

## ESRP Storage Program

**EMC CLARiiON CX4-120 (1,000 User)  
Exchange 2010 Mailbox Resiliency  
Storage Solution**

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



**EMC Global Solutions**

Copyright © 1998-2010 EMC Corporation. All rights reserved.

Published May, 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 CLARiON CX4-120 (1,000 User) Exchange 2010 Mailbox Resiliency Storage Solution  
Part Number: H6717

---

## Table of Contents

Overview.....	4
Disclaimer .....	4
Features .....	5
Solution description .....	6
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® CX4-120 (1,000 User) Mailbox Resiliency storage solution for Microsoft Exchange 2010 based on the *Microsoft Exchange Solution Reviewed Program (ESRP) - Storage* program. For any questions or comments regarding the contents of this document, see “[Contact information](#)” on page 21.

*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 CLARiiON CX4 model 120 provides entry-level networked storage for departmental applications or for midsize organizations. CLARiiON CX4-120 combines the CLARiiON proven five 9s (99.999 percent) availability with innovative technologies like Flash drives, Virtual Provisioning™, a 64-bit operating system, and multi-core processors. The CX4 model 120 scales from 5 TB up to 120 TB of capacity.

With up to twice the performance, twice the capacity, twice the memory, and twice the number of LUNs (logical unit numbers) of previous generations, this enables support of multiple application tiers on a single CLARiiON CX4 array.

The ability to support dual-protocol Fibre Channel and iSCSI storage area network (SAN) connections with online expansion is a unique feature in the market. EMC's new UltraFlex™ technology also enables the CLARiiON CX4 Series to easily and nondisruptively incorporate future connectivity technologies such as 8 Gb/s Fibre Channel (FC), and 10 Gb/s iSCSI and FCoE (Fibre Channel over Ethernet).

## Solution description

This solution represents a possible configuration for Microsoft Exchange 2010 on an EMC CLARiiON CX4-120 storage array. This solution utilizes low-cost, high-capacity 1 TB SATA disks in a RAIDless disk configuration. In a RAIDless configuration, at least three copies on each database are needed. The three copies are provided through Exchange 2010 database availability group (DAG) technology. A DAG is a set of mailbox servers that uses 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.

In this solution, a single 1 TB drive housed both the database and log files for an individual database. Each database contained 250 users with a 2 GB mailbox limit. Although using individual disks is an option on the CLARiiON, as used in this solution, EMC generally recommends using RAID for additional protection in all configurations.

Figure 1 illustrates the layout of the physical architecture.

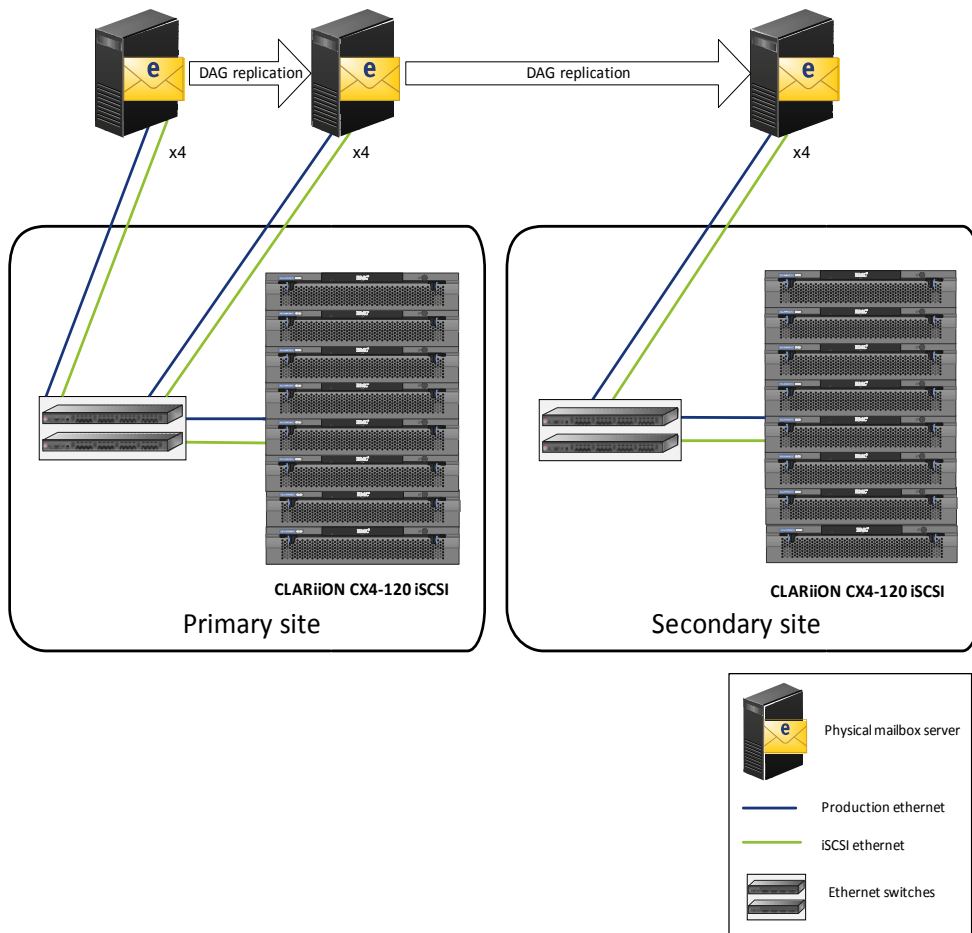
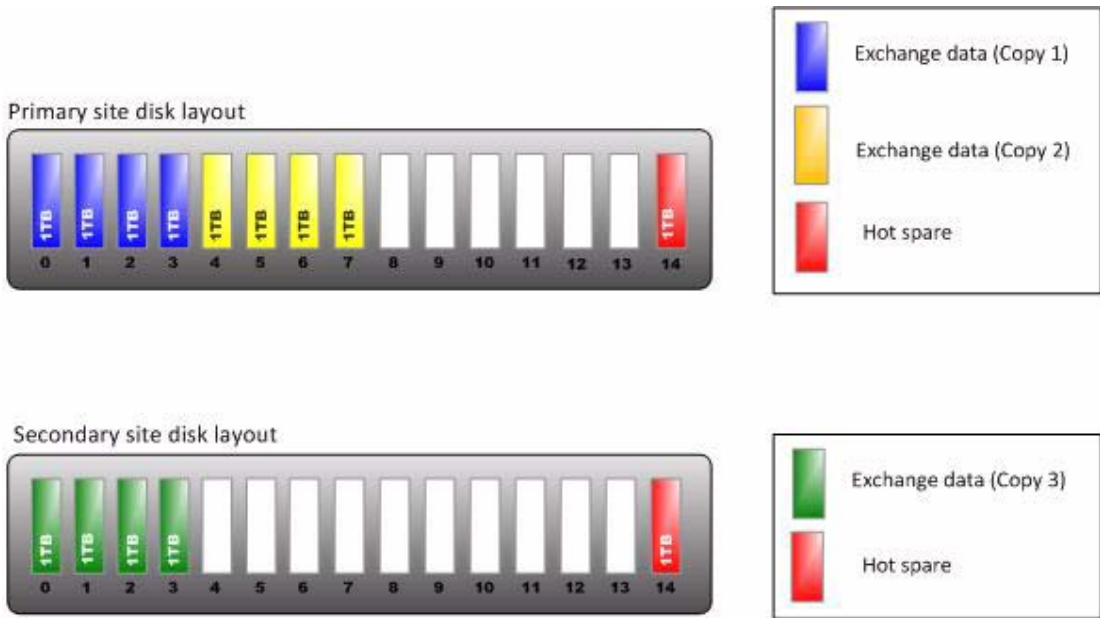


Figure 1 Physical architecture

Figure 2 illustrates the disk layout.



