

# Hitachi Adaptable Modular Storage 2500 Dynamically Provisioned 32,000 User Microsoft Exchange 2010 Resiliency Storage Solution

Tested with: ESRP—Storage Version 3.0

Test Date: December 2010 -January 2011

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## Overview

This document provides information on a Hitachi Adaptable Modular Storage 2500 resiliency storage solution using Hitachi Dynamic Provisioning for Microsoft Exchange Server 2010. This solution is based on the Microsoft Exchange Solution Reviewed Program (ESRP)—Storage program. For more information about the contents of this document or Hitachi Data Systems best practice recommendations for Microsoft Exchange Server 2010 storage design, see [Hitachi Data Systems Microsoft Exchange Solutions Web page](#).

The ESRP—Storage program was developed by Microsoft Corporation to provide a common storage testing framework for vendors to provide information on their storage solutions for Microsoft Exchange Server. For more information about the Microsoft ESRP—Storage program, see [TechNet's overview of the program](#).

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## Features

The purpose of this testing was to measure the ESRP 3.0 results on a Microsoft Exchange 2010 environment with 32,000 users and eight Hitachi Compute Blade 2000 server blades. This testing used a Hitachi Adaptable Modular Storage 2500 (AMS 2500) storage system using Hitachi Dynamic Provisioning in a two-pool RAID-10 configuration (one for databases and one for logs) in a resiliency configuration. These results help answer questions about the kind of performance capabilities to expect with a large-scale Exchange deployment on an AMS 2500.

Testing used eight Hitachi Compute Blade E55A2 server blades in a single chassis, each with the following:

- 64GB of RAM
- Two six-core Intel Xeon X5670 2.93GHz CPUs
- One two-port 8Gb/sec FC PCIe HBA (Model HFCE0802)
- Microsoft Windows Server 2008 R2 Enterprise

The eight servers used LUNs created on RAID groups on 32 450GB SAS disks as boot volumes.

This solution includes Exchange 2010 Mailbox Resiliency by using the Database Availability Group (DAG) feature. This tested configuration uses eight DAGs, each containing two database copies and two servers. The test configuration was capable of supporting 32,000 users with a 0.12 IOPS per user profile and user mailbox size of 1GB.

An AMS 2500 with the following was used for these tests:

- 176 2TB 7.2k RPM SAS disks
- 32 450GB 15k RPM SAS disks
- 32GB of cache
- 16 4Gb/sec paths.

Hitachi Adaptable Modular Storage 2500 is a, high-performance, highly reliable midrange storage system that can scale to 480 disks while maintaining 99.999% availability. It is highly suitable for a variety of applications and host platforms and is modular in scale. With the option of in-system and cross- system replication functionality, AMS 2500 is fully capable of being used as the core underlying storage platform for high-performance Exchange Server 2010 architectures.

## Solution Description

Deploying Microsoft Exchange Server 2010 requires careful consideration of all aspects of the solution architecture. Host servers need to be configured so that they are robust enough to handle the required Exchange load. The storage solution must be designed to provide the necessary performance while also being reliable and easy to administer. Of course, an effective backup and recovery plan should be incorporated into the solution as well. The aim of this solution report is to provide a tested configuration that uses an AMS2500 to meet the needs of a large Exchange Server 2010 deployment.

This solution used Hitachi Dynamic Provisioning, which is enabled on AMS 2500 via a license key. In the most basic sense, the use of Hitachi Dynamic Provisioning is similar to the use of a host-based logical volume manager (LVM), but with several additional features available within an AMS 2500 and without the need to install software on the host or incur host processing overhead. Hitachi Dynamic Provisioning is a superior solution by providing for one or more pools of wide striping across many RAID groups within an AMS 2500. One or more dynamic provisioning virtual volumes (DP-VOLs) of a user- specified logical size (with no initial physical space allocated) are created and associated with a single pool.

Hitachi Dynamic Provisioning also carries the side benefit of thin provisioning, where physical space is only assigned from the pool to the DP-VOL as needed using 1GB chunks per RAID group, up to the logical size specified for each DP-VOL. Space from a 1GB chunk is then allocated as needed as 32MB pool pages to that DP-VOL's logical block address range (divided up into 32MB strides). A pool can also be dynamically expanded by adding more RAID groups without disruption or requiring downtime. Upon expansion, a pool can easily be rebalanced so that the data and workload is wide striped evenly across the current and newly added RAID groups that make up the pool.

High availability is also a part of this solution with the use of the Database Availability Group (DAG) feature, which is the base component of the high availability and site resilience framework built into Microsoft Exchange Server 2010. A DAG is a group of up to 16 mailbox servers that host a set of databases and logs and uses continuous replication to provide automatic database-level recovery from failures that affect individual servers or databases.

Any server in a DAG can host a copy of a mailbox database from any other server in the DAG. When a server is added to a DAG, it monitors and works with the other servers in the DAG to provide automatic recovery delivering a robust, highly available Exchange solution without the administrative complexities of traditional failover clustering. For more information about the DAG feature in Exchange Server 2010, see <http://technet.microsoft.com/en-us/library/dd979799.aspx>

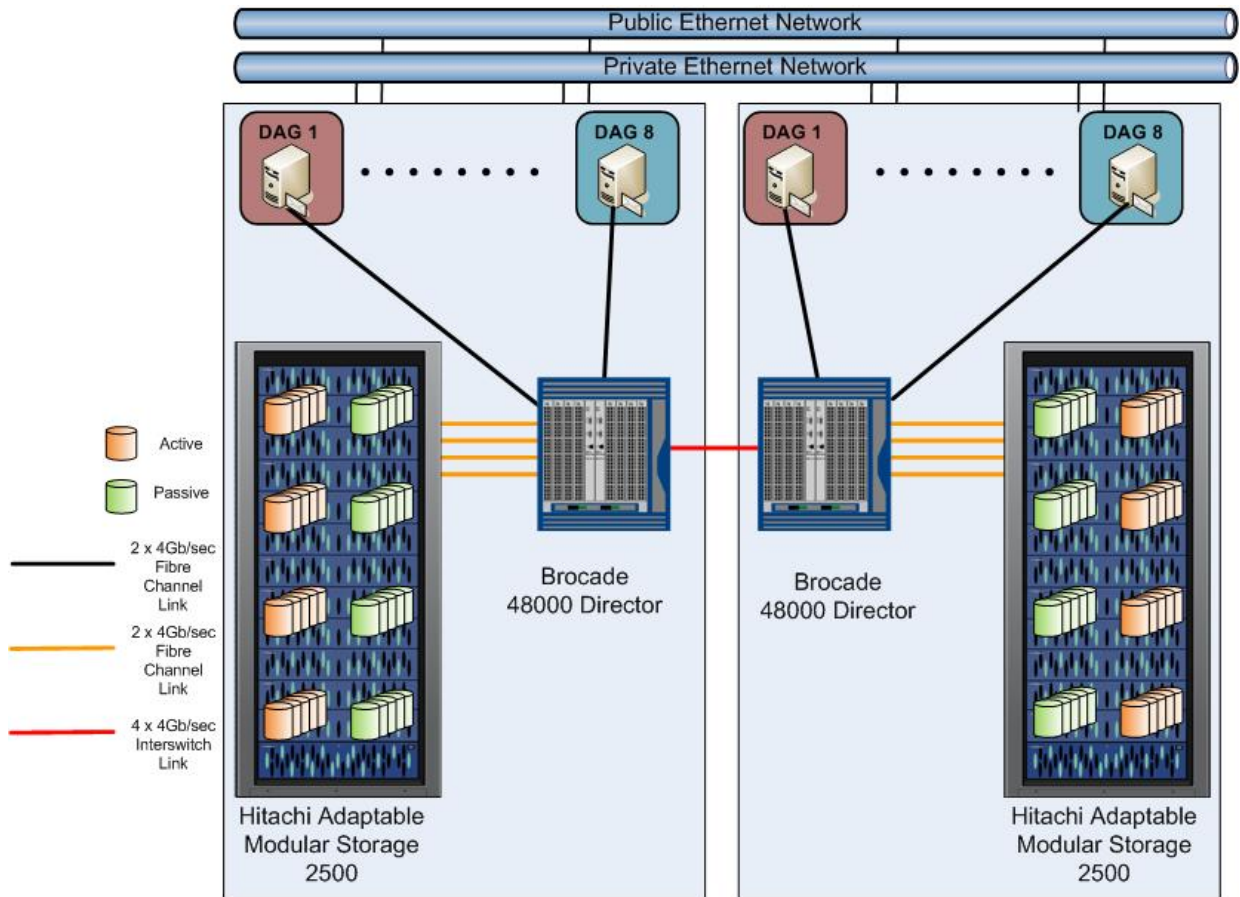
Hitachi Compute Blade 2000 server blades used in these tests were booted from the SAN. The boot volumes for the servers were LUNs from the same AMS 2500 that was tested in the solution. There was a dedicated set of 32 450GB 15k RPM SAS disks which were only used for creating RAID groups from which the SAN boot LUNs were created.

