

## ESRP Storage Program

EMC CLARiiON AX4-5i (500 User)  
Exchange 2010 Mailbox Resiliency  
Storage Solution

**Tested with:** ESRP - Storage Version 3.0  
**Tested Date:** 25 November 2009



**EMC Global Solutions**

Copyright © 2010 EMC Corporation. All rights reserved.

Published February, 2010

EMC believes the information in this publication is accurate as of its publication date. The information is subject to change without notice.

THE INFORMATION IN THIS PUBLICATION IS PROVIDED "AS IS." EMC CORPORATION MAKES NO REPRESENTATIONS OR WARRANTIES OF ANY KIND WITH RESPECT TO THE INFORMATION IN THIS PUBLICATION, AND SPECIFICALLY DISCLAIMS IMPLIED WARRANTIES OF

MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Use, copying, and distribution of any EMC software described in this publication requires an applicable software license. For the most up-to-date listing of EMC product names, see EMC Corporation Trademarks on EMC.com

All other trademarks used herein are the property of their respective owners.

EMC CLARiiON AX4-5i (500 User) Exchange 2010 Mailbox Resiliency Storage Solution  
Part Number: H6716

---

## Table of Contents

Overview.....	4
Disclaimer .....	4
Features .....	4
Solution description .....	5
Targeted customer profile .....	9
Tested deployment.....	10
Best practices .....	15
Test results summary.....	18
Conclusion .....	20
Contact information.....	21
Appendix: Test reports .....	22

---

## Overview

This document provides information on the EMC® CLARiiON® AX4-5i (500 User) Exchange 2010 Mailbox Resiliency storage solution 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, visit:

<http://technet.microsoft.com/en-us/exchange/ff182054.aspx>

---

## Disclaimer

This document has been produced independently of Microsoft Corporation. Microsoft Corporation expressly disclaims responsibility for, and makes no warranty—express or implied—with respect to the accuracy of the contents of this document.

The information contained in this document represents the current view of EMC on the issues discussed as of the date of publication. Due to changing market conditions, it should not be interpreted as a commitment on the part of EMC. In addition, EMC cannot guarantee the accuracy of any information presented after the date of publication.

---

## Features

EMC's CLARiiON AX4-5i is a versatile and cost-effective solution for organizations looking for an alternative to server-based storage. CLARiiON AX4-5i delivers performance, scalability, and advanced data management features in one easy-to-use storage solution.

Advanced capabilities start with the scalability to meet both the needs of today and the requirements of tomorrow. Single-controller EMC CLARiiON AX4-5i models are a low-cost approach to deploying external storage. They provide an economical storage platform for applications such as backup-to-disk and a variety of data archiving tasks. Dual-controller models offer superior availability.

The CLARiiON AX4-5i can scale up to 60 drives through four expansion enclosures. Note that the four expansions enclosures are in addition to the system enclosure. The capabilities of the CLARiiON AX4-5i go beyond simply providing generous storage capacity. With the ability to provide consolidated storage for up to 64 hosts, the CLARiiON AX4-5i provides maximum flexibility for growing organizations that want to add servers and applications.

The CLARiiON AX4-5i can be equipped with serial-attached SCSI (SAS) drives for performance-orientated applications, and serial ATA (SATA) drives to deliver the lowest cost per gigabyte and highest capacity per drive. The ability to mix SAS and SATA drives within each enclosure provides the most flexible and economical system configurations for all needs.

EMC's CLARiiON AX4 series delivers functionality that unleashes the benefits of tiered storage. Users can easily deploy, expand, and re-deploy storage with the AX4 series.

It delivers maximum capability in an entry-level system without added and unwanted complexity. The system combines exceptional ease of use and intuitive manageability with the performance and scalability that business-critical applications requires.

EMC's CLARiiON AX4 also offers unmatched flexibility with a choice of management environments and software solutions, enabling customers to grow the capabilities of the system to match their changing environments.

---

## Solution description

This solution utilizes low-cost, high-capacity 1 TB SATA disks for Exchange data. High availability is also part of this solution with the use of Microsoft Database Availability Groups (DAGs). A DAG is a set of mailbox servers that use continuous replication to provide automatic recovery in the event of failures. A DAG may contain up to 16 mailbox servers, each one having a replicated copy of the production databases and log files.

This solution utilizes three copies of each Exchange database. Two of these copies are on the primary site storage array. To provide additional protection, a third copy of each database is placed on a second storage array. When using three copies within a DAG, EMC recommends that the third copy is placed on a separate storage array.

Due to changes in the architecture of Exchange Server 2010, failover is now at the individual database level. DAGs provide automatic failover without the complexity of traditional clustering.

With the new features in Exchange 2010, customers can now deploy much larger mailboxes than with previous versions of Exchange server without degraded performance. Also, Exchange data can now reside on lower-speed disks such as SATA drives, as used in this solution.

This solution uses a building-block approach to storage design. One method used to simplify the sizing and configuration of storage for use with Microsoft Exchange Server 2010 is to define a unit of measure—a *building-block*. Such a unit of measure needs to meet all of the Microsoft Exchange Server recommended metrics for excellent reliability, scalability, and performance, and needs to be easy to implement. An organization can take this block of work and multiply it by some factor until the desired number of Microsoft Exchange Server users (that is, Microsoft Messaging API (MAPI) Outlook users), has been properly met or configured to satisfy the Microsoft Exchange Server recommended performance metrics. If each unit is properly configured, it will match the Microsoft Exchange Server recommendations for a healthy-performing system, from both a disk and an end-user perspective.

EMC's best practices involving the building-block approach for an Exchange Server design proved to be very successful throughout many customers' implementations.

Two 2+2 RAID 10 groups were used in this configuration. Logs and databases were placed on the same spindles but within different RAID groups—for example, database 1 was placed in RAID group 1, with its corresponding logs in RAID group 2, and so on.

Each 2+2 RAID 10 group can be used for 250 users with a profile of 0.18 IOPS (which includes 20 percent overhead) and a mailbox size of 5 GB. This building block can then be used for each DAG copy of the Exchange data.

A total of four Exchange databases were used, two databases per RAID group. This satisfies both the performance and capacity requirements for this solution.

Figure 1 illustrates the layout of the simulated Exchange 2010 solution.

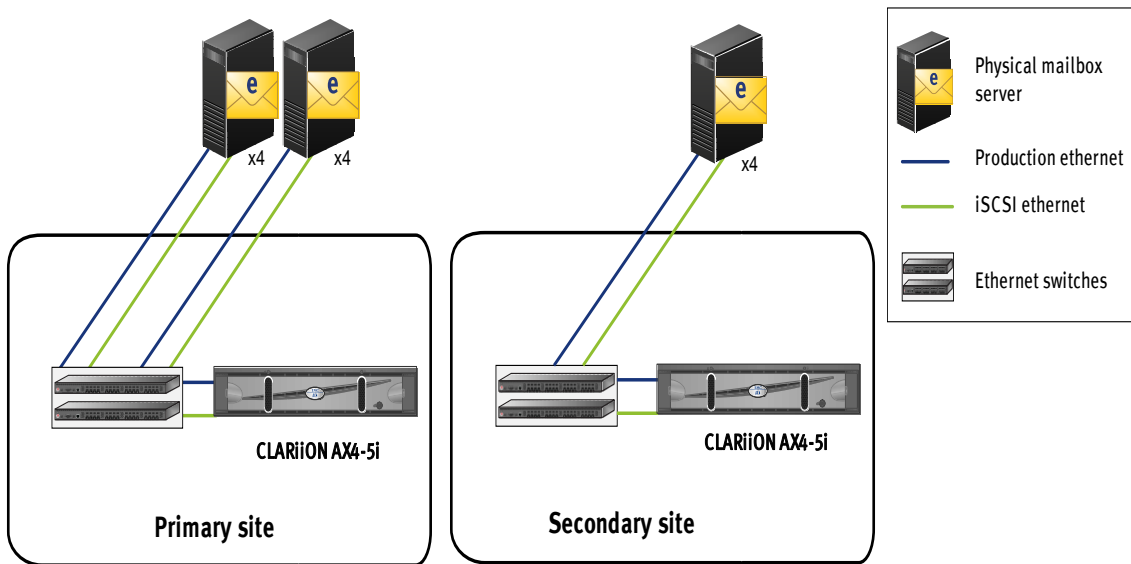
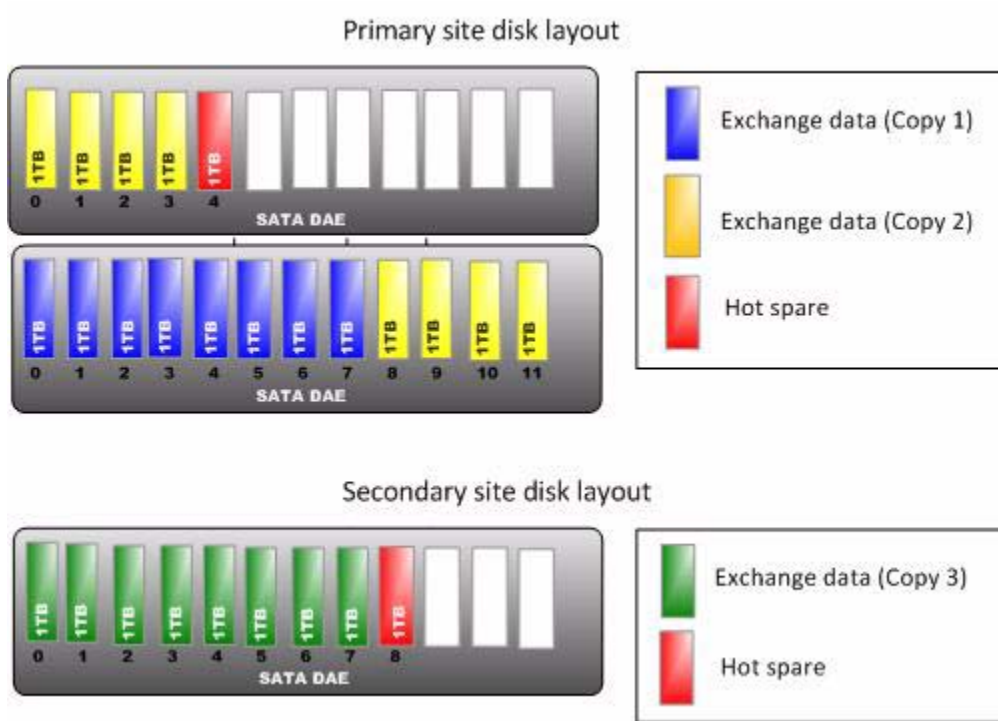


