has 5756 samples queried.

Test Result Report –Checksum

Microsoft Exchange Server Jetstress
Checksum Statistics - All

Database	Seen pages	Bad pages	Correctable pages	Wrong page no pages	File length / seconds taken
E:\Jetstress1.edb	25791170	0	0	0	201493 MBytes / 6694 seconds
F:\Jetstress1.edb	25789890	0	0	0	201483 MBytes / 6685 seconds
G:\Jetstress1.edb	25789890	0	0	0	201483 MBytes / 6360 seconds
H:\Jetstress1.edb	25788098	0	0	0	201469 MBytes / 6462 seconds
(Sum)	103159048	0	0	0	805930 MBytes / 6694 seconds

Disk Subsystem Performance (of checksum)

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec
E:	0.080	0.000	481.640	0.001
F:	0.087	0.000	481.853	0.001
G:	0.088	0.001	507.822	0.001
H:	0.085	0.001	499.473	0.001

Memory System Performance (of checksum)

Counter	Average	Minimum	Maximum
% Processor Time	14.995	9.941	18.829
Available MBytes	30627.897	30603.000	30641.000
Free System Page Table Entries	33560595.632	33560029.000	33561336.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	69458976.143	68853760.000	70066176.000
Pool Paged Bytes	113663099.982	112783360.000	142725120.000

Test Log 9/25/2008 1:09:28 PM -- Jetstress testing begins ...
9/25/2008 1:09:28 PM -- Prepare testing begins ...
9/25/2008 1:09:33 PM -- Attaching databases ...
9/25/2008 1:09:33 PM -- Prepare testing ends.
9/25/2008 1:09:33 PM -- Dispatching transactions begins ...
9/25/2008 1:09:33 PM -- Database cache settings: (minimum: 128.0 MB, maximum: 1.0 GB)
9/25/2008 1:09:33 PM -- Database flush thresholds: (start: 10.2 MB, stop: 20.5 MB)
9/25/2008 1:09:39 PM -- Database read latency thresholds: (average: 0.02 seconds/read, maximum: 0.1 seconds/read).
9/25/2008 1:09:39 PM -- Log write latency thresholds: (average: 0.01 seconds/write, maximum: 0.1 seconds/write).
9/25/2008 1:09:41 PM -- Operation mix: Sessions 5, Inserts 40%, Deletes 30%, Replaces 5%, Reads 25%, Lazy Commits 55%.
9/25/2008 1:09:41 PM -- Performance logging begins (interval: 15000 ms).
9/25/2008 1:09:41 PM -- Attaining prerequisites:
9/25/2008 1:18:38 PM -- \MSEExchange Database(JetstressWin)\Database Cache Size, Last: 968114200.0 (lower bound: 966367600.0, upper bound: none)
9/26/2008 1:18:39 PM -- Performance logging ends.
9/26/2008 1:18:39 PM -- JetInterop batch transaction stats: 244364, 244649, 244104, and 243852.
9/26/2008 1:18:41 PM -- Dispatching transactions ends.
9/26/2008 1:18:41 PM -- Shutting down databases ...
9/26/2008 1:18:43 PM -- Instance4168.1 (complete), Instance4168.2 (complete), Instance4168.3 (complete), and Instance4168.4 (complete)
9/26/2008 1:18:44 PM -- Performance logging begins (interval: 30000 ms).
9/26/2008 1:18:44 PM -- Verifying database checksums ...
9/26/2008 3:10:19 PM -- E: (100% processed), F: (100% processed), G: (100% processed), and H: (100% processed)
9/26/2008 3:10:20 PM -- Performance logging ends.
9/26/2008 3:10:20 PM -- C:\Program Files\Exchange Jetstress\DBChecksum_2008_9_26_13_18_43.blg has 223 samples.