**Figure 2 Disk layout**

The Windows Hardware Compatibility List link for EMC CLARiiON CX4-120 is:

<http://www.windowsservercatalog.com/item.aspx?idItem=e7e04552-a2b2-3e27-c3b8-6b49e9b5366d&bCatID=1282>

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

---

## Targeted customer profile

This solution is intended for small and medium-sized businesses that are price-sensitive but still want high availability and ease of use. This solution has the ability to grow with a customer's needs. When additional databases are needed (two disks for each local copy and one disk for remote copy), three 1 TB drives are required. The targeted customer profile for this solution is described below:

- One host attached, up to 128 hosts possible.
- User I/O profile of 0.06 (including 20 percent headroom).
- User mailbox size of 2 GB.
- Background database maintenance (BDM) was running 24x7.
- DAG was used for mailbox resiliency as the primary protection for Exchange data. EMC recommends having two DAG copies locally and having the third copy on a disaster recovery (DR) array, which may be in a different geographical location.

## 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	1000
Number of DAGs	1
Number of servers/DAG	3
Number of active mailboxes/server	1000
Number of databases/host	4
Number of copies/database	3
Number of mailboxes/database	250
Simulated profile: I/Os per second per mailbox (IOPS, include 20% headroom)	0.06
Database/Log LUN size	817 GB database/100 GB log
Total database size for performance testing	1956 GB
% storage capacity used by Exchange database**	59.85%

\*\*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.

## 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 II drives
Storage model and OS/firmware revision	CLARiiON CX4-120, FLARE <sup>®</sup> OS version: 04.29.000.5.001
Storage cache	4 GB
Number of storage controllers	2
Number of storage ports	4
Maximum bandwidth of storage connectivity to host	4 Gb/s
Switch type/model/firmware revision	Ethernet switch, Dell PowerConnect 5324, 2 gigabit port speed, Layer 2
HBA model and firmware	Intel PRO/1000 PT Quad Port Server Adapter
Number of HBAs/host	2
Host server type	Dell PowerEdge R710 2* Intel Xeon CPU E5520 @ 2.27 GHz, 2261 MHz, 4 core 96 GB memory
Total number of disks tested in solution	4
Maximum number of spindles that can be hosted in the storage	120

## Storage software

Table 3 lists the software used in the environment.

**Table 3**      **Software**

Item	Description
Multipathing	Microsoft iSCSI Initiator Version 6.0 Build 6000 EMC PowerPath <sup>®</sup> 5.3 (64-bit)
Host OS	Microsoft Windows Server 2008 Enterprise 6.0.6002 Service Pack 2 Build 6002
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 II 7.2k, 300F/1237
Raw capacity per disk (GB)	917.18
Number of physical disks in test	4
Total raw storage capacity (GB)	3668.72
Disk slice size (GB)	917.18
Number of slices per LUN or number of disks per LUN	1
RAID level	N/A
Total formatted capacity	3668.72 GB
Storage capacity utilization	100%
Database capacity utilization	53.31%

## Storage disk configuration (transactional log disks utilizing the same disks as mailbox store databases)

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 II 7.2k, 300F/1237
Raw capacity per disk (GB)	917.18
Number of spindles in test	4
Total raw storage capacity (GB)	3668.72
Disk slice size	917.18
Number of slices per LUN or number of disks per LUN	1
RAID level	N/A
Total formatted capacity	3668.72 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 1 TB SATA disk supported 250 Average (20 sent / 60 received) users with an I/O profile of 0.06 IOPS. Each disk holds the database and log files on one single LUN that was created on each disk. A mailbox size of 2 GB per user was also used.

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 also supports SATA disks. The change allows for the use of RAID 5 as a viable RAID configuration, along with RAIDless configurations, but only when deployed with no less than three copies per database using DAG. 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 or Windows Server 2008 R2 X64.

---

- 2 When formatting a newly partitioned LUN, it is recommended that for database and log files, set the ALU size 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 NICs are recommended as a minimum.
  - c Isolate iSCSI networks from production networks. Use VLANs to segment this traffic.
  - d Use at least two NICs for iSCSI. This builds in fault tolerance and increases performance.
  - e Using the Windows built-in iSCSI initiator, connect each NIC to the storage with a load-balanced approach—for example, NIC 0 to SPa0, and SPb1NIC 1 to SPb0 and SPa1. This builds in fault tolerance to the connectivity.
  - f On each iSCSI NIC, do the following:
    - Set all iSCSI NIC speeds to 1 GB full.
    - Disable **Microsoft Networking**.
    - Disable **File & Print Sharing**.
    - Disable **IPv6** if not being used.
    - Do not implement **TCP Chimney** for Brocade.
    - Disable *all* related **TCP Offload Engine** parameters where applicable, based on vendor-specific NICs.
- 4 The following list details the recommended best practices for core storage:
- a When tuning the CX4-120 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 CLARiiON CX4-120 storage array:
    - Page size is set to 8 KB if there are other applications also sharing this array.
    - Page size is set to 16 KB if the array is dedicated to Exchange 2010 workload.
    - Read and Write cache should be turned on for all LUNs.
  - b Isolate Microsoft Exchange server database workload from other IO-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 Logs and databases can be placed on the same physical spindles under the following conditions:
  - DAG is in place.
  - Each database within the DAG contains a minimum of three copies.
- f When DAG is not being used, logs and databases should not share the same physical spindles. The exception to this is if there are multiple RAID groups in the storage configuration. Under these conditions, logs and databases may share the same spindles but logs for the same database should be placed on different spindles—for example, if there are two RAID groups being used for four databases: RAID Group 1 may contain database1, database2, logs3, logs4 and RAID Group 2 may contain database 3, database4, logs1, logs2. This provides additional protection to RAID when DAG is not being used, which is the configuration used in this solution.
- g Microsoft 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. Database seeding times should also be considered when deploying large databases. 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 DR hosts are analyzed for integrity to ensure there is no database/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 31](#).