Figure 1 Physical architecture

Figure 2 illustrates the disk layout.



**Figure 2 Disk layout**

The Windows Hardware Compatibility List link for EMC's CLARiiON AX4-5i is:

<http://www.windowsservercatalog.com/item.aspx?itemId=53f4f795-0c47-2df1-24b7-690341b1769e>

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 consider when designing a scalable Exchange solution. 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

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 deployments.

For more information on identifying and addressing performance bottlenecks in an Exchange system, refer to Microsoft's *Troubleshooting Microsoft Exchange Server Performance* available at: <http://go.microsoft.com/fwlink/?LinkId=23454>.

---

## Targeted customer profile

This solution is intended for small and medium-sized businesses hosting 500 Exchange mailboxes. The configuration used for testing is described below:

- 500 users
- One host attached, up to 64 hosts possible
- User I/O profile of 0.18 (including 20 percent extra for headroom)
- User mailbox size of 5 GB
- DAG used for mailbox resiliency

## Tested deployment

The following tables summarize the tested environment.

### Simulated Exchange configuration

Table 1 lists the simulated Exchange configuration details.

**Table 1 Simulated Exchange configuration**

Item	Description
Number of Exchange mailboxes simulated	500
Number of DAGs	1
Number of servers/DAG	3
Number of active mailboxes/server	500
Number of databases/host	4
Number of copies/database	3
Number of mailboxes/databases	125
Simulated profile: I/Os per second per mailbox (IOPS, include 20% headroom)	0.18
Database LUN size	850 GB
Log LUN size	26 GB
Total database size for performance testing	2440 GB
% formatted storage capacity used by Exchange database **	72%

\*\*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

Table 2 lists the hardware used in the environment.

**Table 2 Hardware (list of all hardware used for the test)**

Item	Description
Storage Connectivity (Fibre Channel, SAS, SATA, iSCSI)	iSCSI and SATA
Storage model and OS/firmware revision	CLARiiON AX4-5i, FLARE <sup>®</sup> OS version 02.23.050.5.705
Storage cache	2 GB
Number of storage controllers	2
Number of storage ports	4
Maximum bandwidth of storage connectivity to host	4 GB
Switch type/model/firmware revision	Ethernet switch, Dell PowerConnect 5324, 2 GB, Layer 2
HBA model and firmware	Intel PRO/1000 PT dual port adapter
Number of HBAs/host	2
Host server type	Dell PowerEdge 2950, 2 x Intel Xeon CPU E53452.33 GHz, 2327 MHz, 4-core and 16 GB memory
Total number of disks tested in solution	8
Maximum number of spindles that can be hosted in the storage	60

## Storage software

Table 3 lists the software used in the environment.

**Table 3**      **Software**

<b>Item</b>	<b>Description</b>
Multipathing	Microsoft iSCSI Initiator Version 6.0 Build 6000 EMC PowerPath <sup>®</sup> 5.3 (64-bit)
Host OS	Microsoft Windows Server 2008 Enterprise Service Pack 2
ESE.dll file version	14.0.639.19
Replication solution name/version	N/A

## Storage disk configuration (mailbox store disks)

Table 4 lists the disk configuration (mailbox store disks) for the environment.

**Table 4 Disk configuration (mailbox store)**

Item	Description
Disk type, speed and firmware revision	SATA 11 7.2k, 300F/1237
Raw capacity per disk (GB)	917.18 GB
Number of physical disks in test	8 disks
Total raw storage capacity (GB)	7337.44 GB
Disk slice size (GB)	917.18 GB
Number of slices per LUN or number of disks per LUN	4
RAID level	10
Total formatted capacity	3400 GB
Storage capacity utilization	46.34%
Database capacity utilization	33.25%

## Storage disk configuration (transactional log disks utilizes same disks as mailbox store database)

Table 5 lists the disk configuration (transactional log disks) for the environment.

**Table 5 Disk configuration**

Item	Description
Disk type, speed and firmware revision	SATA 7.2k rpm, 300F/1237
Raw capacity per disk (GB)	917.18 GB
Number of spindles in test	8 disks (shared with database disks)
Total raw storage capacity (GB)	7337.44 GB
Number of slices disks per LUN	4
RAID level	10
Total formatted capacity	104 GB

## Best practices

A building-block approach should be used when designing Exchange 2010 storage layouts. The building-block approach defines the number of physical disks required for a certain number of users with a certain user profile.

In this solution, each 2+2 RAID 10 configuration satisfies the capacity and performance requirements for 250 users with a mailbox size of 5 GB and a user profile of 0.18 IOPs (including 20 percent overhead), ensuring that response times remain well within the required Microsoft thresholds. Once the number of disks is determined for the original Exchange data, this number must be scaled up to satisfy each copy of the data within a DAG

With the reduction in IOPS, capacity may now be the limiting factor in many cases, as it was in this solution. Only a total of four physical disks was required to ensure that required performance would be achieved but four disks did not satisfy the capacity requirement.

Microsoft Exchange Server 2010 has changed significantly since early versions of Exchange, particularly when it comes to I/O and storage. There have been many changes to the core schema and the extensible storage engine (ESE) to reduce I/O. Due to this I/O reduction, Exchange 2010 now supports SATA disks. The change also enables the use of RAID 5 as an optimal RAID configuration. This allows for larger mailboxes at a reduced cost without degrading performance.

For more information on these changes, visit:

[http://technet.microsoft.com/en-us/library/bb125040\(EXCHG.140\).aspx#StoreSchemaChanges](http://technet.microsoft.com/en-us/library/bb125040(EXCHG.140).aspx#StoreSchemaChanges)

For Exchange 2010 best practices on storage design, visit:

[http://technet.microsoft.com/en-us/library/bb124558\(EXCHG.140\).aspx](http://technet.microsoft.com/en-us/library/bb124558(EXCHG.140).aspx)

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

1. Disk alignment is no longer required when running Microsoft Windows Server 2008.

---

**Note:** Exchange Server 2010 requires Windows Server 2008.

2. When formatting a newly partitioned LUN, EMC recommends that for database and log files the ALU is set to 64 K. This can be done from the drop-down list in Disk Manager or through the CLI.
3. The following list details the recommended best practices for networking:
  - a. Multiple network switches are preferred for fault tolerance and performance. Where this is not possible, VLANs must be used to isolate iSCSI traffic.
  - b. For iSCSI solutions, 1 Gb/s NICs are recommended as a minimum.
  - c. Isolate iSCSI networks from production networks. Use VLANs to segment this traffic.
  - d. EMC recommends the use of two NICs for added fault tolerance.
  - e. Using the Windows built-in iSCSI initiator, connect each NIC to the storage with a load-balanced approach—for example, NIC0 to SPA2 and SPB2. This builds in fault tolerance to the connectivity.
  - f. On each iSCSI NIC, do the following:
    - Set all iSCSI NIC speeds to 1 Gb/s or 1000, depending on the NIC manufacturer.
    - Disable **Microsoft Networking**.
    - Disable **File & Print Sharing**.
    - Disable **IPv6** if not being used.
    - Do not implement TCP Chimney for Broadcom.
    - Disable all TOE features for Intel.
4. The following list details the recommended best practices for core storage:
  - a. When tuning the AX4-5i storage system parameters, it is important to ensure the optimal performance. The following list details the optimal configuration settings for Exchange 2010 on an EMC AX4-5i storage array:
    - Page size is set to 8 KB if there are other applications also sharing this array.
    - Page size set to 16 KB if the array is dedicated to the Exchange 2010 workload.
    - Write cache turned on for all LUNs.