Appendix B: Performance Test Reports (2 Hrs)

Microsoft Exchange Server Jetstress

Performance Test Result Report

Test Summary

Overall Test Result Pass

Machine Name RTPSOL395

Test

Description

Test Start Time 9/23/2008 2:18:54 PM

Test End Time 9/23/2008 4:27:58 PM

Jetstress Version 08.02.0060.000

Ese Version

08.01.0240.005

Operating System Windows Server (R) 2008 Enterprise Service Pack 1 (6.0.6001.65536)

Performance Log C:\Program Files\Exchange Jetstress\Performance_2008_9_23_14_19_4.blg
C:\Program Files\Exchange Jetstress\DBChecksum_2008_9_23_16_27_58.blg

Database Sizing and Throughput

Achieved I/O per Second 776.095

Capacity Percentage 100%

Throughput Percentage 100%

Initial database size 817249189888

Final database size 820107608064

Database files (count) 4

Jetstress System Parameters

Thread count 5 (per-storage group)

Log buffers 9000

Minimum database cache 128.0 MB

Maximum database cache 1024.0 MB

Insert operations 40%

Delete operations 30%

Replace operations 5%

Read operations 25%
 Lazy commits 55%

Disk Subsystem Performance

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec	Avg. Disk Bytes/Write
Database (E:)	0.013	0.004	102.552	92.311	(n/a)
Database (F:)	0.013	0.004	102.079	91.567	(n/a)
Database (G:)	0.013	0.004	102.166	91.150	(n/a)
Database (H:)	0.013	0.004	102.564	91.706	(n/a)
Log (K:)	0.000	0.002	0.000	58.730	4582.947
Log (L:)	0.000	0.002	0.000	58.491	4559.175
Log (M:)	0.000	0.002	0.000	58.299	4610.252
Log (N:)	0.000	0.002	0.000	58.791	4511.553

Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	1.985	1.086	5.588
Available MBytes	29722.979	29714.000	29811.000
Free System Page Table Entries	33560548.794	33560024.000	33560832.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	63151035.733	62558208.000	63651840.000
Pool Paged Bytes	107391249.067	107352064.000	107614208.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log 9/23/2008 2:18:54 PM -- Jetstress testing begins ...
 9/23/2008 2:18:54 PM -- Prepare testing begins ...
 9/23/2008 2:18:59 PM -- Attaching databases ...
 9/23/2008 2:18:59 PM -- Prepare testing ends.
 9/23/2008 2:18:59 PM -- Dispatching transactions begins ...
 9/23/2008 2:18:59 PM -- Database cache settings: (minimum: 128.0 MB, maximum: 1.0 GB)
 9/23/2008 2:18:59 PM -- Database flush thresholds: (start: 10.2 MB, stop: 20.5 MB)
 9/23/2008 2:19:04 PM -- Database read latency thresholds: (average: 0.02 seconds/read, maximum: 0.05 seconds/read).
 9/23/2008 2:19:04 PM -- Log write latency thresholds: (average: 0.01

seconds/write, maximum: 0.05 seconds/write).

9/23/2008 2:19:05 PM -- Operation mix: Sessions 5, Inserts 40%, Deletes 30%, Replaces 5%, Reads 25%, Lazy Commits 55%.

9/23/2008 2:19:05 PM -- Performance logging begins (interval: 15000 ms).

9/23/2008 2:19:05 PM -- Attaining prerequisites:

9/23/2008 2:27:57 PM -- \MSEExchange Database(JetstressWin)\Database Cache Size, Last: 968056800.0 (lower bound: 966367600.0, upper bound: none)

9/23/2008 4:27:57 PM -- Performance logging ends.

9/23/2008 4:27:57 PM -- JetInterop batch transaction stats: 22511, 22311, 22416, and 22575.

9/23/2008 4:27:58 PM -- Dispatching transactions ends.

9/23/2008 4:27:58 PM -- Shutting down databases ...

9/23/2008 4:27:58 PM -- Instance3660.1 (complete), Instance3660.2 (complete), Instance3660.3 (complete), and Instance3660.4 (complete)

9/23/2008 4:27:59 PM -- Performance logging begins (interval: 30000 ms).

9/23/2008 4:27:59 PM -- Verifying database checksums ...

9/23/2008 6:13:51 PM -- E: (100% processed), F: (100% processed), G: (100% processed), and H: (100% processed)

9/23/2008 6:13:51 PM -- Performance logging ends.

9/23/2008 6:13:51 PM -- C:\Program Files\Exchange Jetstress\DBChecksum_2008_9_23_16_27_58.blg has 211 samples.

9/23/2008 6:13:53 PM -- C:\Program Files\Exchange Jetstress\DBChecksum_2008_9_23_16_27_58.html is saved.

9/23/2008 6:13:53 PM -- Verifying log checksums ...