This solution included two copies of each Exchange database using eight DAGs, with each DAG configured with two server blades (one simulated) that host active mailboxes in eleven databases.

To target the 32,000-user resiliency solution, a Hitachi Adaptable Modular Storage 2500 (AMS 2500) is configured with 176 disks (of a maximum of 480) for Exchange and 32 additional disks for those LUNs used as boot volumes by the blade servers. Eight servers (one per DAG) were used, with each server configured with 4,000 mailboxes. There were 88 active databases and simulated database copies for the tests.

Each DAG contained two copies of every database; a local, active copy on a server connected to the primary AMS 2500 and the passive copy (simulated) on another server connected to a second AMS 2500 (simulated). This recommended configuration can support both high-availability and disaster-recovery scenarios when the active and passive database copies are allocated among both DAG members and dispersed across both AMS 2500 systems. Each simulated DAG server node in this solution maintains a mirrored configuration and possesses adequate capacity and performance capabilities to support the second set of replicated databases.

Figure 1 below illustrates the two systems that make up the simulated DAG configuration. For more information, see the Hitachi Data Systems [Storage Systems web page](#).



**Figure1.**



This solution enables organizations to consolidate Exchange Server 2010 DAG deployments on two AMS 2500 storage systems. Using identical hardware and software configurations guarantees that an active database and its replicated copy do not share storage paths, disk spindles or storage controllers, making it a very reliable, high-performing, highly available Exchange Server 2010 solution that is cost effective and easy to manage. This helps ensure that performance and service levels related to storage are maintained regardless of which server is hosting the active database. If further protection is needed in a production environment, additional Exchange Server 2010 mailbox servers can be easily added to support these failover scenarios.


Table 1 illustrates how the disks in an AMS 2500 were organized into RAID groups for use by the databases, logs, or SAN boot. Each set of colored disks represents a RAID-10 (2D+ 2D) group. There were 176 2TB 7.2k RPM SAS disks used in these tests configured as 44 RAID groups for the Exchange databases and logs. Another 32 450GB 15k RPM SAS disks were used in these tests as 8 RAID groups for the SAN boot volumes.

**Table1. Adaptable Modular Storage 2500 RAID Groups by RKA Tray Layout**

Drive Slot	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
RKA 11															
RKA 10															
RKA 9			RG4				RG5				RG6			RG7	
RKA 8	RG0				RG1				RG2				RG3		

Drive Slot	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
RKA 7	41	41	4	4	4	4	4	4	4	4	4	4	4	4	4										
RKA 6	36	36	3	3	3	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4				
RKA 5	30	30	1	1	1	1	1	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	36
RKA 4	23	25	2	2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	30
RKA	18	19	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	24
RKA 2	12	13	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	18
RKA 1	7	7	7		8	8	8	8	9	9	9	9	10		1	1		1	1	1	1	1	1	1	12
RKA 0	1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	4	5	5	5	5	5	6	6	6	6

 Database RGs- Raid10 2+2 added to Database DP Pool  
 Log RGs- Raid10 2+2 added to Log DP Pool

 OS RGs- Raid10 2+2

 Spare Disks

Disk trays RKA-0 through RKA-5 held 24 SAS 7200 RPM disks each. Tray RKA-6 held 19 SAS 7200 RPM disks and tray RKA-7 held 17 SAS 7200 RPM disks. These SAS 7200 RPM disks were used for ESRP. Trays RKA-8 through RKA-11 each contained 15 450GB SAS 15K RPM disks. These SAS disks were only used for RAID Groups for the 8 SAN boot volumes.

Two dynamic provisioning pools were created, one for the databases and the other for the logs. The database pool was created from 39 RAID-10 RAID groups and the log pool was created from 5 RAID-10 groups. From the database pool, 88 DP-VOLs (each specified to have a 1600GB size limit) were created for 88 databases (11 per server). From the log pool, 88 DP-VOLs (each specified to have a size limit of 180GB) were created for 88 logs (11 per server).

From the SAS 15k RPM disks in trays RKA-8 to RKA-11, eight RAID-10 (2+2) RAID groups were created. One LUN (each of size 150 GB) was created on each RAID Group. These eight LUNs, one per server, were used by the eight server blades as boot volumes from the SAN.

Table 2 outlines the port layout for the primary storage and servers for SAN Boot.

**Table2. Adaptable Modular Storage 2500 Port to Server Layout for SAN Boot**

<i>Server</i>	<i>Primary path</i>	<i>Secondary path</i>
HBS 107	0E	1E
HBS 108	0F	1F
HBS 109	0G	1G
HBS 110	0H	1H
HBS 111	1E	0E
HBS 112	1F	0F
HBS 113	1G	0G
HBS 114	1H	0H

Table 3 outlines the port layout for the SAN boot volume assignments for the primary storage and servers. An identical configuration would be deployed on the replicated storage and servers for this solution.

**Table 3. Adaptable Modular Storage 2500 Port to SAN Boot OS LUN Layout**

<i>Port</i>	<i>OS LUN for server</i>	<i>LUN</i>
0E	HBS107	0
0F	HBS108	1
0G	HBS109	2
0H	HBS110	3
1E	HBS111	4
1F	HBS112	5
1G	HBS113	6
1H	HBS114	7

Table 4 provides the detailed specifications for the storage configuration for the eight SAN boot volumes which used RAID-10 (2D+2D) groups and 450GB 15k SAS disks.

**Table 4. Adaptable Modular Storage 2500 Configuration Details for SAN Boot OS LUNs**

<i>Host</i>	<i>Raid Group</i>	<i>Port</i>	<i>LUN</i>	<i>Size (GB)</i>	<i>Description</i>
HBS 107	0	0E/1E	0	150	OS LUN for HBS 107
HBS 108	1	0F/1F	1	150	OS LUN for HBS 108
HBS 109	2	0G/1G	2	150	OS LUN for HBS 109
HBS 110	3	0H/1H	3	150	OS LUN for HBS 110
HBS 111	4	1E/0E	4	150	OS LUN for HBS 111
HBS 112	5	1F/0F	5	150	OS LUN for HBS 112
HBS 113	6	1G/0G	6	150	OS LUN for HBS 113
HBS 114	7	1H/0H	7	150	OS LUN for HBS 114

Table 5 outlines the port layout for the primary storage and servers for ESRP. An identical configuration would be deployed on the replicated storage and servers for this solution.

**Table 5. Adaptable Modular Storage 2500 Port to Server Layout for ESRP**

<i>Server</i>	<i>Primary path</i>	<i>Secondary path</i>
HBS107	0A	1A
HBS108	0B	1B
HBS109	0C	1C
HBS110	0D	1D
HBS111	1A	0A
HBS112	1B	0B
HBS113	1C	0C
HBS114	1D	0D

Table 6 outlines the port layout with the database DP-VOL assignments for the primary storage and servers. An identical configuration is deployed on the replicated storage and servers for this solution.