- b. Isolate Microsoft Exchange server database workload from other I/O-intensive applications or workloads. This ensures the highest level of performance for Exchange and simplifies troubleshooting in the event of a disk-related Microsoft Exchange performance issue.
- c. Always size the disks for IOPS before capacity. Once this is calculated, determine the capacity required.
- d. When you get the actual IOPS numbers, always apply a 20 percent I/O overhead factor to your calculations to add some reserve.
- e. Microsoft recommends that logs and databases are placed on the same physical spindles under the following conditions:
  - DAG is in place.
  - DAG contains a minimum of three database copies.
- f. DAG copies must be homed on at least two separate storage devices, that is, AX4-5i arrays.
- g. For conditions where logs and databases can share the same spindles, visit:  
[http://technet.microsoft.com/en-us/library/bb124558\(EXCHG.140\).aspx](http://technet.microsoft.com/en-us/library/bb124558(EXCHG.140).aspx).
- h. Microsoft currently recommends a maximum database size of 200 GB in solutions where DAG is not being used. When DAG is being used with a minimum of three database copies, the maximum database size can be up to 2 TB. Backup (if applicable) and restore times should be accounted for when calculating the database size.

For more information on EMC solutions for Microsoft Exchange Server, visit:

<http://www.emc.com/solutions/application-environment/microsoft/solutions-for-microsoft-exchange-unified-communications.htm>

---

## Test results summary

This section provides a high-level summary of the test data from ESRP, as well as links to the detailed reports that are generated by the ESRP testing framework. The results are located in [“Appendix: Test reports” on page 22](#).

---

## 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 while replicating synchronously. Following the stress test, both log and database files on production and the DR hosts are analyzed for integrity to ensure there is no database or log corruption.

- No errors were reported in the event log file for the storage reliability testing.
- No errors were reported for the database and log checksum.
- No errors were reported during the backup-to-disk test.

---

## Storage performance results

To see the Jetstress performance results (2-hour performance test), see the section [“Microsoft Exchange Server 2010 Jetstress – 2-hour performance” on page 32](#).

Storage performance testing exercises 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 two-hour test duration.

Each server is listed separately, and the aggregate numbers across all servers are listed in [“Individual server metrics” on page 19](#).

**Individual server metrics**

The information in the following table includes the sum of I/Os across storage groups and the average latency across all storage groups on a per-server basis.

<b>Database I/O</b>	
Database disks transfers/sec	108.045
Database disks reads/sec	64.283
Database disks writes/sec	43.761
Average database disk read latency (ms)	11.180
Average database disk write latency (ms)	5.350
<b>Transaction log I/O</b>	
Log disks writes/sec	42.875
Average log disk write latency (ms)	1.91075

**Database backup/recovery performance**

There are two test reports in this section. The first one is to measure the sequential read rate of the database files, and the second is to measure the recovery/replay performance (playing transaction logs in to the database).

**Database read-only performance**

This test is used to measure the maximum rate at which databases could be backed up via Volume Shadow (Copy) Service (VSS). The following table shows the average rate for a single database file.

MB read/sec per database	31.335
MB read/sec total per server	125.34

**Transaction log recovery/replay performance**

This test is used 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)	3.338
---	-------

---

## Conclusion

This document has been developed by EMC, and reviewed by the Microsoft Exchange Product team. The test results and data presented in this document are based on tests introduced in the ESRP test framework. Customers should not quote the data directly for their predeployment 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, use the following numbers:

**United States:** (800) 782-4362 (SVC-4EMC)

**Canada:** (800) 543-4782 (543-4SVC)

**Worldwide:** (508) 497-7901

For additional information on EMC products and services available to customers and partners, visit:

**<http://EMC.com>**

or

**<http://Powerlink.EMC.com>**

## Appendix: Test reports

The test results included in this section include:

- “Microsoft Exchange Server 2010 Jetstress – 24-hour stress” on page 22
- “Microsoft Exchange Server 2010 Jetstress – 2-hour performance” on page 32
- “Microsoft Exchange Server 2010 Jetstress – database backup” on page 42
- “Microsoft Exchange Server 2010 Jetstress – SoftRecovery” on page 45

### Microsoft Exchange Server 2010 Jetstress – 24-hour stress

#### Stress test result report

##### Test summary

<b>Overall Test Result</b>	<b>Pass</b>
<b>Machine Name</b>	F8PEX01
<b>Test Description</b>	N/A
<b>Test Start Time</b>	18/11/2009 06:46:27
<b>Test End Time</b>	19/11/2009 07:00:08
<b>Collection Start Time</b>	18/11/2009 06:59:55
<b>Collection End Time</b>	19/11/2009 06:59:50
<b>Jetstress Version</b>	14.01.0040.000
<b>Ese Version</b>	14.00.0639.019
<b>Operating System</b>	Windows Server (R) 2008 Enterprise Service Pack 2 (6.0.6002.131072)
<b>Performance Log</b>	<ul style="list-style-type: none"> <li>• C:\Program Files\Exchange Jetstress\Results\Stress\Test1\Stress_2009_11_18_6_46_41.blg</li> <li>• C:\Program Files\Exchange Jetstress\Results\Stress\Test1\DBChecksum_2009_11_19_7_0_8.blg</li> </ul>

**Database sizing and throughput**

<b>Achieved Transactional I/O per Second</b>	113.131
<b>Target Transactional I/O per Second</b>	90
<b>Initial Database Size (bytes)</b>	2623048777728
<b>Final Database Size (bytes)</b>	2627578626048
<b>Database Files (Count)</b>	4

**Jetstress system parameters**

<b>Thread Count</b>	1 (per database)
<b>Minimum Database Cache</b>	128.0 MB
<b>Maximum Database Cache</b>	1024.0 MB
<b>Insert Operations</b>	40%
<b>Delete Operations</b>	20%
<b>Replace Operations</b>	5%
<b>Read Operations</b>	35%
<b>Lazy Commits</b>	70%
<b>Run Background Database Maintenance</b>	True
<b>Number of Copies per Database</b>	3

**Database configuration**

<b>Instance1760.1</b>	Log Path: S:\LOG1\FILES Database: S:\DB1\FILES\Jetstress001001.edb
<b>Instance1760.2</b>	Log Path: T:\LOG2\FILES Database: T:\DB2\FILES\Jetstress002001.edb
<b>Instance1760.3</b>	Log Path: U:\LOG3\FILES Database: U:\DB3\FILES\Jetstress003001.edb
<b>Instance1760.4</b>	Log Path: V:\LOG4\FILES Database: V:\DB4\FILES\Jetstress004001.edb

## Transactional I/O performance

MSExchange Database ==> Instances	I/O Database Reads Average Latency (msec)	I/O Database Writes Average Latency (msec)	I/O Database Reads/sec	I/O Database Writes/sec	I/O Database Reads Average Bytes	I/O Database Writes Average Bytes	I/O Log Reads Average Latency (msec)	I/O Log Writes Average Latency (msec)	I/O Log Reads/sec	I/O Log Writes/sec	I/O Log Reads Average Bytes	I/O Log Writes Average Bytes
Instance1760.1	11.249	5.219	16.885	11.537	39353.417	36811.237	0.000	1.911	0.000	10.526	0.000	4630.679
Instance1760.2	11.825	5.544	16.752	11.431	38679.019	36853.404	0.000	1.883	0.000	10.434	0.000	4590.435
Instance1760.3	11.054	5.218	16.796	11.463	39159.187	36783.967	0.000	1.928	0.000	10.425	0.000	4614.098
Instance1760.4	11.668	5.695	16.793	11.473	38868.262	36883.462	0.000	1.893	0.000	10.461	0.000	4594.559

## Background database maintenance I/O performance

MSExchange Database ==> Instances	Database Maintenance I/O Reads/sec	Database Maintenance I/O Reads Average Bytes
Instance1760.1	29.082	261478.181
Instance1760.2	28.816	261484.446
Instance1760.3	29.228	261471.372
Instance1760.4	28.944	261471.555

## Log replication I/O performance

MSEExchange Database ==> Instances	I/O Log Reads/sec	I/O Log Reads Average Bytes
Instance1760.1	0.387	76005.893
Instance1760.2	0.385	75595.559
Instance1760.3	0.385	75842.879
Instance1760.4	0.385	75535.395