9/23/2008 6:13:53 PM -- K:\ (2 logs passed), L:\ (3 logs passed), M:\ (2 logs passed), and N:\ (2 logs passed)

9/23/2008 6:13:53 PM -- C:\Program Files\Exchange Jetstress\Performance_2008_9_23_14_19_4.blg has 515 samples.

9/23/2008 6:13:53 PM -- Creating test report ...

9/23/2008 6:13:56 PM -- Volume E: has 0.0127 for Avg. Disk sec/Read.

9/23/2008 6:13:56 PM -- Volume F: has 0.0129 for Avg. Disk sec/Read.

9/23/2008 6:13:56 PM -- Volume G: has 0.0127 for Avg. Disk sec/Read.

9/23/2008 6:13:56 PM -- Volume H: has 0.0130 for Avg. Disk sec/Read.

9/23/2008 6:13:56 PM -- Volume K: has 0.0023 for Avg. Disk sec/Write.

9/23/2008 6:13:56 PM -- Volume K: has 0.0000 for Avg. Disk sec/Read.

9/23/2008 6:13:56 PM -- Volume L: has 0.0023 for Avg. Disk sec/Write.

9/23/2008 6:13:56 PM -- Volume L: has 0.0000 for Avg. Disk sec/Read.

9/23/2008 6:13:56 PM -- Volume M: has 0.0022 for Avg. Disk sec/Write.

9/23/2008 6:13:56 PM -- Volume M: has 0.0000 for Avg. Disk sec/Read.

9/23/2008 6:13:56 PM -- Volume N: has 0.0022 for Avg. Disk sec/Write.

9/23/2008 6:13:56 PM -- Volume N: has 0.0000 for Avg. Disk sec/Read.

9/23/2008 6:13:56 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.

9/23/2008 6:13:56 PM -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.

9/23/2008 6:13:56 PM -- C:\Program Files\Exchange Jetstress\Performance_2008_9_23_14_19_4.xml has 479 samples queried.

Database	Seen pages	Bad pages	Correctable pages	Wrong page no pages	File length / seconds taken
E:\Jetstress1.edb	25029298	0	0	0	195541 MBytes / 6345 seconds
F:\Jetstress1.edb	25027250	0	0	0	195525 MBytes / 6350 seconds
G:\Jetstress1.edb	25027762	0	0	0	195529 MBytes / 6183 seconds
H:\Jetstress1.edb	25026482	0	0	0	195519 MBytes / 6287 seconds
(Sum)	100110792	0	0	0	782115 MBytes / 6351 seconds

Test Result Report –Checksum

Microsoft Exchange Server Jetstress

Test Result Report

Checksum Statistics - All

Disk Subsystem Performance (of checksum)

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec
E:	0.079	0.001	492.549	0.002
F:	0.086	0.001	490.537	0.002
G:	0.089	0.001	506.877	0.002
H:	0.086	0.001	497.757	0.002

Memory System Performance (of checksum)

Counter	Average	Minimum	Maximum
% Processor Time	15.973	12.384	20.128
Available MBytes	30767.109	30756.000	30778.000
Free System Page Table Entries	33560822.355	33560350.000	33561752.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	63271513.782	62611456.000	63905792.000
Pool Paged Bytes	107036866.123	106463232.000	107102208.000