**Table 6. Adaptable Modular Storage 2500 Port to Database DP-VOL Layout**

<i>Port</i>	<i>Database</i>	<i>DB DP-VOL</i>
0A	Databases 1-11	8-18
0B	Databases 12-22	19-29
0C	Databases 23-33	30-40
0D	Databases 34-44	41-51
1A	Databases 45-55	52-62
1B	Databases 56-66	63-73
1C	Databases 67-77	74-84
1D	Databases 78-88	85-95

Table 7 outlines the port layout with the log DP-VOL assignments for the primary storage and servers. An identical configuration is deployed on the replicated storage and servers for this solution.

**Table 7. Adaptable Modular Storage 2500 Port to Log DP-VOL Layout**

<i>Port</i>	<i>Log</i>	<i>Log DP-VOL</i>
0A	Logs 1-11	96-106
0B	Logs 12-22	107-117
0C	Logs 23-33	118-128
0D	Logs 34-44	129-139
1A	Logs 45-55	140-150
1B	Logs 56-66	151-161
1C	Logs 67-77	162-172
1D	Logs 78-88	173-183

Table 8 provides the detailed specifications for the storage configuration which uses RAID-10 (2D+2D) groups and 2TB SAS 7.2k RPM disks. Dynamic provisioning pool 0 is dedicated for the databases and Dynamic provisioning pool 1 is dedicated for the logs.

**Table 8. Adaptable Modular Storage 2500 Configuration Details**

<i>Host</i>	<i>Pool</i>	<i>Port</i>	<i>DP-VOLs</i>	<i>Size (GB)</i>	<i>Description</i>
HBS 107	0	0A/1A	8-18	1600	Databases 1-11
HBS 108	0	0B/1B	19-29	1600	Databases 12-22
HBS 109	0	0C/1C	30-40	1600	Databases 23-33
HBS 110	0	0D/1D	41-51	1600	Databases 34-44
HBS 111	0	1A/0A	52-62	1600	Databases 45-55
HBS 112	0	1B/0B	63-73	1600	Databases 56-66
HBS 113	0	1C/0C	74-84	1600	Databases 67-77
HBS 114	0	1D/0D	85-95	1600	Databases 78-88
HBS 107	1	0A/1A	96-106	160	Logs 1-11
HBS 108	1	0B/1B	107-117	160	Logs 12-22
HBS 109	1	0C/1C	118-128	160	Logs 23-33
HBS 110	1	0D/1D	129-139	160	Logs 34-44
HBS 111	1	1A/0A	140-150	160	Logs 45-55
HBS 112	1	1B/0B	151-161	160	Logs 56-66
HBS 113	1	1C/0C	162-172	160	Logs 67-77
HBS 114	1	1D/0D	173-183	160	Logs 78-88

The ESRP— Storage program focuses on storage solution testing to address performance and reliability issues with storage design. However, storage is not the only factor to take into consideration when designing a scale-up Exchange solution. These factors also affect server scalability:

- 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

These factors are all beyond the scope of the ESRP— Storage program. Therefore, the number of mailboxes hosted per server as part of the tested configuration might not necessarily be viable for some customer deployments.

For more information about identifying and addressing performance bottlenecks in an Exchange system, see Microsoft's [Troubleshooting Microsoft Exchange Server Performance](#).

## Targeted Customer Profile

This solution is designed for medium to large organizations that plan to consolidate their Exchange Server 2010 storage on high-performance, high-reliability storage systems. This configuration is designed to support 32,000 Exchange users with the following specifications:

- 16 Exchange servers (8 servers tested, 8 servers simulated for the database copies)
- 8 Database Availability Groups each with two servers and two copies per database
- 2 Adaptable Modular Storage 2500s (one tested, using 16 4Gb/sec paths, with 8 used for the DB/Logs and 8 used for the SAN boot volumes)
- 0.1 IOPS per user (0.12 tested for 20 percent growth)
- 1GB mailbox size
- Mailbox resiliency provides high-availability and used as primary data protection mechanism.
- Adaptable Modular Storage RAID protection against physical failure or loss.
- 24 × 7 background database maintenance enabled.

## Test Deployment

The following tables summarize the testing environment.

**Table 9. Simulated Exchange Configuration**

<i>Number of Exchange mailboxes simulated</i>	32,000
<i>Number of database availability groups (DAGs)</i>	8
<i>Number of servers per DAG</i>	2 (1 simulated)
<i>Number of active mailboxes per server</i>	4,000
<i>Number of databases per host</i>	11
<i>Number of copies per database</i>	2
<i>Number of mailboxes per database</i>	364
<i>Simulated profile: I/Os per second per mailbox (IOPS, include 20% headroom)</i>	0.12
<i>Database LU size</i>	1600GB
<i>Log LU size</i>	160GB
<i>Total database size for performance testing</i>	32,000GB
<i>% storage capacity used by Exchange database**</i>	22.6%

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

**Table 10. Primary Storage Hardware**

<i>Storage connectivity (Fibre Channel, SAS, SATA, iSCSI)</i>	Fibre Channel
<i>Storage model and OS/firmware revision</i>	1 Hitachi Adaptable Modular Storage 2500 Firmware: 0897/B-Z WHQL listing: Hitachi Adaptable Modular Storage 2500
<i>Storage cache</i>	32GB
<i>Number of storage controllers</i>	2
<i>Number of storage ports</i>	8
<i>Maximum bandwidth of storage connectivity to host</i>	32Gb/sec (8x 4Gb/sec ports)
<i>Switch type/model/firmware revision</i>	Brocade 5320, Fabric OS v6.4.0b
<i>HBA model and firmware</i>	HFCE0802 Firmware : 00300439
<i>Number of HBAs per host</i>	2 dual-ported HBA per host, 2 4Gb/sec port used per HBA
<i>Host server type</i>	Hitachi Compute Blade E55A2 2 2.93GHz six-core Intel Xeon X5670 CPU, 64GB memory
<i>Total number of disks tested in solution</i>	176
<i>Maximum number of spindles that can be hosted in the storage</i>	480

**Table 11. Primary Storage Software**

<i>HBA driver</i>	Driver version :4.2.6.670
<i>HBA QueueTarget setting</i>	0
<i>HBA QueueDepth setting</i>	32
<i>Multipathing</i>	Hitachi Dynamic Link Manager v6.4.0-00
<i>Host OS</i>	Microsoft Windows Server 2008 R2 Enterprise
<i>ESE.dll file version</i>	14.00.0639.019
<i>Replication solution name/version</i>	N/A

**Table 12. Storage Disk Configuration (Mailbox Store Disks)**

<i>Disk type, speed and firmware revision</i>	SAS 2TB 7.2k 5C04
<i>Raw capacity per disk (GB)</i>	2TB
<i>Number of physical disks in test</i>	156 (dynamic provisioning pool)
<i>Total raw storage capacity (GB)</i>	312,000
<i>Disk slice size (GB)</i>	N /A
<i>Number of slices per LU or number of disks per LU</i>	N/A
<i>RAID level</i>	RAID 1+0 (2D+2D) at storage level
<i>Total formatted capacity</i>	141,570
<i>Storage capacity utilization</i>	45.4%
<i>Database capacity utilization</i>	45.1%

**Table 13. Storage Disk Configuration (Transaction Log Disks)**

<i>Disk type, speed and firmware revision</i>	SAS 2TB 7.2k 5C04
<i>Raw capacity per disk (GB)</i>	2TB
<i>Number of spindles in test</i>	20 (dynamic provisioning pool)
<i>Total raw storage capacity (GB)</i>	40000
<i>Disk slice size (GB)</i>	N/A
<i>Number of slices per LU or number of disks per LU</i>	N/A
<i>RAID level</i>	RAID 1+0 (2D+2D) at storage level
<i>Total formatted capacity</i>	18,150