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 this 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	91.732
Database disks reads/sec	53.441
Database disks writes/sec	38.291
Average database disk read latency (ms)	9.746
Average database disk write latency (ms)	3.44425
<b>Transaction log I/O</b>	
Log disks writes/sec	34.303
Average log disk write latency (ms)	0.76375

**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 using Volume Shadow (Copy) Service (VSS). The following table shows the average rate for a single database file.

<b>MB read/sec per database</b>	47.035
<b>MB read/sec total per server</b>	188.14

**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 tables show the average rate for 500 log files played in a single storage group. Each log file is 1 MB in size.

<b>Average time to play one log file (sec)</b>	6.092
--	-------

---

## Conclusion

This document has been 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 test framework. The 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 to:

**<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 31](#)
- [“Microsoft Exchange Server 2010 Jetstress – database backup” on page 40](#)
- [“Microsoft Exchange Server 2010 Jetstress – soft recovery” on page 43](#)

### 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>	F2PEX01
<b>Test Description</b>	N/A
<b>Test Start Time</b>	02/12/2009 09:25:08
<b>Test End Time</b>	03/12/2009 09:43:16
<b>Collection Start Time</b>	02/12/2009 09:42:51
<b>Collection End Time</b>	03/12/2009 09:42:48
<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\ESRP\Stress\Stress_2009_12_2_9_25_18.blg</li> <li>• C:\Program Files\Exchange Jetstress\ESRP\Stress\DBChecksum_2009_12_3_9_43_16.blg</li> </ul>

### Database sizing and throughput

<b>Achieved Transactional I/O per Second</b>	84.089
<b>Target Transactional I/O per Second</b>	60
<b>Initial Database Size (bytes)</b>	2104085446656
<b>Final Database Size (bytes)</b>	2107466055680
<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>Instance3860.1</b>	Log Path: F:\FILES Database: E:\FILES\Jetstress001001.edb
<b>Instance3860.2</b>	Log Path: H:\FILES Database: G:\FILES\Jetstress002001.edb
<b>Instance3860.3</b>	Log Path: J:\FILES Database: I:\FILES\Jetstress003001.edb
<b>Instance3860.4</b>	Log Path: L:\FILES Database: K:\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
Instance3860.1	11.238	3.455	12.168	8.751	42161.099	36021.632	0.000	0.748	0.000	7.750	0.000	4620.778
Instance3860.2	10.832	3.412	12.204	8.764	42570.304	35877.100	0.000	0.747	0.000	7.746	0.000	4614.810
Instance3860.3	10.481	3.351	12.299	8.868	41893.473	35944.073	0.000	0.745	0.000	7.815	0.000	4649.546
Instance3860.4	10.875	3.376	12.231	8.804	41870.437	35929.977	0.000	0.746	0.000	7.800	0.000	4593.586

## Background database maintenance I/O performance

MSExchange Database ==> Instances	Database Maintenance I/O Reads/sec	Database Maintenance I/O Reads Average Bytes
Instance3860.1	30.050	261303.513
Instance3860.2	30.136	261319.644
Instance3860.3	30.344	261322.997
Instance3860.4	30.336	261317.787

## Log replication I/O performance

MSExchange Database ==> Instances	I/O Log Reads/sec	I/O Log Reads Average Bytes
Instance3860.1	0.285	55647.596
Instance3860.2	0.285	55471.890
Instance3860.3	0.286	55972.279
Instance3860.4	0.286	55726.563

## 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
Instance3860.1	11.238	3.455	42.218	8.751	198142.568	36021.632	1.438	0.748	0.285	7.750	55647.596	4620.778
Instance3860.2	10.832	3.412	42.340	8.764	198268.407	35877.100	1.312	0.747	0.285	7.746	55471.890	4614.810
Instance3860.3	10.481	3.351	42.643	8.868	198037.065	35944.073	1.351	0.745	0.286	7.815	55972.279	4649.546
Instance3860.4	10.875	3.376	42.566	8.804	198262.751	35929.977	1.423	0.746	0.286	7.800	55726.563	4593.586

**Host system performance**

Counter	Average	Minimum	Maximum
% Processor Time	0.197	0.026	1.356
Available MBytes	13719.582	13594.000	13846.000
Free System Page Table Entries	33558738.746	33558313.000	33559274.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	82421569.157	81870848.000	83218432.000
Pool Paged Bytes	128552307.004	127680512.000	169447424.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

**Test log**

```

02/12/2009 09:25:08 -- Command Line: "C:\Program Files\Exchange
Jetstress\JetstressCmd.exe" /c "C:\Program Files\Exchange
Jetstress\ESRP\Stress\jetstressconfig_24hr.xml"
02/12/2009 09:25:08 -- Jetstress testing begins ...
02/12/2009 09:25:08 -- Prepare testing begins ...
02/12/2009 09:25:13 -- Attaching databases ...
02/12/2009 09:25:13 -- Prepare testing ends.
02/12/2009 09:25:13 -- Dispatching transactions begins ...
02/12/2009 09:25:13 -- Database cache settings: (minimum: 128.0 MB,
maximum: 1.0 GB)
02/12/2009 09:25:13 -- Database flush thresholds: (start: 10.2 MB, stop:
20.5 MB)
02/12/2009 09:25:18 -- Database read latency thresholds: (average: 20
msec/read, maximum: 200 msec/read).
02/12/2009 09:25:18 -- Log write latency thresholds: (average: 10
msec/write, maximum: 200 msec/write).
02/12/2009 09:25:20 -- Operation mix: Sessions 1, Inserts 40%, Deletes
20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
02/12/2009 09:25:20 -- Performance logging begins (interval: 15000 ms).
02/12/2009 09:25:20 -- Attaining prerequisites:

```

02/12/2009 09:42:51 -- \MSExchange Database(JetstressCmd)\Database Cache Size, Last: 966684700.0 (lower bound: 966367600.0, upper bound: none)

03/12/2009 09:42:51 -- Performance logging ends.

03/12/2009 09:42:51 -- JetInterop batch transaction stats: 59550, 59918, 60121 and 60036.

03/12/2009 09:42:52 -- Dispatching transactions ends.

03/12/2009 09:42:52 -- Shutting down databases ...

03/12/2009 09:43:16 -- Instance3860.1 (complete), Instance3860.2 (complete), Instance3860.3 (complete) and Instance3860.4 (complete)

03/12/2009 09:43:16 -- Performance logging begins (interval: 30000 ms).

03/12/2009 09:43:16 -- Verifying database checksums ...

03/12/2009 12:51:25 -- E: (100% processed), G: (100% processed), I: (100% processed) and K: (100% processed)

03/12/2009 12:51:25 -- Performance logging ends.