Test Log 9/23/2008 2:18:54 PM -- Jetstress testing begins ...
9/23/2008 2:18:54 PM -- Prepare testing begins ...
9/23/2008 2:18:59 PM -- Attaching databases ...
9/23/2008 2:18:59 PM -- Prepare testing ends.
9/23/2008 2:18:59 PM -- Dispatching transactions begins ...
9/23/2008 2:18:59 PM -- Database cache settings: (minimum: 128.0 MB, maximum: 1.0 GB)
9/23/2008 2:18:59 PM -- Database flush thresholds: (start: 10.2 MB, stop: 20.5 MB)
9/23/2008 2:19:04 PM -- Database read latency thresholds: (average: 0.02 seconds/read, maximum: 0.05 seconds/read).
9/23/2008 2:19:04 PM -- Log write latency thresholds: (average: 0.01 seconds/write, maximum: 0.05 seconds/write).
9/23/2008 2:19:05 PM -- Operation mix: Sessions 5, Inserts 40%, Deletes 30%, Replaces 5%, Reads 25%, Lazy Commits 55%.
9/23/2008 2:19:05 PM -- Performance logging begins (interval: 15000 ms).
9/23/2008 2:19:05 PM -- Attaining prerequisites:
9/23/2008 2:27:57 PM -- \MSEExchange Database(JetstressWin)\Database Cache Size, Last: 968056800.0 (lower bound: 966367600.0, upper bound: none)
9/23/2008 4:27:57 PM -- Performance logging ends.
9/23/2008 4:27:57 PM -- JetInterop batch transaction stats: 22511, 22311, 22416, and 22575.
9/23/2008 4:27:58 PM -- Dispatching transactions ends.
9/23/2008 4:27:58 PM -- Shutting down databases ...
9/23/2008 4:27:58 PM -- Instance3660.1 (complete), Instance3660.2 (complete), Instance3660.3 (complete), and Instance3660.4 (complete)
9/23/2008 4:27:59 PM -- Performance logging begins (interval: 30000 ms).
9/23/2008 4:27:59 PM -- Verifying database checksums ...
9/23/2008 6:13:51 PM -- E: (100% processed), F: (100% processed), G: (100% processed), and H: (100% processed)
9/23/2008 6:13:51 PM -- Performance logging ends.
9/23/2008 6:13:51 PM -- C:\Program Files\Exchange Jetstress\DBChecksum_2008_9_23_16_27_58.blg has 211 samples.

Appendix C: Database Read-only Performance

Microsoft Exchange Server Jetstress

Streaming backup Test Result Report

Streaming Backup Statistics - All

Database Instance	Database Size (MBytes)	Elapsed Backup Time	MBytes Transferred/sec
Instance2920.1	194845.40	01:28:19	36.77
Instance2920.2	194845.40	01:29:38	36.23
Instance2920.3	194845.40	01:25:48	37.84
Instance2920.4	194845.40	01:26:16	37.64

Jetstress System Parameters

Thread count	5 (per-storage group)
Log buffers	9000
Minimum database cache	128.0 MB
Maximum database cache	1024.0 MB
Insert operations	40%
Delete operations	30%
Replace operations	5%
Read operations	25%
Lazy commits	55%

Disk Subsystem Performance

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec	Avg. Disk Bytes/Write
Database (E:)	0.003	0.000	290.199	0.008	(n/a)
Database (F:)	0.003	0.000	289.875	0.001	(n/a)
Database (G:)	0.003	0.000	290.210	0.008	(n/a)
Database (H:)	0.003	0.000	290.227	0.008	(n/a)
Log (K:)	0.000	0.000	0.001	0.005	38.192
Log (L:)	0.000	0.000	0.000	0.000	0.000
Log (M:)	0.000	0.000	0.001	0.006	61.203
Log (N:)	0.000	0.000	0.001	0.005	38.604

Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	14.774	6.005	19.180
Available MBytes	30593.670	30226.000	30635.000
Free System Page Table Entries	33558114.642	33557454.000	33558959.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	62365238.346	61341696.000	62926848.000
Pool Paged Bytes	117255825.877	102047744.000	495681536.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log 9/24/2008 6:35:56 AM -- Jetstress testing begins ...
9/24/2008 6:35:56 AM -- Prepare testing begins ...
9/24/2008 6:36:01 AM -- Attaching databases ...
9/24/2008 6:36:01 AM -- Prepare testing ends.
9/24/2008 6:36:07 AM -- Performance logging begins (interval: 30000 ms).
9/24/2008 6:36:07 AM -- Streaming backup databases ...
9/24/2008 8:05:45 AM -- Performance logging ends.
9/24/2008 8:05:45 AM -- Instance2920.1 (100% processed),
Instance2920.2 (100% processed), Instance2920.3 (100% processed), and
Instance2920.4 (100% processed)
9/24/2008 8:05:45 AM -- [C:\Program Files\Exchange
Jetstress\StreamingBackup_2008_9_24_6_36_1.blg](#) has 179 samples.
9/24/2008 8:05:45 AM -- Creating test report ...