## Total I/O performance

MSEExchange Database ==> Instances	I/O Database Reads Average Latency (msec)	I/O Database Writes Average Latency (msec)	I/O Database Reads/sec	I/O Database Writes/sec	I/O Database Reads Average Bytes	I/O Database Writes Average Bytes	I/O Log Reads Average Latency (msec)	I/O Log Writes Average Latency (msec)	I/O Log Reads/sec	I/O Log Writes/sec	I/O Log Reads Average Bytes	I/O Log Writes Average Bytes
Instance1760.1	11.249	5.219	45.967	11.537	179883.749	36811.237	3.462	1.911	0.387	10.526	76005.893	4630.679
Instance1760.2	11.825	5.544	45.568	11.431	179573.678	36853.404	3.879	1.883	0.385	10.434	75595.559	4590.435
Instance1760.3	11.054	5.218	46.024	11.463	180341.879	36783.967	3.372	1.928	0.385	10.425	75842.879	4614.098
Instance1760.4	11.668	5.695	45.737	11.473	179738.840	36883.462	3.807	1.893	0.385	10.461	75535.395	4594.559

**Host system performance**

Counter	Average	Minimum	Maximum
% Processor Time	0.776	0.000	4.528
Available MBytes	13955.571	13936.000	14094.000
Free System Page Table Entries	33559100.752	33558084.000	33559288.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	52751366.796	52236288.000	52924416.000
Pool Paged Bytes	125312393.076	122740736.000	127082496.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

**Test log**

```

18/11/2009 06:46:27 -- Command Line: "C:\Program Files\Exchange
Jetstress\JetstressCmd.exe" /c "C:\Program Files\Exchange
Jetstress\Results\Stress\Test1\Stress_Test1.xml"
18/11/2009 06:46:27 -- Jetstress testing begins ...
18/11/2009 06:46:27 -- Prepare testing begins ...
18/11/2009 06:46:36 -- Attaching databases ...
18/11/2009 06:46:36 -- Prepare testing ends.
18/11/2009 06:46:36 -- Dispatching transactions begins ...
18/11/2009 06:46:36 -- Database cache settings: (minimum: 128.0 MB,
maximum: 1.0 GB)
18/11/2009 06:46:36 -- Database flush thresholds: (start: 10.2 MB, stop:
20.5 MB)
18/11/2009 06:46:41 -- Database read latency thresholds: (average: 20
msec/read, maximum: 200 msec/read).
18/11/2009 06:46:41 -- Log write latency thresholds: (average: 10
msec/write, maximum: 200 msec/write).
18/11/2009 06:46:45 -- Operation mix: Sessions 1, Inserts 40%, Deletes
20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
18/11/2009 06:46:45 -- Performance logging begins (interval: 15000 ms).
18/11/2009 06:46:45 -- Attaining prerequisites:

```

```
18/11/2009 06:59:55 -- \MSExchange Database(JetstressCmd)\Database Cache
Size, Last: 967573500.0 (lower bound: 966367600.0, upper bound: none)
19/11/2009 06:59:56 -- Performance logging ends.
19/11/2009 06:59:56 -- JetInterop batch transaction stats: 80823, 80264,
80429 and 80099.
19/11/2009 06:59:56 -- Dispatching transactions ends.
19/11/2009 06:59:56 -- Shutting down databases ...
19/11/2009 07:00:08 -- Instance1760.1 (complete), Instance1760.2
(complete), Instance1760.3 (complete) and Instance1760.4 (complete)
19/11/2009 07:00:10 -- Performance logging begins (interval: 30000 ms).
19/11/2009 07:00:10 -- Verifying database checksums ...
19/11/2009 11:40:27 -- S:\DB1\FILES (100% processed), T:\DB2\FILES (100%
processed), U:\DB3\FILES (100% processed) and V:\DB4\FILES (100%
processed)
19/11/2009 11:40:27 -- Performance logging ends.
19/11/2009 11:40:27 -- C:\Program Files\Exchange
Jetstress\Results\Stress\Test1\DBChecksum_2009_11_19_7_0_8.blg has 558
samples.
19/11/2009 11:40:41 -- C:\Program Files\Exchange
Jetstress\Results\Stress\Test1\DBChecksum_2009_11_19_7_0_8.html is
saved.
19/11/2009 11:40:41 -- Verifying log checksums ...
19/11/2009 11:40:42 -- S:\LOG1\FILES (6 log(s) processed), T:\LOG2\FILES
(8 log(s) processed), U:\LOG3\FILES (7 log(s) processed) and
V:\LOG4\FILES (8 log(s) processed)
19/11/2009 11:40:42 -- C:\Program Files\Exchange
Jetstress\Results\Stress\Test1\Stress_2009_11_18_6_46_41.blg has 5778
samples.
19/11/2009 11:40:42 -- Creating test report ...
19/11/2009 11:41:52 -- Instance1760.1 has 11.2 for I/O Database Reads
Average Latency.
19/11/2009 11:41:52 -- Instance1760.1 has 1.9 for I/O Log Writes Average
Latency.
19/11/2009 11:41:52 -- Instance1760.1 has 1.9 for I/O Log Reads Average
Latency.
```

19/11/2009 11:41:52 -- Instance1760.2 has 11.8 for I/O Database Reads Average Latency.

19/11/2009 11:41:52 -- Instance1760.2 has 1.9 for I/O Log Writes Average Latency.

19/11/2009 11:41:52 -- Instance1760.2 has 1.9 for I/O Log Reads Average Latency.

19/11/2009 11:41:52 -- Instance1760.3 has 11.1 for I/O Database Reads Average Latency.

19/11/2009 11:41:52 -- Instance1760.3 has 1.9 for I/O Log Writes Average Latency.

19/11/2009 11:41:52 -- Instance1760.3 has 1.9 for I/O Log Reads Average Latency.

19/11/2009 11:41:52 -- Instance1760.4 has 11.7 for I/O Database Reads Average Latency.

19/11/2009 11:41:52 -- Instance1760.4 has 1.9 for I/O Log Writes Average Latency.

19/11/2009 11:41:52 -- Instance1760.4 has 1.9 for I/O Log Reads Average Latency.

19/11/2009 11:41:52 -- Test has 0 Maximum Database Page Fault Stalls/sec.

19/11/2009 11:41:52 -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.

19/11/2009 11:41:52 -- C:\Program Files\Exchange Jetstress\Results\Stress\Test1\Stress\_2009\_11\_18\_6\_46\_41.xml has 5725 samples queried.

## Test result report

## Checksum statistics - All

Database	Seen pages	Bad pages	Correctable pages	Wrong page-number pages	File length/seconds taken
S:\DB1\FILES\Jetstress001001.edb	20046898	0	0	0	626465 MBytes/16816 sec
T:\DB2\FILES\Jetstress002001.edb	20046642	0	0	0	626457 MBytes/16551 sec
U:\DB3\FILES\Jetstress003001.edb	20047154	0	0	0	626473 MBytes/16816 sec
V:\DB4\FILES\Jetstress004001.edb	20046642	0	0	0	626457 MBytes/16544 sec
(Sum)	80187336	0	0	0	2505854 MBytes/16816 sec

## Disk subsystem performance (of checksum)

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec	Avg. Disk Bytes/Write
S:\DB1\FILES	0.106	0.000	595.551	0.000	65536.000
T:\DB2\FILES	0.103	0.000	605.682	0.000	65536.000
U:\DB3\FILES	0.104	0.000	595.545	0.000	65536.000
V:\DB4\FILES	0.103	0.000	606.333	0.000	65536.000

## Memory system performance (of checksum)

Counter	Average	Minimum	Maximum
% Processor Time	10.122	7.590	11.790
Available MBytes	14981.608	14953.000	14990.000
Free System Page Table Entries	33559580.857	33558749.000	33560478.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	56529864.946	55955456.000	61554688.000
Pool Paged Bytes	125817059.556	124882944.000	126304256.000

**Test log**

```
18/11/2009 06:46:27 -- Command Line: "C:\Program Files\Exchange
Jetstress\JetstressCmd.exe" /c "C:\Program Files\Exchange
Jetstress\Results\Stress\Test1\Stress_Test1.xml"
18/11/2009 06:46:27 -- Jetstress testing begins ...
18/11/2009 06:46:27 -- Prepare testing begins ...
18/11/2009 06:46:36 -- Attaching databases ...
18/11/2009 06:46:36 -- Prepare testing ends.
18/11/2009 06:46:36 -- Dispatching transactions begins ...
18/11/2009 06:46:36 -- Database cache settings: (minimum: 128.0 MB,
maximum: 1.0 GB)
18/11/2009 06:46:36 -- Database flush thresholds: (start: 10.2 MB, stop:
20.5 MB)
18/11/2009 06:46:41 -- Database read latency thresholds: (average: 20
msec/read, maximum: 200 msec/read).
18/11/2009 06:46:41 -- Log write latency thresholds: (average: 10
msec/write, maximum: 200 msec/write).
18/11/2009 06:46:45 -- Operation mix: Sessions 1, Inserts 40%, Deletes
20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
18/11/2009 06:46:45 -- Performance logging begins (interval: 15000 ms).
18/11/2009 06:46:45 -- Attaining prerequisites:
18/11/2009 06:59:55 -- \MSExchange Database(JetstressCmd)\Database Cache
Size, Last: 967573500.0 (lower bound: 966367600.0, upper bound: none)
19/11/2009 06:59:56 -- Performance logging ends.
19/11/2009 06:59:56 -- JetInterop batch transaction stats: 80823, 80264,
80429 and 80099.
19/11/2009 06:59:56 -- Dispatching transactions ends.
19/11/2009 06:59:56 -- Shutting down databases ...
19/11/2009 07:00:08 -- Instance1760.1 (complete), Instance1760.2
(complete), Instance1760.3 (complete) and Instance1760.4 (complete)
19/11/2009 07:00:10 -- Performance logging begins (interval: 30000 ms).
19/11/2009 07:00:10 -- Verifying database checksums ...
```

19/11/2009 11:40:27 -- S:\DB1\FILES (100% processed), T:\DB2\FILES (100% processed), U:\DB3\FILES (100% processed) and V:\DB4\FILES (100% processed)

19/11/2009 11:40:27 -- Performance logging ends.