03/12/2009 12:51:25 -- C:\Program Files\Exchange Jetstress\ESRP\Stress\DBChecksum\_2009\_12\_3\_9\_43\_16.blg has 375 samples.

03/12/2009 12:51:39 -- C:\Program Files\Exchange Jetstress\ESRP\Stress\DBChecksum\_2009\_12\_3\_9\_43\_16.html is saved.

03/12/2009 12:51:39 -- Verifying log checksums ...

03/12/2009 12:51:40 -- F:\FILES (6 log(s) processed), H:\FILES (7 log(s) processed), J:\FILES (7 log(s) processed) and L:\FILES (8 log(s) processed)

03/12/2009 12:51:40 -- C:\Program Files\Exchange Jetstress\ESRP\Stress\Stress\_2009\_12\_2\_9\_25\_18.blg has 5821 samples.

03/12/2009 12:51:40 -- Creating test report ...

03/12/2009 12:53:18 -- Instance3860.1 has 11.2 for I/O Database Reads Average Latency.

03/12/2009 12:53:18 -- Instance3860.1 has 0.7 for I/O Log Writes Average Latency.

03/12/2009 12:53:18 -- Instance3860.1 has 0.7 for I/O Log Reads Average Latency.

03/12/2009 12:53:18 -- Instance3860.2 has 10.8 for I/O Database Reads Average Latency.

03/12/2009 12:53:18 -- Instance3860.2 has 0.7 for I/O Log Writes Average Latency.

03/12/2009 12:53:18 -- Instance3860.2 has 0.7 for I/O Log Reads Average Latency.

03/12/2009 12:53:18 -- Instance3860.3 has 10.5 for I/O Database Reads Average Latency.

03/12/2009 12:53:18 -- Instance3860.3 has 0.7 for I/O Log Writes Average Latency.

03/12/2009 12:53:18 -- Instance3860.3 has 0.7 for I/O Log Reads Average Latency.

03/12/2009 12:53:18 -- Instance3860.4 has 10.9 for I/O Database Reads Average Latency.

03/12/2009 12:53:18 -- Instance3860.4 has 0.7 for I/O Log Writes Average Latency.

03/12/2009 12:53:18 -- Instance3860.4 has 0.7 for I/O Log Reads Average Latency.

03/12/2009 12:53:18 -- Test has 0 Maximum Database Page Fault Stalls/sec.

03/12/2009 12:53:18 -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.

03/12/2009 12:53:18 -- C:\Program Files\Exchange Jetstress\ESRP\Stress\Stress\_2009\_12\_2\_9\_25\_18.xml has 5751 samples queried.

## Test result report

### Checksum statistics - All

Database	Seen pages	Bad pages	Correctable pages	Wrong page-number pages	File length/seconds taken
E:\FILES\Jetstress001001.edb	16078626	0	0	0	502457 MBytes/10905 sec
G:\FILES\Jetstress002001.edb	16078626	0	0	0	502457 MBytes/11288 sec
I:\FILES\Jetstress003001.edb	16078882	0	0	0	502465 MBytes/10650 sec
K:\FILES\Jetstress004001.edb	16078626	0	0	0	502457 MBytes/11218 sec
(Sum)	64314760	0	0	0	2009836 MBytes/11288 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
E:	0.074	0.000	739.003	0.000	65536.000
G:	0.075	0.002	711.544	0.000	65536.000
I:	0.075	0.001	756.396	0.001	65536.000
K:	0.076	0.001	718.085	0.000	65536.000

**Memory system performance (of checksum)**

Counter	Average	Minimum	Maximum
% Processor Time	4.494	2.390	10.149
Available MBytes	14639.267	14570.000	14752.000
Free System Page Table Entries	33559447.181	33558889.000	33559702.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	86694177.451	86036480.000	89817088.000
Pool Paged Bytes	134583735.637	133079040.000	135176192.000

**Test log**

```

02/12/2009 09:25:08 -- Command Line: "C:\Program Files\Exchange
Jetstress\JetstressCmd.exe" /c "C:\Program Files\Exchange
Jetstress\ESRP\Stress\jetstressconfig_24hr.xml"
02/12/2009 09:25:08 -- Jetstress testing begins ...
02/12/2009 09:25:08 -- Prepare testing begins ...
02/12/2009 09:25:13 -- Attaching databases ...
02/12/2009 09:25:13 -- Prepare testing ends.
02/12/2009 09:25:13 -- Dispatching transactions begins ...
02/12/2009 09:25:13 -- Database cache settings: (minimum: 128.0 MB,
maximum: 1.0 GB)
02/12/2009 09:25:13 -- Database flush thresholds: (start: 10.2 MB, stop:
20.5 MB)

```

02/12/2009 09:25:18 -- Database read latency thresholds: (average: 20 msec/read, maximum: 200 msec/read).

02/12/2009 09:25:18 -- Log write latency thresholds: (average: 10 msec/write, maximum: 200 msec/write).

02/12/2009 09:25:20 -- Operation mix: Sessions 1, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.

02/12/2009 09:25:20 -- Performance logging begins (interval: 15000 ms).

02/12/2009 09:25:20 -- Attaining prerequisites:

02/12/2009 09:42:51 -- \MSEExchange Database(JetstressCmd)\Database Cache Size, Last: 966684700.0 (lower bound: 966367600.0, upper bound: none)

03/12/2009 09:42:51 -- Performance logging ends.

03/12/2009 09:42:51 -- JetInterop batch transaction stats: 59550, 59918, 60121 and 60036.

03/12/2009 09:42:52 -- Dispatching transactions ends.

03/12/2009 09:42:52 -- Shutting down databases ...

03/12/2009 09:43:16 -- Instance3860.1 (complete), Instance3860.2 (complete), Instance3860.3 (complete) and Instance3860.4 (complete)

03/12/2009 09:43:16 -- Performance logging begins (interval: 30000 ms).

03/12/2009 09:43:16 -- Verifying database checksums ...

03/12/2009 12:51:25 -- E: (100% processed), G: (100% processed), I: (100% processed) and K: (100% processed)

03/12/2009 12:51:25 -- Performance logging ends.