Appendix D: Log Read-only Performance Test Reports

Microsoft Exchange Server Jetstress

SoftRecovery Test Result Report

Soft-Recovery Statistics - All

Database Instance	Log files replayed	Elapsed seconds
Instance3292.1	500	874.1185909
Instance3292.2	505	899.5782805
Instance3292.3	506	901.9651264
Instance3292.4	516	896.3958193

Disk Subsystem Performance

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec	Avg. Disk Bytes/Write
Database (E:)	0.184	0.056	249.767	5.633	(n/a)
Database (F:)	0.201	0.052	251.336	5.677	(n/a)
Database (G:)	0.179	0.046	249.283	5.655	(n/a)
Database (H:)	0.192	0.049	251.689	5.804	(n/a)
Log (K:)	0.019	0.000	18.377	0.053	92.331
Log (L:)	0.020	0.000	18.549	0.040	62.005
Log (M:)	0.021	0.000	18.539	0.021	58.130
Log (N:)	0.020	0.000	18.950	0.029	25.154

Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	5.158	1.357	63.846
Available MBytes	29597.482	29030.000	30472.000
Free System Page Table Entries	33558402.621	33557971.000	33558835.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	70961517.714	68702208.000	71561216.000
Pool Paged Bytes	121249371.429	110018560.000	643293184.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log 9/24/2008 12:11:08 AM -- Jetstress testing begins ...

9/24/2008 12:11:08 AM -- Prepare testing begins ...

9/24/2008 12:11:13 AM -- Attaching databases ...

9/24/2008 12:11:13 AM -- Prepare testing ends.

9/24/2008 12:11:13 AM -- Dispatching transactions begins ...
 9/24/2008 12:11:13 AM -- Database cache settings: (minimum: 128.0 MB, maximum: 1.0 GB)
 9/24/2008 12:11:13 AM -- Database flush thresholds: (start: 10.2 MB, stop: 20.5 MB)
 9/24/2008 12:11:18 AM -- Database read latency thresholds: (average: 0.02 seconds/read, maximum: 0.05 seconds/read).
 9/24/2008 12:11:19 AM -- Log write latency thresholds: (average: 0.01 seconds/write, maximum: 0.05 seconds/write).
 9/24/2008 12:11:20 AM -- Operation mix: Sessions 5, Inserts 40%, Deletes 30%, Replaces 5%, Reads 25%, Lazy Commits 55%.
 9/24/2008 12:11:20 AM -- Performance logging begins (interval: 15000 ms).
 9/24/2008 12:11:20 AM -- Generating log files ...
 9/24/2008 1:24:19 AM -- K:\ (100.2% generated), L:\ (101.2% generated), M:\ (101.4% generated), and N:\ (103.4% generated)
 9/24/2008 1:24:19 AM -- Performance logging ends.
 9/24/2008 1:24:19 AM -- JetInterop batch transaction stats: 12818, 12928, 12918, and 13003.
 9/24/2008 1:24:20 AM -- Dispatching transactions ends.
 9/24/2008 1:24:20 AM -- Shutting down databases ...
 9/24/2008 1:24:21 AM -- Instance3292.1 (complete), Instance3292.2 (complete), Instance3292.3 (complete), and Instance3292.4 (complete)
 9/24/2008 1:24:21 AM -- C:\Program Files\Exchange Jetstress\Performance_2008_9_24_0_11_19.blg has 291 samples.
 9/24/2008 1:24:21 AM -- Creating test report ...
 9/24/2008 1:24:23 AM -- Volume E: has 0.0125 for Avg. Disk sec/Read.
 9/24/2008 1:24:23 AM -- Volume F: has 0.0125 for Avg. Disk sec/Read.
 9/24/2008 1:24:23 AM -- Volume G: has 0.0124 for Avg. Disk sec/Read.
 9/24/2008 1:24:23 AM -- Volume H: has 0.0128 for Avg. Disk sec/Read.
 9/24/2008 1:24:23 AM -- Volume K: has 0.0023 for Avg. Disk sec/Write.
 9/24/2008 1:24:23 AM -- Volume K: has 0.0034 for Avg. Disk sec/Read.
 9/24/2008 1:24:23 AM -- Volume L: has 0.0023 for Avg. Disk sec/Write.
 9/24/2008 1:24:23 AM -- Volume L: has 0.0035 for Avg. Disk sec/Read.
 9/24/2008 1:24:23 AM -- Volume M: has 0.0023 for Avg. Disk sec/Write.
 9/24/2008 1:24:23 AM -- Volume M: has 0.0034 for Avg. Disk sec/Read.
 9/24/2008 1:24:23 AM -- Volume N: has 0.0022 for Avg. Disk sec/Write.
 9/24/2008 1:24:23 AM -- Volume N: has 0.0033 for Avg. Disk sec/Read.
 9/24/2008 1:24:23 AM -- Test has 0 Maximum Database Page Fault Stalls/sec.
 9/24/2008 1:24:23 AM -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.
 9/24/2008 1:24:23 AM -- C:\Program Files\Exchange Jetstress\Performance_2008_9_24_0_11_19.xml has 290 samples queried.
 9/24/2008 1:24:24 AM -- C:\Program Files\Exchange Jetstress\Performance_2008_9_24_0_11_19.html is saved.
 9/24/2008 1:24:25 AM -- Performance logging begins (interval: 2000 ms).
 9/24/2008 1:24:25 AM -- Recovering databases ...
 9/24/2008 1:39:27 AM -- Performance logging ends.