19/11/2009 11:40:27 -- C:\Program Files\Exchange Jetstress\Results\Stress\Test1\DBChecksum\_2009\_11\_19\_7\_0\_8.blg has 558 samples.

## Microsoft Exchange Server 2010 Jetstress – 2-hour performance

### Performance test result report

#### Test summary

<b>Overall Test Result</b>	<b>Pass</b>
<b>Machine Name</b>	F8PEX01
<b>Test Description</b>	N/A
<b>Test Start Time</b>	17/11/2009 07:18:45
<b>Test End Time</b>	17/11/2009 09:32:33
<b>Collection Start Time</b>	17/11/2009 07:32:21
<b>Collection End Time</b>	17/11/2009 09:32:16
<b>Jetstress Version</b>	14.01.0040.000
<b>Ese Version</b>	14.00.0639.019
<b>Operating System</b>	Windows Server (R) 2008 Enterprise Service Pack 2 (6.0.6002.131072)
<b>Performance Log</b>	<ul style="list-style-type: none"> <li>C:\Program Files\Exchange Jetstress\results\Performance\Test1\Performance_2009_11_17_7_18_56.blg</li> <li>C:\Program Files\Exchange Jetstress\results\Performance\Test1\DBCchecksum_2009_11_17_9_32_33.blg</li> </ul>

#### Database sizing and throughput

<b>Achieved Transactional I/O per Second</b>	108.045
<b>Target Transactional I/O per Second</b>	90
<b>Initial Database Size (bytes)</b>	2621446553600
<b>Final Database Size (bytes)</b>	2621874372608
<b>Database Files (Count)</b>	4
<b>Achieved Transactional I/O per Second</b>	108.045

**Jetstress system parameters**

<b>Thread Count</b>	1 (per database)
<b>Minimum Database Cache</b>	128.0 MB
<b>Maximum Database Cache</b>	1024.0 MB
<b>Insert Operations</b>	40%
<b>Delete Operations</b>	20%
<b>Replace Operations</b>	5%
<b>Read Operations</b>	35%
<b>Lazy Commits</b>	70%
<b>Run Background Database Maintenance</b>	True
<b>Number of Copies per Database</b>	3

**Database configuration**

<b>Instance2660.1</b>	Log Path: S:\LOG1\FILES Database: S:\DB1\FILES\Jetstress001001.edb
<b>Instance2660.2</b>	Log Path: T:\LOG2\FILES Database: T:\DB2\FILES\Jetstress002001.edb
<b>Instance2660.3</b>	Log Path: U:\LOG3\FILES Database: U:\DB3\FILES\Jetstress003001.edb
<b>Instance2660.4</b>	Log Path: V:\LOG4\FILES Database: V:\DB4\FILES\Jetstress004001.edb

## Transactional I/O performance

MSExchange Database ==> Instances	I/O Database Reads Average Latency (msec)	I/O Database Writes Average Latency (msec)	I/O Database Reads/sec	I/O Database Writes/sec	I/O Database Reads Average Bytes	I/O Database Writes Average Bytes	I/O Log Reads Average Latency (msec)	I/O Log Writes Average Latency (msec)	I/O Log Reads/sec	I/O Log Writes/sec	I/O Log Reads Average Bytes	I/O Log Writes Average Bytes
Instance2660.1	11.197	5.314	16.180	10.991	38632.413	36653.780	0.000	1.954	0.000	10.777	0.000	4507.022
Instance2660.2	11.663	5.444	16.046	10.950	38992.391	36833.403	0.000	1.922	0.000	10.765	0.000	4519.233
Instance2660.3	10.677	4.958	16.263	11.080	38519.658	36537.088	0.000	1.894	0.000	10.789	0.000	4638.912
Instance2660.4	11.182	5.681	15.794	10.740	38498.829	36516.403	0.000	1.873	0.000	10.544	0.000	4542.755

## Background database maintenance I/O performance

MSExchange Database ==> Instances	Database Maintenance I/O Reads/sec	Database Maintenance I/O Reads Average Bytes
Instance2660.1	29.172	261569.836
Instance2660.2	29.123	261527.177
Instance2660.3	29.630	261392.095
Instance2660.4	29.538	261468.641

## Log replication I/O performance

MSEExchange Database ==> Instances	I/O Log Reads/sec	I/O Log Reads Average Bytes
Instance2660.1	0.389	75765.989
Instance2660.2	0.393	77354.695
Instance2660.3	0.398	78170.688
Instance2660.4	0.386	75240.575

## Total I/O performance

MSEExchange Database ==> Instances	I/O Database Reads Average Latency (msec)	I/O Database Writes Average Latency (msec)	I/O Database Reads/sec	I/O Database Writes/sec	I/O Database Reads Average Bytes	I/O Database Writes Average Bytes	I/O Log Reads Average Latency (msec)	I/O Log Writes Average Latency (msec)	I/O Log Reads/sec	I/O Log Writes/sec	I/O Log Reads Average Bytes	I/O Log Writes Average Bytes
Instance2660.1	11.197	5.314	45.353	10.991	182033.009	36653.780	3.659	1.954	0.389	10.777	75765.989	4507.022
Instance2660.2	11.663	5.444	45.169	10.950	182474.480	36833.403	3.599	1.922	0.393	10.765	77354.695	4519.233
Instance2660.3	10.677	4.958	45.893	11.080	182413.407	36537.088	3.102	1.894	0.398	10.789	78170.688	4638.912
Instance2660.4	11.182	5.681	45.333	10.740	183783.973	36516.403	3.263	1.873	0.386	10.544	75240.575	4542.755

**Host system performance**

Counter	Average	Minimum	Maximum
% Processor Time	0.729	0.000	3.504
Available MBytes	14005.168	14000.000	14098.000
Free System Page Table Entries	33558454.579	33558275.000	33558542.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	50479559.111	50466816.000	50507776.000
Pool Paged Bytes	120913799.782	120827904.000	121024512.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

**Test log**

```

17/11/2009 07:18:45 -- Command Line: "C:\Program Files\Exchange
Jetstress\JetstressCmd.exe" /c "C:\Program Files\Exchange
Jetstress\results\Performance\Test1\Perf_Test1.xml"
17/11/2009 07:18:45 -- Jetstress testing begins ...
17/11/2009 07:18:45 -- Prepare testing begins ...
17/11/2009 07:18:51 -- Attaching databases ...
17/11/2009 07:18:51 -- Prepare testing ends.
17/11/2009 07:18:51 -- Dispatching transactions begins ...
17/11/2009 07:18:51 -- Database cache settings: (minimum: 128.0 MB,
maximum: 1.0 GB)
17/11/2009 07:18:51 -- Database flush thresholds: (start: 10.2 MB, stop:
20.5 MB)
17/11/2009 07:18:56 -- Database read latency thresholds: (average: 20
msec/read, maximum: 100 msec/read).
17/11/2009 07:18:56 -- Log write latency thresholds: (average: 10
msec/write, maximum: 100 msec/write).
17/11/2009 07:19:00 -- Operation mix: Sessions 1, Inserts 40%, Deletes
20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
17/11/2009 07:19:00 -- Performance logging begins (interval: 15000 ms).
17/11/2009 07:19:00 -- Attaining prerequisites:

```

```
17/11/2009 07:32:21 -- \MSExchange Database(JetstressCmd)\Database Cache
Size, Last: 966787100.0 (lower bound: 966367600.0, upper bound: none)
17/11/2009 09:32:22 -- Performance logging ends.
17/11/2009 09:32:22 -- JetInterop batch transaction stats: 7571, 7625,
7676 and 7602.
17/11/2009 09:32:22 -- Dispatching transactions ends.
17/11/2009 09:32:22 -- Shutting down databases ...
17/11/2009 09:32:33 -- Instance2660.1 (complete), Instance2660.2
(complete), Instance2660.3 (complete) and Instance2660.4 (complete)
17/11/2009 09:32:35 -- Performance logging begins (interval: 30000 ms).
17/11/2009 09:32:35 -- Verifying database checksums ...
17/11/2009 14:12:29 -- S:\DB1\FILES (100% processed), T:\DB2\FILES (100%
processed), U:\DB3\FILES (100% processed) and V:\DB4\FILES (100%
processed)
17/11/2009 14:12:29 -- Performance logging ends.
17/11/2009 14:12:29 -- C:\Program Files\Exchange
Jetstress\results\Performance\Test1\DBChecksum_2009_11_17_9_32_33.blg
has 558 samples.
17/11/2009 14:12:44 -- C:\Program Files\Exchange
Jetstress\results\Performance\Test1\DBChecksum_2009_11_17_9_32_33.html
is saved.
17/11/2009 14:12:44 -- Verifying log checksums ...
17/11/2009 14:12:45 -- S:\LOG1\FILES (8 log(s) processed), T:\LOG2\FILES
(7 log(s) processed), U:\LOG3\FILES (8 log(s) processed) and
V:\LOG4\FILES (7 log(s) processed)
17/11/2009 14:12:45 -- C:\Program Files\Exchange
Jetstress\results\Performance\Test1\Performance_2009_11_17_7_18_56.blg
has 530 samples.
17/11/2009 14:12:45 -- Creating test report ...
17/11/2009 14:12:52 -- Instance2660.1 has 11.2 for I/O Database Reads
Average Latency.
17/11/2009 14:12:52 -- Instance2660.1 has 2.0 for I/O Log Writes Average
Latency.
17/11/2009 14:12:52 -- Instance2660.1 has 2.0 for I/O Log Reads Average
Latency.
```

17/11/2009 14:12:52 -- Instance2660.2 has 11.7 for I/O Database Reads Average Latency.

17/11/2009 14:12:52 -- Instance2660.2 has 1.9 for I/O Log Writes Average Latency.

17/11/2009 14:12:52 -- Instance2660.2 has 1.9 for I/O Log Reads Average Latency.

17/11/2009 14:12:52 -- Instance2660.3 has 10.7 for I/O Database Reads Average Latency.

17/11/2009 14:12:52 -- Instance2660.3 has 1.9 for I/O Log Writes Average Latency.

17/11/2009 14:12:52 -- Instance2660.3 has 1.9 for I/O Log Reads Average Latency.

17/11/2009 14:12:52 -- Instance2660.4 has 11.2 for I/O Database Reads Average Latency.

17/11/2009 14:12:52 -- Instance2660.4 has 1.9 for I/O Log Writes Average Latency.

17/11/2009 14:12:52 -- Instance2660.4 has 1.9 for I/O Log Reads Average Latency.

17/11/2009 14:12:52 -- Test has 0 Maximum Database Page Fault Stalls/sec.

17/11/2009 14:12:52 -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.

17/11/2009 14:12:52 -- C:\Program Files\Exchange Jetstress\results\Performance\Test1\Performance\_2009\_11\_17\_7\_18\_56.xml has 476 samples queried.

## Test result report

## Checksum statistics - All

Database	Seen pages	Bad pages	Correctable pages	Wrong page-number pages	File length/seconds taken
S:\DB1\FILES\Jetstress001001.edb	20003122	0	0	0	625097 MBytes 16793 sec
T:\DB2\FILES\Jetstress002001.edb	20003378	0	0	0	625105 MBytes/16608 sec
U:\DB3\FILES\Jetstress003001.edb	20003378	0	0	0	625105 MBytes/16778 sec
V:\DB4\FILES\Jetstress004001.edb	20003378	0	0	0	625105 MBytes/16574 sec
(Sum)	80013256	0	0	0	2500414 MBytes/16794 sec

## Disk subsystem performance (of checksum)

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec	Avg. Disk Bytes/Write
S:\DB1\FILES	0.106	0.000	595.164	0.000	65536.000
T:\DB2\FILES	0.104	0.000	602.313	0.000	65536.000
U:\DB3\FILES	0.104	0.000	595.802	0.000	65536.000
V:\DB4\FILES	0.103	0.000	603.810	0.000	65536.000

## Memory system performance (of checksum)

Counter	Average	Minimum	Maximum
% Processor Time	10.080	8.557	12.135
Available MBytes	15048.050	15040.000	15065.000
Free System Page Table Entries	33558916.545	33558504.000	33559410.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	54502807.398	53739520.000	59228160.000
Pool Paged Bytes	120699650.753	119607296.000	120864768.000

**Test log**

```
17/11/2009 07:18:45 -- Command Line: "C:\Program Files\Exchange
Jetstress\JetstressCmd.exe" /c "C:\Program Files\Exchange
Jetstress\results\Performance\Test1\Perf_Test1.xml"
17/11/2009 07:18:45 -- Jetstress testing begins ...
17/11/2009 07:18:45 -- Prepare testing begins ...
17/11/2009 07:18:51 -- Attaching databases ...
17/11/2009 07:18:51 -- Prepare testing ends.
17/11/2009 07:18:51 -- Dispatching transactions begins ...
17/11/2009 07:18:51 -- Database cache settings: (minimum: 128.0 MB,
maximum: 1.0 GB)
17/11/2009 07:18:51 -- Database flush thresholds: (start: 10.2 MB, stop:
20.5 MB)
17/11/2009 07:18:56 -- Database read latency thresholds: (average: 20
msec/read, maximum: 100 msec/read).
17/11/2009 07:18:56 -- Log write latency thresholds: (average: 10
msec/write, maximum: 100 msec/write).
17/11/2009 07:19:00 -- Operation mix: Sessions 1, Inserts 40%, Deletes
20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
17/11/2009 07:19:00 -- Performance logging begins (interval: 15000 ms).
17/11/2009 07:19:00 -- Attaining prerequisites:
17/11/2009 07:32:21 -- \MSExchange Database(JetstressCmd)\Database Cache
Size, Last: 966787100.0 (lower bound: 966367600.0, upper bound: none)
17/11/2009 09:32:22 -- Performance logging ends.
17/11/2009 09:32:22 -- JetInterop batch transaction stats: 7571, 7625,
7676 and 7602.
17/11/2009 09:32:22 -- Dispatching transactions ends.
17/11/2009 09:32:22 -- Shutting down databases ...
17/11/2009 09:32:33 -- Instance2660.1 (complete), Instance2660.2
(complete), Instance2660.3 (complete) and Instance2660.4 (complete)
17/11/2009 09:32:35 -- Performance logging begins (interval: 30000 ms).
17/11/2009 09:32:35 -- Verifying database checksums ...
```

17/11/2009 14:12:29 -- S:\DB1\FILES (100% processed), T:\DB2\FILES (100% processed), U:\DB3\FILES (100% processed) and V:\DB4\FILES (100% processed)

17/11/2009 14:12:29 -- Performance logging ends.

17/11/2009 14:12:29 -- C:\Program Files\Exchange Jetstress\results\Performance\Test1\DBChecksum\_2009\_11\_17\_9\_32\_33.blg has 558 samples.

## Microsoft Exchange Server 2010 Jetstress – database backup

### Database backup statistics - All

Database Instance	Database Size (MBytes)	Elapsed Backup Time	MBytes Transferred/sec
Instance2672.1	626457.59	05:05:23	34.19
Instance2672.2	626449.59	05:20:20	32.59
Instance2672.3	626465.59	05:52:30	29.62
Instance2672.4	626449.59	06:00:49	28.94

### Jetstress system parameters

Thread Count	1 (per database)
Minimum Database Cache	128.0 MB
Maximum Database Cache	1024.0 MB
Insert Operations	40%
Delete Operations	20%
Replace Operations	5%
Read Operations	35%
Lazy Commits	70%

### Database configuration

Instance2496.1	Log Path: S:\LOG1\FILES Database: S:\DB1\FILES\Jetstress001001.edb
Instance2496.2	Log Path: T:\LOG2\FILES Database: T:\DB2\FILES\Jetstress002001.edb
Instance2496.3	Log Path: U:\LOG3\FILES Database: U:\DB3\FILES\Jetstress003001.edb
Instance2496.4	Log Path: V:\LOG4\FILES Database: V:\DB4\FILES\Jetstress004001.edb

## Transactional I/O performance

MSExchange Database ==> Instances	I/O Database Reads Average Latency (msec)	I/O Database Writes Average Latency (msec)	I/O Database Reads/sec	I/O Database Writes/sec	I/O Database Reads Average Bytes	I/O Database Writes Average Bytes	I/O Log Reads Average Latency (msec)	I/O Log Writes Average Latency (msec)	I/O Log Reads/sec	I/O Log Writes/sec	I/O Log Reads Average Bytes	I/O Log Writes Average Bytes
Instance2496.1	11.927	0.000	136.791	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance2496.2	12.947	0.000	130.274	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance2496.3	13.735	0.000	118.558	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance2496.4	15.535	0.000	115.626	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