03/12/2009 12:51:25 -- C:\Program Files\Exchange Jetstress\ESRP\Stress\DBChecksum\_2009\_12\_3\_9\_43\_16.blg has 375 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>	F2PEX01
<b>Test Description</b>	N/A
<b>Test Start Time</b>	01/12/2009 16:46:35
<b>Test End Time</b>	01/12/2009 19:03:01
<b>Collection Start Time</b>	01/12/2009 17:02:53
<b>Collection End Time</b>	01/12/2009 19:02:43
<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\ESRP\Performance\Performance_2009_12_1_16_46_44.blg</li> <li>C:\Program Files\Exchange Jetstress\ESRP\Performance\DBChecksum_2009_12_1_19_3_1.blg</li> </ul>

#### Database sizing and throughput

<b>Achieved Transactional I/O per Second</b>	91.732
<b>Target Transactional I/O per Second</b>	60
<b>Initial Database Size (bytes)</b>	2102541942784
<b>Final Database Size (bytes)</b>	2102877487104
<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>Instance2660.1</b>	Log Path: Q:\FILES Database: P:\FILES\Jetstress001001.edb
<b>Instance2660.2</b>	Log Path: S:\FILES Database: R:\FILES\Jetstress002001.edb
<b>Instance2660.3</b>	Log Path: M:\FILES Database: D:\FILES\Jetstress003001.edb
<b>Instance2660.4</b>	Log Path: O:\FILES Database: N:\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
Instance3292.1	9.754	3.484	13.306	9.527	40186.410	36303.933	0.000	0.758	0.000	8.651	0.000	4528.658
Instance3292.2	9.350	3.384	13.298	9.473	40485.172	36638.152	0.000	0.769	0.000	8.588	0.000	5050.596
Instance3292.3	9.614	3.535	13.319	9.572	40507.624	36397.741	0.000	0.782	0.000	8.354	0.000	4544.446
Instance3292.4	10.266	3.374	13.518	9.719	39777.060	36602.087	0.000	0.746	0.000	8.710	0.000	4614.772

## Background database maintenance I/O performance

MSExchange Database ==> Instances	Database Maintenance I/O Reads/sec	Database Maintenance I/O Reads Average Bytes
Instance3292.1	30.998	261378.092
Instance3292.2	30.957	261393.807
Instance3292.3	30.922	261299.286
Instance3292.4	30.889	261397.483

## Log replication I/O performance

MSExchange Database ==> Instances	I/O Log Reads/sec	I/O Log Reads Average Bytes
Instance3292.1	0.316	61302.895
Instance3292.2	0.311	60764.168
Instance3292.3	0.306	59356.772
Instance3292.4	0.321	62617.140

## 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
Instance3292.1	9.754	3.484	44.305	9.527	194946.840	36303.933	1.476	0.758	0.316	8.651	61302.895	4528.658
Instance3292.2	9.350	3.384	44.255	9.473	195015.649	36638.152	1.461	0.769	0.311	8.588	60764.168	5050.596
Instance3292.3	9.614	3.535	44.241	9.572	194829.714	36397.741	1.568	0.782	0.306	8.354	59356.772	4544.446
Instance3292.4	10.266	3.374	44.407	9.719	193933.389	36602.087	1.685	0.746	0.321	8.710	62617.140	4614.772

## Host system performance

Counter	Average	Minimum	Maximum
% Processor Time	0.204	0.058	0.539
Available MBytes	13687.739	13615.000	13837.000
Free System Page Table Entries	33559357.079	33559162.000	33559473.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	85136155.257	85114880.000	85168128.000
Pool Paged Bytes	128563589.077	128446464.000	128720896.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

## Test log

```

01/12/2009 16:46:35 -- Command Line: "C:\Program Files\Exchange
Jetstress\JetstressCmd.exe" /c "C:\Program Files\Exchange
Jetstress\ESRP\Performance\jetstressconfig_perf.xml"
01/12/2009 16:46:35 -- Jetstress testing begins ...
01/12/2009 16:46:35 -- Prepare testing begins ...
01/12/2009 16:46:40 -- Attaching databases ...
01/12/2009 16:46:40 -- Prepare testing ends.
01/12/2009 16:46:40 -- Dispatching transactions begins ...
01/12/2009 16:46:40 -- Database cache settings: (minimum: 128.0 MB,
maximum: 1.0 GB)
01/12/2009 16:46:40 -- Database flush thresholds: (start: 10.2 MB, stop:
20.5 MB)
01/12/2009 16:46:44 -- Database read latency thresholds: (average: 20
msec/read, maximum: 100 msec/read).
01/12/2009 16:46:44 -- Log write latency thresholds: (average: 10
msec/write, maximum: 100 msec/write).
01/12/2009 16:46:46 -- Operation mix: Sessions 1, Inserts 40%, Deletes
20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
01/12/2009 16:46:46 -- Performance logging begins (interval: 15000 ms).
01/12/2009 16:46:46 -- Attaining prerequisites:

```

01/12/2009 17:02:53 -- \MSEExchange Database(JetstressCmd)\Database Cache Size, Last: 966574100.0 (lower bound: 966367600.0, upper bound: none)

01/12/2009 19:02:53 -- Performance logging ends.

01/12/2009 19:02:53 -- JetInterop batch transaction stats: 6181, 6157, 6122 and 6295.

01/12/2009 19:02:53 -- Dispatching transactions ends.

01/12/2009 19:02:53 -- Shutting down databases ...

01/12/2009 19:03:01 -- Instance3292.1 (complete), Instance3292.2 (complete), Instance3292.3 (complete) and Instance3292.4 (complete)

01/12/2009 19:03:02 -- Performance logging begins (interval: 30000 ms).

01/12/2009 19:03:02 -- Verifying database checksums ...

01/12/2009 22:10:33 -- P: (100% processed), R: (100% processed), D: (100% processed) and N: (100% processed)

01/12/2009 22:10:33 -- Performance logging ends.

01/12/2009 22:10:33 -- C:\Program Files\Exchange Jetstress\ESRP\Performance\DBChecksum\_2009\_12\_1\_19\_3\_1.blg has 374 samples.

01/12/2009 22:10:44 -- C:\Program Files\Exchange Jetstress\ESRP\Performance\DBChecksum\_2009\_12\_1\_19\_3\_1.html is saved.

01/12/2009 22:10:44 -- Verifying log checksums ...

01/12/2009 22:10:45 -- Q:\FILES (8 log(s) processed), S:\FILES (7 log(s) processed), M:\FILES (7 log(s) processed) and O:\FILES (8 log(s) processed)

01/12/2009 22:10:45 -- C:\Program Files\Exchange Jetstress\ESRP\Performance\Performance\_2009\_12\_1\_16\_46\_44.blg has 543 samples.

01/12/2009 22:10:45 -- Creating test report ...

01/12/2009 22:10:55 -- Instance3292.1 has 9.8 for I/O Database Reads Average Latency.

01/12/2009 22:10:55 -- Instance3292.1 has 0.8 for I/O Log Writes Average Latency.

01/12/2009 22:10:55 -- Instance3292.1 has 0.8 for I/O Log Reads Average Latency.

01/12/2009 22:10:55 -- Instance3292.2 has 9.3 for I/O Database Reads Average Latency.

01/12/2009 22:10:55 -- Instance3292.2 has 0.8 for I/O Log Writes Average Latency.

01/12/2009 22:10:55 -- Instance3292.2 has 0.8 for I/O Log Reads Average Latency.

01/12/2009 22:10:55 -- Instance3292.3 has 9.6 for I/O Database Reads Average Latency.