## Replication Configuration

**Table 14. Replication Configuration**

<i>Replication mechanism</i>	Exchange Server 2010 Database Availability Group (DAG)
<i>Number of links</i>	2
<i>Simulated link distance</i>	N/A
<i>Link type</i>	IP
<i>Link bandwidth</i>	GigE (1Gbps)

**Table 15. Replicated Storage Hardware**

<i>Storage connectivity (Fiber Channel, SAS, SATA, iSCSI)</i>	Fibre Channel
<i>Storage model and OS/firmware revision</i>	1 Hitachi Adaptable Modular Storage 2500 Firmware: 0897/B-Z WHQL listing: Hitachi Adaptable Modular Storage 2500
<i>Storage cache</i>	32GB
<i>Number of storage controllers</i>	2
<i>Number of storage ports</i>	16
<i>Maximum bandwidth of storage connectivity to host</i>	32Gb/sec (8x 4Gb/sec ports)
<i>Switch type/model/firmware revision</i>	Brocade 5320, Fabric OS v6.4.0b
<i>HBA model and firmware</i>	HFCE0802 Firmware : 00300439
<i>Number of HBAs per host</i>	2 dual-ported HBA per host, 2 4Gb/sec port used per HBA
<i>Host server type</i>	Hitachi Compute Blade E55A2 2 2.93GHz six-core Intel Xeon X5670 CPU, 64GB memory
<i>Total number of disks tested in solution</i>	176
<i>Maximum number of spindles that can be hosted in the storage</i>	480

**Table 16. Replicated Storage Software**

<i>HBA driver</i>	Driver version :4.2.6.670 hfcmgr version : 2.4
<i>HBA QueueTarget setting</i>	0
<i>HBA QueueDepth setting</i>	32
<i>Multipathing</i>	Hitachi Dynamic Link Manager v6.4.0-00
<i>Host OS</i>	Microsoft Windows Server 2008 R2 Enterprise
<i>ESE.dll file version</i>	14.00.0639.019
<i>Replication solution name/version</i>	N/A

**Table 17. Replicated Storage Disk Configuration (Mailbox Store Disks)**

<i>Disk type, speed and firmware revision</i>	SAS 2TB 7.2k 5C04
<i>Raw capacity per disk (GB)</i>	2TB
<i>Number of physical disks in test</i>	156 (dynamic provisioning pool)
<i>total raw storage capacity (GB)</i>	312,000
<i>Disk slice size (GB)</i>	N /A
<i>Number of slices per LU or number of disks per LU</i>	N/A
<i>Raid level</i>	RAID 1+0 (2D+2D) at storage level
<i>Total formatted capacity</i>	141,570
<i>Storage capacity utilization</i>	45.4%
<i>Database capacity utilization</i>	45.1%

**Table 18. Replicated Storage Disk Configuration (Transactional Log Disks)**

<i>Disk type, speed and firmware revision</i>	SAS 2TB 7.2k 5C04
<i>Raw capacity per disk (GB)</i>	2TB
<i>Number of spindles in test</i>	20 (dynamic provisioning pool)
<i>Total raw storage capacity (GB)</i>	40000
<i>Disk slice size (GB)</i>	N/A
<i>Number of slices per LU or number of disks per LU</i>	N/A
<i>Raid level</i>	RAID 1+0 (2D+2D) at storage level
<i>Total formatted capacity</i>	18,150 GB

## Best Practices

Microsoft Exchange Server 2010 is a disk-intensive application. It presents two distinct workload patterns to the storage, with 32KB random read/write operations to the databases, and sequential write operations of varying size (between 512 bytes up to the log buffer size) to the transaction logs. For this reason, designing an optimal storage configuration can prove challenging in practice. Based on the testing run using the ESRP framework, Hitachi Data Systems recommends these best practices to improve the performance of a Hitachi Adaptable Modular Storage 2500 running Exchange 2010.

For more information about Exchange 2010 best practices for storage design, see the Microsoft TechNet article "[Mailbox Server Storage Design](#)."

### Core Storage

1. When formatting a newly partitioned LU, Hitachi Data Systems recommends setting the ALU to 64K for the database files and 4K for the log files.
2. Disk alignment is no longer required when using Microsoft Windows Server 2008.
3. Keep the Exchange workload isolated from other applications. Mixing another I/O intensive application whose workload differs from Exchange can cause the performance for both applications to degrade.
4. Use Hitachi Dynamic Link Manager for multipathing to provide fault tolerance and high availability for host connectivity.
5. Use Hitachi Dynamic Provisioning to simplify storage management of the Exchange database and log volumes.
6. Due to the difference in I/O patterns, isolate the Exchange database from the log groups. Create a dedicated dynamic provisioning pool for the databases and a separate pool for the logs.
7. Hitachi Data Systems recommends RAID-5 or RAID-10 groups for both the database pools and for the log pool. Use of RAID-10 allows more writes at a lower response time under heavier loads. RAID-10 also supports a shorter RAID group rebuild time on failure of a disk.
8. The log LUs should be at least 10 percent of the size of the database LUs.
9. Hitachi Data Systems does not recommend using LU concatenation
10. Hitachi Data Systems recommends implementing Mailbox Resiliency using the Exchange Server 2010 Database Availability Group feature.
11. Ensure that each DAG maintains at least two database copies to provide high availability.
12. Isolate active databases and their replicated copies in separate dynamic provisioning pools or ensure that they are located on a separate 2500.
13. Use fewer, larger LUs for Exchange 2010 databases (up to 2TB) with Background Database Maintenance (24 x 7) enabled.
14. Size storage solutions for Exchange based primarily on performance criteria. The number of disks, RAID level and percent utilization of each disk directly affect the level of achievable performance. Factor in capacity requirements only after performance is addressed.

15. Disk size is unrelated to performance with regards to IOPS or throughput rates. Disk size is related to the usable capacity of all of the LUs from a RAID group, which is a choice users make.
16. The number of spindles, coupled with the RAID level, determines the physical IOPS capacity of the RAID group and all of its LUs. If the disk has too few spindles, the response times grow to large values very quickly.

## Storage-based Replication

N/A

## Backup Strategy

N/A

## Test Results Summary

This section provides a high-level summary of the test data from ESRP and the link to the detailed HTML reports that are generated by ESRP testing framework.

### Reliability

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

- No errors were reported in the event log file for the storage reliability testing.
- No errors were reported for the [database](#) and [log](#) checksum process.
- If done, no errors were reported during the backup to disk test [process](#).
- No errors were reported for the database checksum on the remote storage database.

### Storage [Performance](#) Results

Primary storage performance testing exercises the storage with maximum sustainable Exchange type of I/O for two hours. The test shows how long it takes for the storage to respond to an I/O under load. The following data is the sum of all of the logical disk I/Os and average of all the logical disks I/O latency in the two-hour test duration.

#### *Individual Server Metrics*

These individual server metrics show the sum of the I/O across the storage groups and the average latency across all storage groups on a per-server basis.