## Host system performance

Counter	Average	Minimum	Maximum
% Processor Time	7.513	1.849	10.368
Available MBytes	15092.535	15066.000	15094.000
Free System Page Table Entries	33559079.225	33558050.000	33559680.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	50106219.883	50081792.000	50237440.000
Pool Paged Bytes	122786845.908	119005184.000	123002880.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

**Test Log**

```
19/11/2009 13:39:39 -- Command Line: "C:\Program Files\Exchange
Jetstress\JetstressCmd.exe" /c "C:\Program Files\Exchange
Jetstress\Results\Backup\Test1\Backup_Test1.xml"
19/11/2009 13:39:39 -- Jetstress testing begins ...
19/11/2009 13:39:39 -- Prepare testing begins ...
19/11/2009 13:39:44 -- Attaching databases ...
19/11/2009 13:39:44 -- Prepare testing ends.
19/11/2009 13:39:51 -- Performance logging begins (interval: 30000 ms).
19/11/2009 13:39:51 -- Backing up databases ...
19/11/2009 19:40:41 -- Performance logging ends.
19/11/2009 19:40:41 -- Instance2672.1 (100% processed), Instance2672.2
(100% processed), Instance2672.3 (100% processed) and Instance2672.4
(100% processed)
19/11/2009 19:40:41 -- C:\Program Files\Exchange
Jetstress\Results\Backup\Test1\DatabaseBackup_2009_11_19_13_39_44.blg
has 719 samples.
19/11/2009 19:40:41 -- Creating test report ...
```

## Microsoft Exchange Server 2010 Jetstress – SoftRecovery

### SoftRecovery test result report

#### Test summary

<b>Overall Test Result</b>	<b>Pass</b>
<b>Machine Name</b>	F8PEX01
<b>Test Description</b>	N/A
<b>Test Start Time</b>	17/11/2009 15:23:39
<b>Test End Time</b>	17/11/2009 20:42:13
<b>Collection Start Time</b>	17/11/2009 15:24:07
<b>Collection End Time</b>	17/11/2009 20:41:52
<b>Jetstress Version</b>	14.01.0040.000
<b>Ese Version</b>	14.00.0639.019
<b>Operating System</b>	Windows Server (R) 2008 Enterprise Service Pack 2 (6.0.6002.131072)
<b>Performance Log</b>	C:\Program Files\Exchange Jetstress\Results\Soft Recovery\Test1\Performance_2009_11_17_15_23_49.b

#### Database sizing and throughput

<b>Target Transactional I/O per Second</b>	134
<b>Initial Database Size (bytes)</b>	90
<b>Final Database Size (bytes)</b>	2621874372608
<b>Database Files (Count)</b>	2623082332160

### Jetstress system parameters

<b>Thread Count</b>	1 (per database)
<b>Minimum Database Cache</b>	128.0 MB
<b>Maximum Database Cache</b>	1024.0 MB
<b>Insert Operations</b>	40%
<b>Delete Operations</b>	20%
<b>Replace Operations</b>	5%
<b>Read Operations</b>	35%
<b>Lazy Commits</b>	70%

### Database configuration

<b>Instance2496.1</b>	Log Path: S:\LOG1\FILES Database: S:\DB1\FILES\Jetstress001001.edb
<b>Instance2496.2</b>	Log Path: T:\LOG2\FILES Database: T:\DB2\FILES\Jetstress002001.edb
<b>Instance2496.3</b>	Log Path: U:\LOG3\FILES Database: U:\DB3\FILES\Jetstress003001.edb
<b>Instance2496.4</b>	Log Path: V:\LOG4\FILES Database: V:\DB4\FILES\Jetstress004001.edb

## Transactional I/O performance

MSEXchange Database ==> Instances	I/O Database Reads Average Latency (msec)	I/O Database Writes Average Latency (msec)	I/O Database Reads/sec	I/O Database Writes/sec	I/O Database Reads Average Bytes	I/O Database Writes Average Bytes	I/O Log Reads Average Latency (msec)	I/O Log Writes Average Latency (msec)	I/O Log Reads/sec	I/O Log Writes/sec	I/O Log Reads Average Bytes	I/O Log Writes Average Bytes
Instance2496.1	13.350	2.794	20.151	13.566	32768.000	37579.518	0.000	1.334	0.000	13.000	0.000	4562.901
Instance2496.2	14.643	2.824	20.024	13.499	32768.000	37683.277	0.000	1.295	0.000	13.000	0.000	4587.708
Instance2496.3	13.540	2.944	19.944	13.446	32768.000	37644.906	0.000	1.294	0.000	12.959	0.000	4566.395
Instance2496.4	14.610	2.684	19.965	13.405	32768.000	37760.769	0.000	1.288	0.000	12.868	0.000	4540.647

## Host system performance

Counter	Average	Minimum	Maximum
% Processor Time	0.594	0.000	3.100
Available MBytes	14038.289	14013.000	15018.000
Free System Page Table Entries	33558083.812	33557615.000	33558160.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	50728603.826	49975296.000	50864128.000
Pool Paged Bytes	122263624.854	120844288.000	122486784.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

**Test log**

```
17/11/2009 15:23:39 -- Command Line: "C:\Program Files\Exchange
Jetstress\JetstressCmd.exe" /c "C:\Program Files\Exchange
Jetstress\Results\Soft Recovery\Test1\Soft_Recovery_Test1.xml"
17/11/2009 15:23:39 -- Jetstress testing begins ...
17/11/2009 15:23:39 -- Prepare testing begins ...
17/11/2009 15:23:44 -- Attaching databases ...
17/11/2009 15:23:44 -- Prepare testing ends.
17/11/2009 15:23:44 -- Dispatching transactions begins ...
17/11/2009 15:23:44 -- Database cache settings: (minimum: 128.0 MB,
maximum: 1.0 GB)
17/11/2009 15:23:44 -- Database flush thresholds: (start: 10.2 MB, stop:
20.5 MB)
17/11/2009 15:23:49 -- Database read latency thresholds: (average: 20
msec/read, maximum: 100 msec/read).
17/11/2009 15:23:49 -- Log write latency thresholds: (average: 10
msec/write, maximum: 100 msec/write).
17/11/2009 15:23:52 -- Operation mix: Sessions 1, Inserts 40%, Deletes
20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
17/11/2009 15:23:52 -- Performance logging begins (interval: 15000 ms).
17/11/2009 15:23:52 -- Generating log files ...
17/11/2009 20:42:02 -- S:\LOG1\FILES (101.2% generated), T:\LOG2\FILES
(102.2% generated), U:\LOG3\FILES (101.2% generated) and V:\LOG4\FILES
(100.2% generated)
17/11/2009 20:42:02 -- Performance logging ends.
17/11/2009 20:42:02 -- JetInterop batch transaction stats: 22136, 22008,
21878 and 21726.
17/11/2009 20:42:02 -- Dispatching transactions ends.
17/11/2009 20:42:02 -- Shutting down databases ...
17/11/2009 20:42:13 -- Instance2496.1 (complete), Instance2496.2
(complete), Instance2496.3 (complete) and Instance2496.4 (complete)
17/11/2009 20:42:13 -- C:\Program Files\Exchange Jetstress\Results\Soft
Recovery\Test1\Performance_2009_11_17_15_23_49.blg has 1265 samples.
17/11/2009 20:42:13 -- Creating test report ...
```

17/11/2009 20:42:27 -- Instance2496.1 has 13.3 for I/O Database Reads Average Latency.

17/11/2009 20:42:27 -- Instance2496.1 has 1.3 for I/O Log Writes Average Latency.

17/11/2009 20:42:27 -- Instance2496.1 has 1.3 for I/O Log Reads Average Latency.

17/11/2009 20:42:27 -- Instance2496.2 has 14.6 for I/O Database Reads Average Latency.

17/11/2009 20:42:27 -- Instance2496.2 has 1.3 for I/O Log Writes Average Latency.

17/11/2009 20:42:27 -- Instance2496.2 has 1.3 for I/O Log Reads Average Latency.

17/11/2009 20:42:27 -- Instance2496.3 has 13.5 for I/O Database Reads Average Latency.

17/11/2009 20:42:27 -- Instance2496.3 has 1.3 for I/O Log Writes Average Latency.

17/11/2009 20:42:27 -- Instance2496.3 has 1.3 for I/O Log Reads Average Latency.

17/11/2009 20:42:27 -- Instance2496.4 has 14.6 for I/O Database Reads Average Latency.

17/11/2009 20:42:27 -- Instance2496.4 has 1.3 for I/O Log Writes Average Latency.

17/11/2009 20:42:27 -- Instance2496.4 has 1.3 for I/O Log Reads Average Latency.

17/11/2009 20:42:27 -- Test has 0 Maximum Database Page Fault Stalls/sec.