01/12/2009 22:10:55 -- Instance3292.3 has 0.8 for I/O Log Writes Average Latency.

01/12/2009 22:10:55 -- Instance3292.3 has 0.8 for I/O Log Reads Average Latency.

01/12/2009 22:10:55 -- Instance3292.4 has 10.3 for I/O Database Reads Average Latency.

01/12/2009 22:10:55 -- Instance3292.4 has 0.7 for I/O Log Writes Average Latency.

01/12/2009 22:10:55 -- Instance3292.4 has 0.7 for I/O Log Reads Average Latency.

01/12/2009 22:10:55 -- Test has 0 Maximum Database Page Fault Stalls/sec.

01/12/2009 22:10:55 -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.

01/12/2009 22:10:55 -- C:\Program Files\Exchange Jetstress\ESRP\Performance\Performance\_2009\_12\_1\_16\_46\_44.xml has 478 samples queried.

## Test result report

### Checksum statistics - All

Database	Seen pages	Bad pages	Correctable pages	Wrong page-number pages	File length/seconds taken
P:\FILES\Jetstress001001.edb	16043554	0	0	0	501361 MBytes/10912 sec
R:\FILES\Jetstress002001.edb	16043554	0	0	0	501361 MBytes/11251 sec
D:\FILES\Jetstress003001.edb	16043810	0	0	0	501369 MBytes/10640 sec
N:\FILES\Jetstress004001.edb	16043810	0	0	0	501369 MBytes/11126 sec
(Sum)	64174728	0	0	0	2005460 MBytes/11251 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
P:	0.074	0.000	735.371	0.000	65536.000
R:	0.075	0.000	711.819	0.000	65536.000
D:	0.075	0.000	754.221	0.000	65536.000
N:	0.076	0.000	721.305	0.000	65536.000

**Memory system performance (of checksum)**

Counter	Average	Minimum	Maximum
% Processor Time	4.402	2.397	5.074
Available MBytes	14723.909	14629.000	14811.000
Free System Page Table Entries	33559210.837	33558864.000	33559436.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	87639549.262	87154688.000	91410432.000
Pool Paged Bytes	128631024.941	127754240.000	128720896.000

**Test log**

```

01/12/2009 16:46:35 -- Command Line: "C:\Program Files\Exchange
Jetstress\JetstressCmd.exe" /c "C:\Program Files\Exchange
Jetstress\ESRP\Performance\jetstressconfig_perf.xml"
01/12/2009 16:46:35 -- Jetstress testing begins ...
01/12/2009 16:46:35 -- Prepare testing begins ...
01/12/2009 16:46:40 -- Attaching databases ...
01/12/2009 16:46:40 -- Prepare testing ends.
01/12/2009 16:46:40 -- Dispatching transactions begins ...
01/12/2009 16:46:40 -- Database cache settings: (minimum: 128.0 MB,
maximum: 1.0 GB)
01/12/2009 16:46:40 -- Database flush thresholds: (start: 10.2 MB, stop:
20.5 MB)

```

01/12/2009 16:46:44 -- Database read latency thresholds: (average: 20 msec/read, maximum: 100 msec/read).

01/12/2009 16:46:44 -- Log write latency thresholds: (average: 10 msec/write, maximum: 100 msec/write).

01/12/2009 16:46:46 -- Operation mix: Sessions 1, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.

01/12/2009 16:46:46 -- Performance logging begins (interval: 15000 ms).

01/12/2009 16:46:46 -- Attaining prerequisites:

01/12/2009 17:02:53 -- \MSEExchange Database(JetstressCmd)\Database Cache Size, Last: 966574100.0 (lower bound: 966367600.0, upper bound: none)

01/12/2009 19:02:53 -- Performance logging ends.

01/12/2009 19:02:53 -- JetInterop batch transaction stats: 6181, 6157, 6122 and 6295.

01/12/2009 19:02:53 -- Dispatching transactions ends.

01/12/2009 19:02:53 -- Shutting down databases ...

01/12/2009 19:03:01 -- Instance3292.1 (complete), Instance3292.2 (complete), Instance3292.3 (complete) and Instance3292.4 (complete)

01/12/2009 19:03:02 -- Performance logging begins (interval: 30000 ms).

01/12/2009 19:03:02 -- Verifying database checksums ...

01/12/2009 22:10:33 -- P: (100% processed), R: (100% processed), D: (100% processed) and N: (100% processed)

01/12/2009 22:10:33 -- Performance logging ends.

01/12/2009 22:10:33 -- C:\Program Files\Exchange Jetstress\ESRP\Performance\DBChecksum\_2009\_12\_1\_19\_3\_1.blg has 374 samples.

## Microsoft Exchange Server 2010 Jetstress – database backup

### Database backup statistics - All

Database Instance	Database Size (MBytes)	Elapsed Backup Time	MBytes Transferred/sec
Instance2780.1	501281.09	02:56:20	47.38
Instance2780.2	501273.09	03:00:54	46.18
Instance2780.3	501273.09	02:55:33	47.59
Instance2780.4	501297.09	02:57:48	46.99

### 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

Instance2780.1	Log Path: F:\FILES Database: E:\FILES\Jetstress001001.edb
Instance2780.2	Log Path: H:\FILES Database: G:\FILES\Jetstress002001.edb
Instance2780.3	Log Path: J:\FILES Database: I:\FILES\Jetstress003001.edb
Instance2780.4	Log Path: L:\FILES Database: K:\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
Instance2780.1	8.272	0.000	189.625	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance2780.2	8.625	0.000	184.351	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance2780.3	8.320	0.000	190.466	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance2780.4	8.340	0.000	187.858	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	3.359	1.829	3.697
Available MBytes	15056.186	15037.000	15059.000
Free System Page Table Entries	33559156.983	33558507.000	33559275.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	79333517.828	79245312.000	79978496.000
Pool Paged Bytes	119804879.778	117542912.000	119992320.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

## Test log

```
20/11/2009 17:09:07 -- Command Line: "C:\Program Files\Exchange
Jetstress\JetstressCmd.exe" /c "C:\Program Files\Exchange
Jetstress\results_.6\backup\test01\backup01.xml"
20/11/2009 17:09:07 -- Jetstress testing begins ...
20/11/2009 17:09:08 -- Prepare testing begins ...
20/11/2009 17:09:12 -- Attaching databases ...
20/11/2009 17:09:12 -- Prepare testing ends.
20/11/2009 17:09:18 -- Performance logging begins (interval: 30000 ms).
20/11/2009 17:09:18 -- Backing up databases ...
20/11/2009 20:10:12 -- Performance logging ends.
20/11/2009 20:10:12 -- Instance2780.1 (100% processed), Instance2780.2
(100% processed), Instance2780.3 (100% processed) and Instance2780.4
(100% processed)
20/11/2009 20:10:12 -- C:\Program Files\Exchange
Jetstress\results_.6\backup\test01\DatabaseBackup_2009_11_20_17_9_12.blg
has 361 samples.
20/11/2009 20:10:12 -- Creating test report ...
```