**Table 19. Individual Server Metrics for Exchange Server (HBS107)**

<i>Database I/O</i>	
<i>Database Disk Transfers Per Second</i>	616
<i>Database Disk Reads Per Second</i>	362
<i>Database Disk Writes Per Second</i>	254
<i>Average Database Disk Read Latency (ms)</i>	15.3
<i>Average Database Disk Write Latency (ms)</i>	2.0
<i>Transaction Log I/O</i>	
<i>Log Disk Writes Per Second</i>	243
<i>Average Log Disk Write Latency (ms)</i>	0.6

**Table 20. Individual Server Metrics for Exchange Server (HBS108)**

<i>Database I/O</i>	
<i>Database Disk Transfers Per Second</i>	616
<i>Database Disk Reads Per Second</i>	362
<i>Database Disk Writes Per Second</i>	254
<i>Average Database Disk Read Latency (ms)</i>	15.1
<i>Average Database Disk Write Latency (ms)</i>	2.1
<i>Transaction Log I/O</i>	
<i>Log Disk Writes Per Second</i>	242
<i>Average Log Disk Write Latency (ms)</i>	0.6

**Table 21. Individual Server Metrics for Exchange Server (HBS109)**

<i>Database I/O</i>	
<i>Database Disk Transfers Per Second</i>	495
<i>Database Disk Reads Per Second</i>	291
<i>Database Disk Writes Per Second</i>	204
<i>Average Database Disk Read Latency (ms)</i>	16.5
<i>Average Database Disk Write Latency (ms)</i>	1.9
<i>Transaction Log I/O</i>	
<i>Log Disk Writes Per Second</i>	196
<i>Average Log Disk Write Latency (ms)</i>	0.6

**Table 22. Individual Server Metrics for Exchange Server (HBS110)**

<i>Database I/O</i>	
<i>Database Disk Transfers Per Second</i>	619
<i>Database Disk Reads Per Second</i>	364
<i>Database Disk Writes Per Second</i>	255
<i>Average Database Disk Read Latency (ms)</i>	15.0
<i>Average Database Disk Write Latency (ms)</i>	2.1
<i>Transaction Log I/O</i>	
<i>Log Disk Writes Per Second</i>	244
<i>Average Log Disk Write Latency (ms)</i>	0.6

**Table 22. Individual Server Metrics for Exchange Server (HBS111)**

<i>Database I/O</i>	
<i>Database Disk Transfers Per Second</i>	624
<i>Database Disk Reads Per Second</i>	366
<i>Database Disk Writes Per Second</i>	258
<i>Average Database Disk Read Latency (ms)</i>	15.5
<i>Average Database Disk Write Latency (ms)</i>	2.1
<i>Transaction Log I/O</i>	
<i>Log Disk Writes Per Second</i>	249
<i>Average Log Disk Write Latency (ms)</i>	0.6

**Table 23. Individual Server Metrics for Exchange Server (HBS112)**

<i>Database I/O</i>	
<i>Database Disk Transfers Per Second</i>	619
<i>Database Disk Reads Per Second</i>	363
<i>Database Disk Writes Per Second</i>	256
<i>Average Database Disk Read Latency (ms)</i>	15.3
<i>Average Database Disk Write Latency (ms)</i>	2.1
<i>Transaction Log I/O</i>	
<i>Log Disk Writes Per Second</i>	247
<i>Average Log Disk Write Latency (ms)</i>	0.6

**Table 24. Individual Server Metrics for Exchange Server (HBS113)**

<i>Database I/O</i>	
<i>Database Disk Transfers Per Second</i>	498
<i>Database Disk Reads Per Second</i>	292
<i>Database Disk Writes Per Second</i>	206
<i>Average Database Disk Read Latency (ms)</i>	16.3
<i>Average Database Disk Write Latency (ms)</i>	1.9
<i>Transaction Log I/O</i>	
<i>Log Disk Writes Per Second</i>	200
<i>Average Log Disk Write Latency (ms)</i>	0.6

**Table 25. Individual Server Metrics for Exchange Server (SUN114)**

<i>Database I/O</i>	
<i>Database Disk Transfers Per Second</i>	625
<i>Database Disk Reads Per Second</i>	366
<i>Database Disk Writes Per Second</i>	259
<i>Average Database Disk Read Latency (ms)</i>	15.4
<i>Average Database Disk Write Latency (ms)</i>	2.1
<i>Transaction Log I/O</i>	
<i>Log Disk Writes Per Second</i>	248
<i>Average Log Disk Write Latency (ms)</i>	0.6

### *Aggregate Performance Across All Servers Metric*

The aggregate performance across all server metrics shows the sum of I/Os across all servers in the solution and the average latency across all servers in the solution.

**Table 26. Aggregate Performance for Exchange Server 2010**

<i>Database I/O</i>	
<i>Database Disk Transfers Per Second</i>	4712
<i>Database Disk Reads Per Second</i>	2766
<i>Database Disk Writes Per Second</i>	1946
<i>Average Database Disk Read Latency (ms)</i>	15.6
<i>Average Database Disk Write Latency (ms)</i>	2.0
<i>Transaction Log I/O</i>	
<i>Log Disk Writes Per Second</i>	1869
<i>Average Log Disk Write Latency (ms)</i>	0.6

## Replicated Storage [Performance](#) Result

These performance tests measure the performance of the secondary storage. The performance tests are identical to that of the primary storage and verify that the secondary storage is capable of being transitioned to become the primary storage. Each server is listed separately and the aggregate numbers across all servers is listed as well.

### *Individual Server Metric*

The sum of the I/Os across the storage groups and the average latency across all storage groups on a per-server basis was measured.

**Table 27. Individual Server Metrics for Exchange Server (HBS107)**

<i>Database I/O</i>	
<i>Database Disk Transfers Per Second</i>	616
<i>Database Disk Reads Per Second</i>	362
<i>Database Disk Writes Per Second</i>	254
<i>Average Database Disk Read Latency (ms)</i>	15.3
<i>Average Database Disk Write Latency (ms)</i>	2.0
<i>Transaction Log I/O</i>	
<i>Log Disk Writes Per Second</i>	243
<i>Average Log Disk Write Latency (ms)</i>	0.6

**Table 28. Individual Server Metrics for Exchange Server (HBS108)**

<i>Database I/O</i>	
<i>Database Disk Transfers Per Second</i>	616
<i>Database Disk Reads Per Second</i>	362
<i>Database Disk Writes Per Second</i>	254
<i>Average Database Disk Read Latency (ms)</i>	15.1
<i>Average Database Disk Write Latency (ms)</i>	2.1
<i>Transaction Log I/O</i>	
<i>Log Disk Writes Per Second</i>	242
<i>Average Log Disk Write Latency (ms)</i>	0.6

**Table 29. Individual Server Metrics for Exchange Server (HBS109)**

<i>Database I/O</i>	
<i>Database Disk Transfers Per Second</i>	495
<i>Database Disk Reads Per Second</i>	291
<i>Database Disk Writes Per Second</i>	204
<i>Average Database Disk Read Latency (ms)</i>	16.5
<i>Average Database Disk Write Latency (ms)</i>	1.9
<i>Transaction Log I/O</i>	
<i>Log Disk Writes Per Second</i>	196
<i>Average Log Disk Write Latency (ms)</i>	0.6

**Table 30. Individual Server Metrics for Exchange Server (HBS110)**

<i>Database I/O</i>	
<i>Database Disk Transfers Per Second</i>	619
<i>Database Disk Reads Per Second</i>	364
<i>Database Disk Writes Per Second</i>	255
<i>Average Database Disk Read Latency (ms)</i>	15.0
<i>Average Database Disk Write Latency (ms)</i>	2.1
<i>Transaction Log I/O</i>	
<i>Log Disk Writes Per Second</i>	244
<i>Average Log Disk Write Latency (ms)</i>	0.6

**Table 31. Individual Server Metrics for Exchange Server (HBS111)**

<i>Database I/O</i>	
<i>Database Disk Transfers Per Second</i>	624
<i>Database Disk Reads Per Second</i>	366
<i>Database Disk Writes Per Second</i>	258
<i>Average Database Disk Read Latency (ms)</i>	15.5
<i>Average Database Disk Write Latency (ms)</i>	2.1
<i>Transaction Log I/O</i>	
<i>Log Disk Writes Per Second</i>	249
<i>Average Log Disk Write Latency (ms)</i>	0.6

**Table 32. Individual Server Metrics for Exchange Server (HBS112)**

<i>Database I/O</i>	
<i>Database Disk Transfers Per Second</i>	619
<i>Database Disk Reads Per Second</i>	363
<i>Database Disk Writes Per Second</i>	256
<i>Average Database Disk Read Latency (ms)</i>	15.3
<i>Average Database Disk Write Latency (ms)</i>	2.1
<i>Transaction Log I/O</i>	
<i>Log Disk Writes Per Second</i>	247
<i>Average Log Disk Write Latency (ms)</i>	0.6