9/24/2008 1:39:27 AM -- Instance3292.1 (874.1185909), Instance3292.2 (899.5782805), Instance3292.3 (901.9651264), and Instance3292.4 (896.3958193)

9/24/2008 1:39:27 AM -- C:\Program Files\Exchange Jetstress\SoftRecovery_2008_9_24_1_24_24.blg has 448 samples.

9/24/2008 1:39:27 AM -- Creating test report ...

Appendix E: Maximum Solution IOPS Testing

The building block described under is the EMC recommended configuration for 1,500 Exchange user workload at 0.5 IOPS per user. The results shown in [Appendix A: Stress Test Reports \(24 hrs Performance Test\)](#) illustrates that this configuration achieved excellent results, with considerable room for growth.

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

After providing that the building block could easily satisfy the ESRP criteria, subsequent tests were run to determine the upper limits of the configuration. The number of Jetstress threads was increased from 5 to 14 without modifying any of the other components. The achieved IOPS increased from 1,552 to 2740, a 43 percent increase. While this workload is not recommended for customers, as it is close to the maximum acceptable latency for ESRP, it highlights the headroom in the recommended building block.

Maximum Performance Test Report

Microsoft Exchange Server Jetstress

Performance Test Result Report

Test Summary

Overall Test Pass

Result

Machine Name RTPSOL395

Test

Description

Test Start Time 9/25/2008 1:24:37 AM

Test End Time 9/25/2008 3:32:00 AM

Jetstress 08.02.0060.000

Version

Ese Version 08.01.0240.005

Operating System Windows Server (R) 2008 Enterprise Service Pack 1
(6.0.6001.65536)

Performance Log C:\Program Files\Exchange Jetstress\Performance_2008_9_25_1_24_48.blg
 C:\Program Files\Exchange Jetstress\DBCchecksum_2008_9_25_3_32_0.blg

Database Sizing and Throughput

Achieved I/O per Second 1370.734
 Capacity Percentage 100%
 Throughput Percentage 100%
 Initial database size 817257578496
 Final database size 821881798656
 Database files (count) 4

Jetstress System Parameters

Thread count 14 (per-storage group)
 Log buffers 9000
 Minimum database cache 128.0 MB
 Maximum database cache 1024.0 MB
 Insert operations 40%
 Delete operations 30%
 Replace operations 5%
 Read operations 25%
 Lazy commits 55%

Disk Subsystem Performance

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec	Avg. Disk Bytes/Write
Database (E:)	0.020	0.006	170.900	175.078	(n/a)
Database (F:)	0.019	0.006	168.282	171.709	(n/a)
Database (G:)	0.019	0.006	168.877	172.182	(n/a)
Database (H:)	0.020	0.006	168.922	174.782	(n/a)
Log (K:)	0.003	0.003	1.508	92.118	4925.044
Log (L:)	0.003	0.002	1.520	91.753	4931.251
Log (M:)	0.003	0.002	1.551	91.629	4957.493
Log (N:)	0.003	0.002	1.552	93.040	4924.559

Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	4.358	2.314	10.266
Available MBytes	29514.702	29459.000	29614.000
Free System Page Table Entries	33558325.733	33557652.000	33558664.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	65895620.267	63655936.000	66670592.000
Pool Paged Bytes	104133708.800	103649280.000	104656896.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log 9/25/2008 1:24:37 AM -- Jetstress testing begins ...
 9/25/2008 1:24:37 AM -- Prepare testing begins ...
 9/25/2008 1:24:43 AM -- Attaching databases ...
 9/25/2008 1:24:43 AM -- Prepare testing ends.
 9/25/2008 1:24:43 AM -- Dispatching transactions begins ...
 9/25/2008 1:24:43 AM -- Database cache settings: (minimum: 128.0 MB, maximum: 1.0 GB)
 9/25/2008 1:24:43 AM -- Database flush thresholds: (start: 10.2 MB, stop: 20.5 MB)
 9/25/2008 1:24:48 AM -- Database read latency thresholds: (average: 0.02 seconds/read, maximum: 0.05 seconds/read).
 9/25/2008 1:24:48 AM -- Log write latency thresholds: (average: 0.01 seconds/write, maximum: 0.05 seconds/write).
 9/25/2008 1:24:50 AM -- Operation mix: Sessions 14, Inserts 40%, Deletes 30%, Replaces 5%, Reads 25%, Lazy Commits 55%.
 9/25/2008 1:24:50 AM -- Performance logging begins (interval: 15000 ms).
 9/25/2008 1:24:50 AM -- Attaining prerequisites:
 9/25/2008 1:31:58 AM -- \MSEExchange Database(JetstressWin)\Database Cache Size, Last: 967032800.0 (lower bound: 966367600.0, upper bound: none)
 9/25/2008 3:31:59 AM -- Performance logging ends.
 9/25/2008 3:31:59 AM -- JetInterop batch transaction stats: 38460, 38064, 38368, and 38427.
 9/25/2008 3:31:59 AM -- Dispatching transactions ends.
 9/25/2008 3:31:59 AM -- Shutting down databases ...
 9/25/2008 3:32:00 AM -- Instance3964.1 (complete), Instance3964.2 (complete), Instance3964.3 (complete), and Instance3964.4 (complete)
 9/25/2008 3:32:02 AM -- Performance logging begins (interval: 30000 ms).
 9/25/2008 3:32:02 AM -- Verifying database checksums ...
 9/25/2008 5:20:24 AM -- E: (100% processed), F: (100% processed), G: (100% processed), and H: (100% processed)
 9/25/2008 5:20:24 AM -- Performance logging ends.
 9/25/2008 5:20:24 AM -- C:\Program Files\Exchange

Jetstress\DBChecksum_2008_9_25_3_32_0.blg has 216 samples.
 9/25/2008 5:20:27 AM -- C:\Program Files\Exchange
 Jetstress\DBChecksum_2008_9_25_3_32_0.html is saved.
 9/25/2008 5:20:27 AM -- Verifying log checksums ...
 9/25/2008 5:20:28 AM -- K:\ (2 logs passed), L:\ (2 logs passed), M:\ (2
 logs passed), and N:\ (2 logs passed)
 9/25/2008 5:20:28 AM -- C:\Program Files\Exchange
 Jetstress\Performance_2008_9_25_1_24_48.blg has 508 samples.
 9/25/2008 5:20:28 AM -- Creating test report ...
 9/25/2008 5:20:31 AM -- Volume E: has 0.0196 for Avg. Disk sec/Read.
 9/25/2008 5:20:31 AM -- Volume F: has 0.0194 for Avg. Disk sec/Read.
 9/25/2008 5:20:31 AM -- Volume G: has 0.0185 for Avg. Disk sec/Read.
 9/25/2008 5:20:31 AM -- Volume H: has 0.0200 for Avg. Disk sec/Read.
 9/25/2008 5:20:31 AM -- Volume K: has 0.0025 for Avg. Disk sec/Write.
 9/25/2008 5:20:31 AM -- Volume K: has 0.0034 for Avg. Disk sec/Read.
 9/25/2008 5:20:31 AM -- Volume L: has 0.0025 for Avg. Disk sec/Write.
 9/25/2008 5:20:31 AM -- Volume L: has 0.0032 for Avg. Disk sec/Read.
 9/25/2008 5:20:31 AM -- Volume M: has 0.0025 for Avg. Disk sec/Write.
 9/25/2008 5:20:31 AM -- Volume M: has 0.0033 for Avg. Disk sec/Read.
 9/25/2008 5:20:31 AM -- Volume N: has 0.0024 for Avg. Disk sec/Write.
 9/25/2008 5:20:31 AM -- Volume N: has 0.0032 for Avg. Disk sec/Read.
 9/25/2008 5:20:31 AM -- Test has 0 Maximum Database Page Fault
 Stalls/sec.
 9/25/2008 5:20:31 AM -- Test has 0 Database Page Fault Stalls/sec samples
 higher than 0.
 9/25/2008 5:20:31 AM -- C:\Program Files\Exchange
 Jetstress\Performance_2008_9_25_1_24_48.xml has 479 samples queried.