17/11/2009 20:42:27 -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.

17/11/2009 20:42:27 -- C:\Program Files\Exchange Jetstress\Results\Soft Recovery\Test1\Performance\_2009\_11\_17\_15\_23\_49.xml has 1264 samples queried.

## SoftRecovery test result report

### Soft recovery statistics - All

Database Instance	Log files replayed	Elapsed seconds
Instance 2496.1	505	1658.1246846
Instance 2496.2	510	1715.1449076
Instance 2496.3	505	1664.4897594
Instance 2496.4	500	1706.392971

### Database configuration

<b>Instance2496.1</b>	Log Path: S:\LOG1\FILES Database: S:\DB1\FILES\Jetstress001001.edb
<b>Instance2496.2</b>	Log Path: T:\LOG2\FILES Database: T:\DB2\FILES\Jetstress002001.edb
<b>Instance2496.3</b>	Log Path: U:\LOG3\FILES Database: U:\DB3\FILES\Jetstress003001.edb
<b>Instance2496.4</b>	Log Path: V:\LOG4\FILES Database: V:\DB4\FILES\Jetstress004001.edb

## Transactional I/O performance

MSExchange Database ==> Instances	I/O Database Reads Average Latency (msec)	I/O Database Writes Average Latency (msec)	I/O Database Reads/sec	I/O Database Writes/sec	I/O Database Reads Average Bytes	I/O Database Writes Average Bytes	I/O Log Reads Average Latency (msec)	I/O Log Writes Average Latency (msec)	I/O Log Reads/sec	I/O Log Writes/sec	I/O Log Reads Average Bytes	I/O Log Writes Average Bytes
Instance2496.1	238.577	69.233	202.697	1.827	51376.222	23643.248	30.180	0.002	2.742	0.007	134371.497	1.267
Instance2496.2	270.616	72.769	188.238	1.782	55250.020	23702.841	47.657	0.000	2.676	0.000	137633.435	0.000
Instance2496.3	246.402	63.842	191.568	1.822	52085.723	22856.691	30.486	0.002	2.735	0.002	132401.518	0.632
Instance2496.4	259.905	74.287	196.628	1.758	54742.555	23225.454	45.269	0.001	2.638	0.004	136445.815	0.616

## Background database maintenance I/O performance

MSExchange Database ==> Instances	Database Maintenance I/O Reads/sec	Database Maintenance I/O Reads Average Bytes
Instance2496.1	13.103	261204.103
Instance2496.2	12.839	261761.057
Instance2496.3	12.855	261402.418
Instance2496.4	12.885	261510.675

## Total I/O performance

MSEXchange Database ==> Instances	I/O Database Reads Average Latency (msec)	I/O Database Writes Average Latency (msec)	I/O Database Reads/sec	I/O Database Writes/sec	I/O Database Reads Average Bytes	I/O Database Writes Average Bytes	I/O Log Reads Average Latency (msec)	I/O Log Writes Average Latency (msec)	I/O Log Reads/sec	I/O Log Writes/sec	I/O Log Reads Average Bytes	I/O Log Writes Average Bytes
Instance2496.1	238.577	69.233	202.697	1.827	51376.222	23643.248	30.180	0.002	2.742	0.007	134371.497	1.267
Instance2496.2	270.616	72.769	188.238	1.782	55250.020	23702.841	47.657	0.000	2.676	0.000	137633.435	0.000
Instance2496.3	246.402	63.842	191.568	1.822	52085.723	22856.691	30.486	0.002	2.735	0.002	132401.518	0.632
Instance2496.4	259.905	74.287	196.628	1.758	54742.555	23225.454	45.269	0.001	2.638	0.004	136445.815	0.616

## Host system performance

Counter	Average	Minimum	Maximum
% Processor Time	3.428	0.000	21.599
Available MBytes	14023.075	13989.000	15001.000
Free System Page Table Entries	33558553.526	33558239.000	33558646.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	58263409.914	52940800.000	60551168.000
Pool Paged Bytes	123147954.833	121753600.000	123203584.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

**Test Log**

```

17/11/2009 15:23:39 -- Command Line: "C:\Program Files\Exchange
Jetstress\JetstressCmd.exe" /c "C:\Program Files\Exchange
Jetstress\Results\Soft Recovery\Test1\Soft_Recovery_Test1.xml"
17/11/2009 15:23:39 -- Jetstress testing begins ...
17/11/2009 15:23:39 -- Prepare testing begins ...
17/11/2009 15:23:44 -- Attaching databases ...
17/11/2009 15:23:44 -- Prepare testing ends.
17/11/2009 15:23:44 -- Dispatching transactions begins ...
17/11/2009 15:23:44 -- Database cache settings: (minimum: 128.0 MB,
maximum: 1.0 GB)
17/11/2009 15:23:44 -- Database flush thresholds: (start: 10.2 MB, stop:
20.5 MB)
17/11/2009 15:23:49 -- Database read latency thresholds: (average: 20
msec/read, maximum: 100 msec/read).
17/11/2009 15:23:49 -- Log write latency thresholds: (average: 10
msec/write, maximum: 100 msec/write).
17/11/2009 15:23:52 -- Operation mix: Sessions 1, Inserts 40%, Deletes
20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
17/11/2009 15:23:52 -- Performance logging begins (interval: 15000 ms).
17/11/2009 15:23:52 -- Generating log files ...
17/11/2009 20:42:02 -- S:\LOG1\FILES (101.2% generated), T:\LOG2\FILES
(102.2% generated), U:\LOG3\FILES (101.2% generated) and V:\LOG4\FILES
(100.2% generated)
17/11/2009 20:42:02 -- Performance logging ends.
17/11/2009 20:42:02 -- JetInterop batch transaction stats: 22136, 22008,
21878 and 21726.
17/11/2009 20:42:02 -- Dispatching transactions ends.
17/11/2009 20:42:02 -- Shutting down databases ...
17/11/2009 20:42:13 -- Instance2496.1 (complete), Instance2496.2
(complete), Instance2496.3 (complete) and Instance2496.4 (complete)
17/11/2009 20:42:13 -- C:\Program Files\Exchange Jetstress\Results\Soft
Recovery\Test1\Performance_2009_11_17_15_23_49.blg has 1265 samples.
17/11/2009 20:42:13 -- Creating test report ...
17/11/2009 20:42:27 -- Instance2496.1 has 13.3 for I/O Database Reads
Average Latency.
17/11/2009 20:42:27 -- Instance2496.1 has 1.3 for I/O Log Writes Average
Latency.
17/11/2009 20:42:27 -- Instance2496.1 has 1.3 for I/O Log Reads Average
Latency.
17/11/2009 20:42:27 -- Instance2496.2 has 14.6 for I/O Database Reads
Average Latency.
17/11/2009 20:42:27 -- Instance2496.2 has 1.3 for I/O Log Writes Average

```

Latency.  
17/11/2009 20:42:27 -- Instance2496.2 has 1.3 for I/O Log Reads Average Latency.  
17/11/2009 20:42:27 -- Instance2496.3 has 13.5 for I/O Database Reads Average Latency.  
17/11/2009 20:42:27 -- Instance2496.3 has 1.3 for I/O Log Writes Average Latency.  
17/11/2009 20:42:27 -- Instance2496.3 has 1.3 for I/O Log Reads Average Latency.  
17/11/2009 20:42:27 -- Instance2496.4 has 14.6 for I/O Database Reads Average Latency.  
17/11/2009 20:42:27 -- Instance2496.4 has 1.3 for I/O Log Writes Average Latency.  
17/11/2009 20:42:27 -- Instance2496.4 has 1.3 for I/O Log Reads Average Latency.  
17/11/2009 20:42:27 -- Test has 0 Maximum Database Page Fault Stalls/sec.  
17/11/2009 20:42:27 -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.  
17/11/2009 20:42:27 -- C:\Program Files\Exchange Jetstress\Results\Soft Recovery\Test1\Performance\_2009\_11\_17\_15\_23\_49.xml has 1264 samples queried.  
17/11/2009 20:42:28 -- C:\Program Files\Exchange Jetstress\Results\Soft Recovery\Test1\Performance\_2009\_11\_17\_15\_23\_49.html is saved.  
17/11/2009 20:42:31 -- Performance logging begins (interval: 2000 ms).  
17/11/2009 20:42:31 -- Recovering databases ...  
17/11/2009 21:11:07 -- Performance logging ends.  
17/11/2009 21:11:07 -- Instance2496.1 (1658.1246846), Instance2496.2 (1715.1449076), Instance2496.3 (1664.4897594) and Instance2496.4 (1706.392971)  
17/11/2009 21:11:07 -- C:\Program Files\Exchange Jetstress\Results\Soft Recovery\Test1\SoftRecovery\_2009\_11\_17\_20\_42\_28.blg has 836 samples.  
17/11/2009 21:11:07 -- Creating test report ...