## Microsoft Exchange Server 2010 Jetstress – soft recovery

### Soft recovery test result report

#### Test summary

<b>Overall Test Result</b>	<b>Pass</b>
<b>Machine Name</b>	F2PEX01
<b>Test Description</b>	N/A
<b>Test Start Time</b>	19/11/2009 03:47:01
<b>Test End Time</b>	19/11/2009 09:15:24
<b>Collection Start Time</b>	19/11/2009 03:47:27
<b>Collection End Time</b>	19/11/2009 09:15:07
<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_.6\softrecovery\test01\Performance_2009_11 _19_3_47_11.blg

#### Database sizing and throughput

<b>Achieved Transactional I/O per Second</b>	125.431
<b>Target Transactional I/O per Second</b>	60
<b>Initial Database Size (bytes)</b>	2097559109632
<b>Final Database Size (bytes)</b>	2098783846400
<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%

**Database configuration**

<b>Instance552.1</b>	Log Path: F:\FILES Database: E:\FILES\Jetstress001001.edb
<b>Instance552.2</b>	Log Path: H:\FILES Database: G:\FILES\Jetstress002001.edb
<b>Instance552.3</b>	Log Path: J:\FILES Database: I:\FILES\Jetstress003001.edb
<b>Instance552.4</b>	Log Path: L:\FILES Database: K:\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
Instance552.1	15.145	1.322	18.327	12.941	32768.000	37795.599	0.000	0.638	0.000	12.457	0.000	4628.522
Instance552.2	14.479	1.279	18.516	13.133	32768.000	37676.933	0.000	0.637	0.000	12.522	0.000	4586.618
Instance552.3	14.738	1.296	18.214	12.864	32768.000	37894.698	0.000	0.640	0.000	12.444	0.000	4563.938
Instance552.4	15.570	1.249	18.388	13.049	32768.000	37708.571	0.000	0.638	0.000	12.809	0.000	4593.196

## Host system performance

Counter	Average	Minimum	Maximum
% Processor Time	0.211	0.084	3.164
Available MBytes	13985.355	13929.000	14961.000
Free System Page Table Entries	33559031.346	33558248.000	33559228.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	80425591.115	79241216.000	80912384.000
Pool Paged Bytes	122186576.256	118484992.000	124719104.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

**Test log**

```
19/11/2009 03:47:01 -- Command Line: "C:\Program Files\Exchange
Jetstress\JetstressCmd.exe" /c "C:\Program Files\Exchange
Jetstress\results_.6\softrecovery\test01\softrecovery01.xml"
19/11/2009 03:47:01 -- Jetstress testing begins ...
19/11/2009 03:47:01 -- Prepare testing begins ...
19/11/2009 03:47:06 -- Attaching databases ...
19/11/2009 03:47:06 -- Prepare testing ends.
19/11/2009 03:47:06 -- Dispatching transactions begins ...
19/11/2009 03:47:06 -- Database cache settings: (minimum: 128.0 MB,
maximum: 1.0 GB)
19/11/2009 03:47:06 -- Database flush thresholds: (start: 10.2 MB, stop:
20.5 MB)
19/11/2009 03:47:11 -- Database read latency thresholds: (average: 20
msec/read, maximum: 100 msec/read).
19/11/2009 03:47:11 -- Log write latency thresholds: (average: 10
msec/write, maximum: 100 msec/write).
19/11/2009 03:47:12 -- Operation mix: Sessions 1, Inserts 40%, Deletes
20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
19/11/2009 03:47:12 -- Performance logging begins (interval: 15000 ms).
19/11/2009 03:47:12 -- Generating log files ...
19/11/2009 09:15:16 -- F:\FILES (100.8% generated), H:\FILES (100.8%
generated), J:\FILES (100.2% generated) and L:\FILES (103.8% generated)
19/11/2009 09:15:16 -- Performance logging ends.
19/11/2009 09:15:17 -- JetInterop batch transaction stats: 21856, 21999,
21673 and 22027.
19/11/2009 09:15:17 -- Dispatching transactions ends.
19/11/2009 09:15:17 -- Shutting down databases ...
19/11/2009 09:15:24 -- Instance552.1 (complete), Instance552.2
(complete), Instance552.3 (complete) and Instance552.4 (complete)
19/11/2009 09:15:24 -- C:\Program Files\Exchange
Jetstress\results_.6\softrecovery\test01\Performance_2009_11_19_3_47_11.
blg has 1311 samples.
19/11/2009 09:15:24 -- Creating test report ...
```

19/11/2009 09:15:41 -- Instance552.1 has 15.1 for I/O Database Reads Average Latency.

19/11/2009 09:15:41 -- Instance552.1 has 0.6 for I/O Log Writes Average Latency.

19/11/2009 09:15:41 -- Instance552.1 has 0.6 for I/O Log Reads Average Latency.

19/11/2009 09:15:41 -- Instance552.2 has 14.5 for I/O Database Reads Average Latency.

19/11/2009 09:15:41 -- Instance552.2 has 0.6 for I/O Log Writes Average Latency.

19/11/2009 09:15:41 -- Instance552.2 has 0.6 for I/O Log Reads Average Latency.

19/11/2009 09:15:41 -- Instance552.3 has 14.7 for I/O Database Reads Average Latency.

19/11/2009 09:15:41 -- Instance552.3 has 0.6 for I/O Log Writes Average Latency.

19/11/2009 09:15:41 -- Instance552.3 has 0.6 for I/O Log Reads Average Latency.

19/11/2009 09:15:41 -- Instance552.4 has 15.6 for I/O Database Reads Average Latency.

19/11/2009 09:15:41 -- Instance552.4 has 0.6 for I/O Log Writes Average Latency.

19/11/2009 09:15:41 -- Instance552.4 has 0.6 for I/O Log Reads Average Latency.

19/11/2009 09:15:41 -- Test has 0 Maximum Database Page Fault Stalls/sec.

19/11/2009 09:15:41 -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.

19/11/2009 09:15:41 -- C:\Program Files\Exchange Jetstress\results\_.6\softrecovery\test01\Performance\_2009\_11\_19\_3\_47\_11.xml has 1310 samples queried.