Test Result Report – Checksum

Microsoft Exchange Server Jetstress

Test Result Report

Checksum Statistics - All

Database	Seen pages	Bad pages	Correctable pages	Wrong page no pages	File length / seconds taken
E:\Jetstress1.edb	25080754	0	0	0	195943 MBytes / 6491 seconds
F:\Jetstress1.edb	25082290	0	0	0	195955 MBytes / 6501 seconds
G:\Jetstress1.edb	25081266	0	0	0	195947 MBytes / 6182 seconds
H:\Jetstress1.edb	25083058	0	0	0	195961

				MBytes / 6296 seconds
(Sum)	100327368	0	0	0
				783807 MBytes / 6501 seconds

Disk Subsystem Performance (of checksum)

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec
E:	0.080	0.001	483.105	0.001
F:	0.087	0.000	479.115	0.001
G:	0.088	0.000	507.825	0.001
H:	0.085	0.000	498.311	0.001

Memory System Performance (of checksum)

Counter	Average	Minimum	Maximum
% Processor Time	15.941	10.747	21.115
Available MBytes	30576.824	30518.000	30599.000
Free System Page Table Entries	33558982.046	33558586.000	33559561.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	66337545.481	65662976.000	66822144.000
Pool Paged Bytes	104042097.778	103411712.000	104251392.000

Test Log 9/25/2008 1:24:37 AM -- Jetstress testing begins ...

9/25/2008 1:24:37 AM -- Prepare testing begins ...

9/25/2008 1:24:43 AM -- Attaching databases ...

9/25/2008 1:24:43 AM -- Prepare testing ends.

9/25/2008 1:24:43 AM -- Dispatching transactions begins ...

9/25/2008 1:24:43 AM -- Database cache settings: (minimum: 128.0 MB, maximum: 1.0 GB)

9/25/2008 1:24:43 AM -- Database flush thresholds: (start: 10.2 MB, stop: 20.5 MB)

9/25/2008 1:24:48 AM -- Database read latency thresholds: (average: 0.02 seconds/read, maximum: 0.05 seconds/read).

9/25/2008 1:24:48 AM -- Log write latency thresholds: (average: 0.01 seconds/write, maximum: 0.05 seconds/write).

9/25/2008 1:24:50 AM -- Operation mix: Sessions 14, Inserts 40%, Deletes 30%, Replaces 5%, Reads 25%, Lazy Commits 55%.

9/25/2008 1:24:50 AM -- Performance logging begins (interval: 15000 ms).

9/25/2008 1:24:50 AM -- Attaining prerequisites:

9/25/2008 1:31:58 AM -- \MSExchange Database(JetstressWin)\Database Cache Size, Last: 967032800.0 (lower bound: 966367600.0, upper bound:

none)
9/25/2008 3:31:59 AM -- Performance logging ends.
9/25/2008 3:31:59 AM -- JetInterop batch transaction stats: 38460, 38064, 38368, and 38427.
9/25/2008 3:31:59 AM -- Dispatching transactions ends.
9/25/2008 3:31:59 AM -- Shutting down databases ...
9/25/2008 3:32:00 AM -- Instance3964.1 (complete), Instance3964.2 (complete), Instance3964.3 (complete), and Instance3964.4 (complete)
9/25/2008 3:32:02 AM -- Performance logging begins (interval: 30000 ms).
9/25/2008 3:32:02 AM -- Verifying database checksums ...
9/25/2008 5:20:24 AM -- E: (100% processed), F: (100% processed), G: (100% processed), and H: (100% processed)
9/25/2008 5:20:24 AM -- Performance logging ends.
9/25/2008 5:20:24 AM -- C:\Program Files\Exchange Jetstress\DBChecksum_2008_9_25_3_32_0.blg has 216 samples.