**Table 33. Individual Server Metrics for Exchange Server (HBS113)**

<i>Database I/O</i>	
<i>Database Disk Transfers Per Second</i>	498
<i>Database Disk Reads Per Second</i>	292
<i>Database Disk Writes Per Second</i>	206
<i>Average Database Disk Read Latency (ms)</i>	16.3
<i>Average Database Disk Write Latency (ms)</i>	1.9
<i>Transaction Log I/O</i>	
<i>Log Disk Writes Per Second</i>	200
<i>Average Log Disk Write Latency (ms)</i>	0.6

**Table 34. Individual Server Metrics for Exchange Server (HBS114)**

<i>Database I/O</i>	
<i>Database Disk Transfers Per Second</i>	625
<i>Database Disk Reads Per Second</i>	366
<i>Database Disk Writes Per Second</i>	259
<i>Average Database Disk Read Latency (ms)</i>	15.4
<i>Average Database Disk Write Latency (ms)</i>	2.1
<i>Transaction Log I/O</i>	
<i>Log Disk Writes Per Second</i>	248
<i>Average Log Disk Write Latency (ms)</i>	0.6

### *Aggregate Performance Across All Servers Metric*

The sum of the I/Os across the servers in the solution and the average latency across all servers in the solution was measured.

**Table 35. Aggregate Performance for Exchange Server 2010**

<i>Database I/O</i>	
<i>Database Disk Transfers Per Second</i>	4712
<i>Database Disk Reads Per Second</i>	2766
<i>Database Disk Writes Per Second</i>	1946
<i>Average Database Disk Read Latency (ms)</i>	15.6
<i>Average Database Disk Write Latency (ms)</i>	2.0
<i>Transaction Log I/O</i>	
<i>Log Disk Writes Per Second</i>	1870
<i>Average Log Disk Write Latency (ms)</i>	0.6

## Database Backup and Recovery Performance

This section has two tests: The first measures the sequential read rate of the database files and the second measures recovery/replay performance (playing transaction logs into the database).

### *Database Read-only [Performance](#)*

This test measures the maximum rate at which databases can be backed up using VSS. The following tables show the average rate for a single database file.

**Table 36. Database Read-only Performance**

<i>MB Read Per Second Per Database</i>	23.55
<i>MB Read Per Second Total Per Server</i>	259.09

### *Transaction Log Recovery/Replay [Performance](#)*

This test measures 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 1MB in size.

**Table 37. Transaction Log Recovery/Replay Performance**

<i>Average Time to Play One Log File (sec)</i>	3.70
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## Conclusion

This document details a tested and robust Exchange Server 2010 Resiliency solution capable of supporting 32,000 users with a 0.12 IOPS per user profile and user mailbox size of 1GB using 8 DAGs each configured with 2 server nodes (one simulated).

A Hitachi Adaptable Modular Storage 2500, with 32GB of cache and sixteen 4Gb/sec Fibre Channel host paths, using Hitachi Dynamic Provisioning (with two pools) and 176 2TB 7.2k RPM SAS disks in a RAID-10 configuration was used for these tests. The AMS 2500 also had 32 450GB 15k RPM SAS disks used in a RAID-10 configuration for creating LUNs that the Hitachi Compute Blade 2000 server blades used as boot disks to boot from SAN.

Testing confirmed that an AMS 2500 is more than capable of delivering the IOPS and capacity requirements needed to support the active and replicated databases for 32,000 Exchange mailboxes configured with the specified user profile, while maintaining additional headroom to support peak throughput.

The solution outlined in this document does not include data protection components, such as VSS snapshot or clone backups, and relies on the built-in Mailbox Resiliency features of Exchange Server 2010 coupled with Adaptable Modular Storage RAID technology to provide high-availability and protection from logical and physical failures. Adding additional protection requirements may affect performance and capacity requirements of the underlying storage configuration, and as such need to be factored into the storage design accordingly.

For more information to about planning Exchange Server 2010 storage architectures for the Hitachi Adaptable Modular Storage 2000 family, see <http://www.hds.com/assets/pdf/hitachi-ams-2000-family.pdf>

This document is developed by Hitachi Data Systems and reviewed by the Microsoft Exchange product team. The test results and data presented in this document are based on the tests introduced in the ESRP test framework. Do not quote the data directly for pre-deployment verification. It is still necessary to validate the storage design for a specific customer environment.

The ESRP program is not designed to be a benchmarking program. Tests do not generate the maximum throughput for a given solution. Rather, the ESRP program is focused on producing recommendations from vendors for Exchange application. Do not use the data presented in this document for direct comparisons among the solutions.

## Appendix — Test Reports

This appendix contains Jetstress test results for one of the servers used in testing this storage solution. These test results are representative of the results obtained for all of the servers tested.

### Performance Test Result Report: HBS 107

#### Test Summary

<i>Overall Test Result</i>	Pass
<i>Machine Name</i>	HBS107
<i>Test Description</i>	
<i>Test Start Time</i>	12/9/2010 3:33:12 AM
<i>Test End Time</i>	12/9/2010 8:28:16 AM
<i>Collection Start Time</i>	12/9/2010 3:40:34 AM
<i>Collection End Time</i>	12/9/2010 5:40:29 AM
<i>Jetstress Version</i>	14.01.0043.000
<i>Ese Version</i>	14.00.0639.019
<i>Operating System</i>	Windows Server 2008 R2 Enterprise (6.1.7600.0)
<i>Performance Log</i>	C:\ESRP3.0_NL-SAS-R10_1GB\Performance\Performance_2010_12_9_3_34_17.blg C:\ESRP3.0_NL-SAS-R10_1GB\Performance\DBChecksum_2010_12_9_8_28_16.blg

#### Database Sizing and Throughput

<i>Achieved Transactional I/O per Second</i>	616.088
<i>Target Transactional I/O per Second</i>	480
<i>Initial Database Size (bytes)</i>	6445404979200
<i>Final Database Size (bytes)</i>	6450656247808
<i>Database Files (Count)</i>	11

#### Jetstress System Parameters

<i>Thread Count</i>	4 (per database)
<i>Minimum Database Cache</i>	352.0 MB
<i>Maximum Database Cache</i>	2816.0 MB
<i>Insert Operations</i>	40%
<i>Delete Operations</i>	20%
<i>Replace Operations</i>	5%
<i>Read Operations</i>	35%
<i>Lazy Commits</i>	70%
<i>Run Background Database Maintenance</i>	True
<i>Number of Copies per Database</i>	2

## Database Configuration

<i>Instance2248.1</i>	Log Path: C:\logluns\log1 Database: C:\dbluns\db1\Jetstress001001.edb
<i>Instance2248.2</i>	Log Path: C:\logluns\log2 Database: C:\dbluns\db2\Jetstress002001.edb
<i>Instance2248.3</i>	Log Path: C:\logluns\log3 Database: C:\dbluns\db3\Jetstress003001.edb
<i>Instance2248.4</i>	Log Path: C:\logluns\log4 Database: C:\dbluns\db4\Jetstress004001.edb
<i>Instance2248.5</i>	Log Path: C:\logluns\log5 Database: C:\dbluns\db5\Jetstress005001.edb
<i>Instance2248.6</i>	Log Path: C:\logluns\log6 Database: C:\dbluns\db6\Jetstress006001.edb
<i>Instance2248.7</i>	Log Path: C:\logluns\log7 Database: C:\dbluns\db7\Jetstress007001.edb
<i>Instance2248.8</i>	Log Path: C:\logluns\log8 Database: C:\dbluns\db8\Jetstress008001.edb
<i>Instance2248.9</i>	Log Path: C:\logluns\log9 Database: C:\dbluns\db9\Jetstress009001.edb
<i>Instance2248.10</i>	Log Path: C:\logluns\log10 Database: C:\dbluns\db10\Jetstress010001.edb
<i>Instance2248.11</i>	Log Path: C:\logluns\log11 Database: C:\dbluns\db11\Jetstress011001.edb