## Soft recovery test result report

### Soft recovery statistics - All

Database Instance	Log files replayed	Elapsed seconds
Instance552.1	504	3076.6049217
Instance552.2	503	3029.9294225
Instance552.3	500	3025.6861953
Instance552.4	518	3206.0233513

### Database configuration

Instance552.1	Log Path: F:\FILES Database: E:\FILES\Jetstress001001.edb
Instance552.2	Log Path: H:\FILES Database: G:\FILES\Jetstress002001.edb
Instance552.3	Log Path: J:\FILES Database: I:\FILES\Jetstress003001.edb
Instance552.4	Log Path: L:\FILES Database: K:\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
Instance552.1	962.411	170.589	79.891	0.982	62982.316	22631.137	3.045	0.000	1.474	0.004	78317.011	0.335
Instance552.2	830.005	148.130	82.249	0.995	65718.674	23100.896	3.030	0.001	1.494	0.004	80149.551	0.680
Instance552.3	962.581	200.970	80.432	0.990	64500.579	23159.830	3.106	0.002	1.487	0.004	80472.649	1.021
Instance552.4	1077.669	232.855	77.351	0.968	60802.177	22820.204	2.961	0.000	1.451	0.000	77180.008	0.000

## Background database maintenance I/O performance

MSExchange Database ==> Instances	Database Maintenance I/O Reads/sec	Database Maintenance I/O Reads Average Bytes
Instance552.1	12.359	238977.444
Instance552.2	13.702	244680.384
Instance552.3	12.460	236504.542
Instance552.4	11.044	231538.358

## 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
Instance552.1	962.411	170.589	92.250	0.982	86560.864	22631.137	3.045	0.000	1.474	0.004	78317.011	0.335
Instance552.2	830.005	148.130	95.951	0.995	91275.514	23100.896	3.030	0.001	1.494	0.004	80149.551	0.680
Instance552.3	962.581	200.970	92.892	0.990	87572.414	23159.830	3.106	0.002	1.487	0.004	80472.649	1.021
Instance552.4	1077.669	232.855	88.395	0.968	82133.749	22820.204	2.961	0.000	1.451	0.000	77180.008	0.000

## Host system performance

Counter	Average	Minimum	Maximum
% Processor Time	0.481	0.000	1.346
Available MBytes	13945.148	13913.000	14892.000
Free System Page Table Entries	33558845.624	33558370.000	33559397.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	88919577.729	83419136.000	90726400.000
Pool Paged Bytes	125067505.849	124145664.000	125104128.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

**Test log**

```
19/11/2009 03:47:01 -- Command Line: "C:\Program Files\Exchange
Jetstress\JetstressCmd.exe" /c "C:\Program Files\Exchange
Jetstress\results_.6\softrecovery\test01\softrecovery01.xml"
19/11/2009 03:47:01 -- Jetstress testing begins ...
19/11/2009 03:47:01 -- Prepare testing begins ...
19/11/2009 03:47:06 -- Attaching databases ...
19/11/2009 03:47:06 -- Prepare testing ends.
19/11/2009 03:47:06 -- Dispatching transactions begins ...
19/11/2009 03:47:06 -- Database cache settings: (minimum: 128.0 MB,
maximum: 1.0 GB)
19/11/2009 03:47:06 -- Database flush thresholds: (start: 10.2 MB, stop:
20.5 MB)
19/11/2009 03:47:11 -- Database read latency thresholds: (average: 20
msec/read, maximum: 100 msec/read).
19/11/2009 03:47:11 -- Log write latency thresholds: (average: 10
msec/write, maximum: 100 msec/write).
19/11/2009 03:47:12 -- Operation mix: Sessions 1, Inserts 40%, Deletes
20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
19/11/2009 03:47:12 -- Performance logging begins (interval: 15000 ms).
19/11/2009 03:47:12 -- Generating log files ...
19/11/2009 09:15:16 -- F:\FILES (100.8% generated), H:\FILES (100.8%
generated), J:\FILES (100.2% generated) and L:\FILES (103.8% generated)
19/11/2009 09:15:16 -- Performance logging ends.
19/11/2009 09:15:17 -- JetInterop batch transaction stats: 21856, 21999,
21673 and 22027.
19/11/2009 09:15:17 -- Dispatching transactions ends.
19/11/2009 09:15:17 -- Shutting down databases ...
19/11/2009 09:15:24 -- Instance552.1 (complete), Instance552.2
(complete), Instance552.3 (complete) and Instance552.4 (complete)
19/11/2009 09:15:24 -- C:\Program Files\Exchange
Jetstress\results_.6\softrecovery\test01\Performance_2009_11_19_3_47_11.
blg has 1311 samples.
19/11/2009 09:15:24 -- Creating test report ...
```

19/11/2009 09:15:41 -- Instance552.1 has 15.1 for I/O Database Reads Average Latency.

19/11/2009 09:15:41 -- Instance552.1 has 0.6 for I/O Log Writes Average Latency.

19/11/2009 09:15:41 -- Instance552.1 has 0.6 for I/O Log Reads Average Latency.

19/11/2009 09:15:41 -- Instance552.2 has 14.5 for I/O Database Reads Average Latency.

19/11/2009 09:15:41 -- Instance552.2 has 0.6 for I/O Log Writes Average Latency.

19/11/2009 09:15:41 -- Instance552.2 has 0.6 for I/O Log Reads Average Latency.

19/11/2009 09:15:41 -- Instance552.3 has 14.7 for I/O Database Reads Average Latency.

19/11/2009 09:15:41 -- Instance552.3 has 0.6 for I/O Log Writes Average Latency.

19/11/2009 09:15:41 -- Instance552.3 has 0.6 for I/O Log Reads Average Latency.

19/11/2009 09:15:41 -- Instance552.4 has 15.6 for I/O Database Reads Average Latency.

19/11/2009 09:15:41 -- Instance552.4 has 0.6 for I/O Log Writes Average Latency.

19/11/2009 09:15:41 -- Instance552.4 has 0.6 for I/O Log Reads Average Latency.

19/11/2009 09:15:41 -- Test has 0 Maximum Database Page Fault Stalls/sec.

19/11/2009 09:15:41 -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.

19/11/2009 09:15:41 -- C:\Program Files\Exchange Jetstress\results\_.6\softrecovery\test01\Performance\_2009\_11\_19\_3\_47\_11.xml has 1310 samples queried.

19/11/2009 09:15:42 -- C:\Program Files\Exchange Jetstress\results\_.6\softrecovery\test01\Performance\_2009\_11\_19\_3\_47\_11.html is saved.

19/11/2009 09:15:44 -- Performance logging begins (interval: 2000 ms).

19/11/2009 09:15:44 -- Recovering databases ...

19/11/2009 10:09:10 -- Performance logging ends.

19/11/2009 10:09:10 -- Instance552.1 (3076.6049217), Instance552.2 (3029.9294225), Instance552.3 (3025.6861953) and Instance552.4 (3206.0233513)

19/11/2009 10:09:10 -- C:\Program Files\Exchange Jetstress\results\_.6\softrecovery\test01\SoftRecovery\_2009\_11\_19\_9\_15\_42 .blg has 1592 samples.

19/11/2009 10:09:10 -- Creating test report ...