Transactional I/O Performance

<i>MSExchange Database ==&gt; Instances</i>	<i>I/O Database Reads Average Latency (msec)</i>	<i>I/O Database Writes Average Latency (msec)</i>	<i>I/O Database Reads/sec</i>	<i>I/O Database Writes/sec</i>	<i>I/O Database Reads Average Bytes</i>	<i>I/O Database Writes Average Bytes</i>	<i>I/O Log Reads Average Latency (msec)</i>	<i>I/O Log Writes Average Latency (msec)</i>	<i>I/O Log Reads/sec</i>	<i>I/O Log Writes/sec</i>	<i>I/O Log Reads Average Bytes</i>	<i>I/O Log Writes Average Bytes</i>
<b>Instance2248.1</b>	17.853	2.153	33.425	23.472	36304.297	37021.837	0.000	0.563	0.000	22.303	0.000	4490.242
<b>Instance2248.2</b>	15.621	2.231	32.608	22.904	36166.160	37098.814	0.000	0.611	0.000	21.995	0.000	4601.957
<b>Instance2248.3</b>	15.387	2.062	32.578	22.684	36824.857	37171.580	0.000	0.560	0.000	21.851	0.000	4567.523
<b>Instance2248.4</b>	15.359	2.073	32.841	23.023	36930.240	37079.105	0.000	0.599	0.000	21.908	0.000	4547.546
<b>Instance2248.5</b>	13.685	2.027	32.853	23.136	36756.697	37147.666	0.000	0.557	0.000	22.074	0.000	4559.134
<b>Instance2248.6</b>	15.467	2.016	32.683	22.856	36520.345	37159.670	0.000	0.610	0.000	22.049	0.000	4556.252
<b>Instance2248.7</b>	15.522	1.898	33.244	23.384	36736.791	37080.337	0.000	0.558	0.000	22.412	0.000	4541.627
<b>Instance2248.8</b>	15.687	1.872	32.789	23.004	36729.194	37059.027	0.000	0.602	0.000	21.839	0.000	4537.078
<b>Instance2248.9</b>	15.166	1.842	32.634	22.808	36750.568	37181.036	0.000	0.562	0.000	21.868	0.000	4572.981
<b>Instance2248.10</b>	13.750	1.916	33.004	23.172	36373.981	37069.104	0.000	0.597	0.000	22.207	0.000	4535.301
<b>Instance2248.11</b>	14.880	1.808	33.445	23.540	37055.801	37154.944	0.000	0.558	0.000	22.333	0.000	4532.003

## Background Database Maintenance I/O Performance

<i>MSExchange Database ==&gt; Instances</i>	<i>Database Maintenance IO Reads/sec</i>	<i>Database Maintenance IO Reads Average Bytes</i>
Instance2248.1	25.678	261496.477
Instance2248.2	27.095	261408.617
Instance2248.3	27.247	261409.850
Instance2248.4	27.389	261457.934
Instance2248.5	29.508	261334.641
Instance2248.6	27.332	261385.193
Instance2248.7	27.074	261496.122
Instance2248.8	26.842	261392.570
Instance2248.9	27.677	261446.700
Instance2248.10	29.466	261407.346
Instance2248.11	28.026	261351.526

## Log Replication I/O Performance

<i>MSExchange Database ==&gt; Instances</i>	<i>I/O Log Reads/sec</i>	<i>I/O Log Reads Average Bytes</i>
Instance2248.1	0.404	158410.733
Instance2248.2	0.408	157914.919
Instance2248.3	0.402	156523.640
Instance2248.4	0.402	157075.840
Instance2248.5	0.404	155811.478
Instance2248.6	0.406	156829.099
Instance2248.7	0.407	158501.626
Instance2248.8	0.398	155124.813
Instance2248.9	0.401	156943.973
Instance2248.10	0.404	157364.473
Instance2248.11	0.407	158063.517

Total I/O Performance

<i>MSExchange Database ==&gt; Instances</i>	<i>I/O Database Reads Average Latency (msec)</i>	<i>I/O Database Writes Average Latency (msec)</i>	<i>I/O Database Reads/sec</i>	<i>I/O Database Writes/sec</i>	<i>I/O Database Reads Average Bytes</i>	<i>I/O Database Writes Average Bytes</i>	<i>I/O Log Reads Average Latency (msec)</i>	<i>I/O Log Writes Average Latency (msec)</i>	<i>I/O Log Reads/sec</i>	<i>I/O Log Writes/sec</i>	<i>I/O Log Reads Average Bytes</i>	<i>I/O Log Writes Average Bytes</i>
<b>Instance2248.1</b>	17.853	2.153	59.103	23.472	134141.818	37021.837	20.601	0.563	0.404	22.303	158410.733	4490.242
<b>Instance2248.2</b>	15.621	2.231	59.704	22.904	138388.392	37098.814	17.606	0.611	0.408	21.995	157914.919	4601.957
<b>Instance2248.3</b>	15.387	2.062	59.826	22.684	139111.370	37171.580	16.763	0.560	0.402	21.851	156523.640	4567.523
<b>Instance2248.4</b>	15.359	2.073	60.230	23.023	139031.337	37079.105	20.075	0.599	0.402	21.908	157075.840	4547.546
<b>Instance2248.5</b>	13.685	2.027	62.361	23.136	143022.086	37147.666	15.586	0.557	0.404	22.074	155811.478	4559.134
<b>Instance2248.6</b>	15.467	2.016	60.015	22.856	138927.612	37159.670	17.940	0.610	0.406	22.049	156829.099	4556.252
<b>Instance2248.7</b>	15.522	1.898	60.318	23.384	137620.393	37080.337	17.048	0.558	0.407	22.412	158501.626	4541.627
<b>Instance2248.8</b>	15.687	1.872	59.631	23.004	137857.804	37059.027	18.255	0.602	0.398	21.839	155124.813	4537.078
<b>Instance2248.9</b>	15.166	1.842	60.310	22.808	139864.125	37181.036	18.374	0.562	0.401	21.868	156943.973	4572.981
<b>Instance2248.10</b>	13.750	1.916	62.470	23.172	142517.845	37069.104	19.760	0.597	0.404	22.207	157364.473	4535.301
<b>Instance2248.11</b>	14.880	1.808	61.471	23.540	139316.141	37154.944	18.296	0.558	0.407	22.333	158063.517	4532.003

## Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	0.665	0.000	2.679
Available MBytes	59246.363	59231.000	59492.000
Free System Page Table Entries	33555287.971	33555281.000	33555288.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	59828852.509	59817984.000	59858944.000
Pool Paged Bytes	81041891.140	80846848.000	81362944.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log 12/9/2010 3:33:12 AM -- Jetstress testing begins ...  
 12/9/2010 3:33:12 AM -- Prepare testing begins ...  
 12/9/2010 3:34:02 AM -- Attaching databases ...  
 12/9/2010 3:34:02 AM -- Prepare testing ends.  
 12/9/2010 3:34:02 AM -- Dispatching transactions begins ...  
 12/9/2010 3:34:02 AM -- Database cache settings: (minimum: 352.0 MB, maximum: 2.8 GB)  
 12/9/2010 3:34:02 AM -- Database flush thresholds: (start: 28.2 MB, stop: 56.3 MB)  
 12/9/2010 3:34:17 AM -- Database read latency thresholds: (average: 20 msec/read, maximum: 100 msec/read).  
 12/9/2010 3:34:17 AM -- Log write latency thresholds: (average: 10 msec/write, maximum: 100 msec/write).  
 12/9/2010 3:34:26 AM -- Operation mix: Sessions 4, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.  
 12/9/2010 3:34:26 AM -- Performance logging begins (interval: 15000 ms).  
 12/9/2010 3:34:26 AM -- Attaining prerequisites:  
 12/9/2010 3:40:34 AM -- \MSExchange Database(JetstressWin)\Database Cache Size, Last: 2664661000.0 (lower bound: 2657511000.0, upper bound: none)  
 12/9/2010 5:40:35 AM -- Performance logging ends.  
 12/9/2010 8:27:47 AM -- JetInterop batch transaction stats: 33734, 33496, 33655, 33606, 33891, 33675, 33692, 33518, 33748, 33607 and 33724.  
 12/9/2010 8:27:50 AM -- Dispatching transactions ends.  
 12/9/2010 8:27:50 AM -- Shutting down databases ...  
 12/9/2010 8:28:16 AM -- Instance2248.1 (complete), Instance2248.2 (complete), Instance2248.3 (complete), Instance2248.4 (complete), Instance2248.5 (complete), Instance2248.6 (complete), Instance2248.7 (complete), Instance2248.8 (complete), Instance2248.9 (complete), Instance2248.10 (complete) and Instance2248.11 (complete)  
 12/9/2010 8:28:17 AM -- Performance logging begins (interval: 30000 ms).  
 12/9/2010 8:28:17 AM -- Verifying database checksums ...  
 12/9/2010 4:16:24 PM -- C:\dbluns\db1 (100% processed), C:\dbluns\db2 (100% processed), C:\dbluns\db3 (100% processed), C:\dbluns\db4 (100% processed), C:\dbluns\db5 (100% processed), C:\dbluns\db6 (100% processed), C:\dbluns\db7 (100% processed), C:\dbluns\db8 (100% processed), C:\dbluns\db9 (100% processed), C:\dbluns\db10 (100% processed) and C:\dbluns\db11 (100% processed)  
 12/9/2010 4:16:24 PM -- Performance logging ends.  
 12/9/2010 4:16:24 PM -- C:\ESRP3.0\_NL-SAS-R10\_1GB\Performance\DBChecksum\_2010\_12\_9\_8\_28\_16.blg has 935 samples.  
 12/9/2010 4:16:33 PM -- C:\ESRP3.0\_NL-SAS-R10\_1GB\Performance\DBChecksum\_2010\_12\_9\_8\_28\_16.html is saved.  
 12/9/2010 4:16:33 PM -- Verifying log checksums ...  
 12/9/2010 4:16:35 PM -- C:\logluns\log1 (12 log(s) processed), C:\logluns\log2 (12 log(s)

processed), C:\logluns\log3 (12 log(s) processed), C:\logluns\log4 (12 log(s) processed),  
C:\logluns\log5 (12 log(s) processed), C:\logluns\log6 (11 log(s) processed), C:\logluns\log7 (11  
log(s) processed), C:\logluns\log8 (11 log(s) processed), C:\logluns\log9 (12 log(s) processed),  
C:\logluns\log10 (12 log(s) processed) and C:\logluns\log11 (11 log(s) processed)  
12/9/2010 4:16:35 PM -- C:\ESRP3.0\_NL-SAS-  
R10\_1GB\Performance\Performance\_2010\_12\_9\_3\_34\_17.blg has 503 samples.  
12/9/2010 4:16:35 PM -- Creating test report ...  
12/9/2010 4:16:39 PM -- Instance2248.1 has 17.9 for I/O Database Reads Average Latency.  
12/9/2010 4:16:39 PM -- Instance2248.1 has 0.6 for I/O Log Writes Average Latency.  
12/9/2010 4:16:39 PM -- Instance2248.1 has 0.6 for I/O Log Reads Average Latency.  
12/9/2010 4:16:39 PM -- Instance2248.2 has 15.6 for I/O Database Reads Average Latency.  
12/9/2010 4:16:39 PM -- Instance2248.2 has 0.6 for I/O Log Writes Average Latency.  
12/9/2010 4:16:39 PM -- Instance2248.2 has 0.6 for I/O Log Reads Average Latency.  
12/9/2010 4:16:39 PM -- Instance2248.3 has 15.4 for I/O Database Reads Average Latency.  
12/9/2010 4:16:39 PM -- Instance2248.3 has 0.6 for I/O Log Writes Average Latency.  
12/9/2010 4:16:39 PM -- Instance2248.3 has 0.6 for I/O Log Reads Average Latency.  
12/9/2010 4:16:39 PM -- Instance2248.4 has 15.4 for I/O Database Reads Average Latency.  
12/9/2010 4:16:39 PM -- Instance2248.4 has 0.6 for I/O Log Writes Average Latency.  
12/9/2010 4:16:39 PM -- Instance2248.4 has 0.6 for I/O Log Reads Average Latency.  
12/9/2010 4:16:39 PM -- Instance2248.5 has 13.7 for I/O Database Reads Average Latency.  
12/9/2010 4:16:39 PM -- Instance2248.5 has 0.6 for I/O Log Writes Average Latency.  
12/9/2010 4:16:39 PM -- Instance2248.5 has 0.6 for I/O Log Reads Average Latency.  
12/9/2010 4:16:39 PM -- Instance2248.6 has 15.5 for I/O Database Reads Average Latency.  
12/9/2010 4:16:39 PM -- Instance2248.6 has 0.6 for I/O Log Writes Average Latency.  
12/9/2010 4:16:39 PM -- Instance2248.6 has 0.6 for I/O Log Reads Average Latency.  
12/9/2010 4:16:39 PM -- Instance2248.7 has 15.5 for I/O Database Reads Average Latency.  
12/9/2010 4:16:39 PM -- Instance2248.7 has 0.6 for I/O Log Writes Average Latency.  
12/9/2010 4:16:39 PM -- Instance2248.7 has 0.6 for I/O Log Reads Average Latency.  
12/9/2010 4:16:39 PM -- Instance2248.8 has 15.7 for I/O Database Reads Average Latency.  
12/9/2010 4:16:39 PM -- Instance2248.8 has 0.6 for I/O Log Writes Average Latency.  
12/9/2010 4:16:39 PM -- Instance2248.8 has 0.6 for I/O Log Reads Average Latency.  
12/9/2010 4:16:39 PM -- Instance2248.9 has 15.2 for I/O Database Reads Average Latency.  
12/9/2010 4:16:39 PM -- Instance2248.9 has 0.6 for I/O Log Writes Average Latency.  
12/9/2010 4:16:39 PM -- Instance2248.9 has 0.6 for I/O Log Reads Average Latency.  
12/9/2010 4:16:39 PM -- Instance2248.10 has 13.7 for I/O Database Reads Average Latency.  
12/9/2010 4:16:39 PM -- Instance2248.10 has 0.6 for I/O Log Writes Average Latency.  
12/9/2010 4:16:39 PM -- Instance2248.10 has 0.6 for I/O Log Reads Average Latency.  
12/9/2010 4:16:39 PM -- Instance2248.11 has 14.9 for I/O Database Reads Average Latency.  
12/9/2010 4:16:39 PM -- Instance2248.11 has 0.6 for I/O Log Writes Average Latency.  
12/9/2010 4:16:39 PM -- Instance2248.11 has 0.6 for I/O Log Reads Average Latency.  
12/9/2010 4:16:39 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.  
12/9/2010 4:16:39 PM -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.  
12/9/2010 4:16:39 PM -- C:\ESRP3.0\_NL-SAS-  
R10\_1GB\Performance\Performance\_2010\_12\_9\_3\_34\_17.xml has 478 samples queried.

## Performance Test Database Checksums Result: HBS 107

### Checksum Statistics - All

<i>Database</i>	<i>Seen pages</i>	<i>Bad pages</i>	<i>Correctable pages</i>	<i>Wrong page-number pages</i>	<i>File length/seconds taken</i>
C:\dbluns\db1\Jetstress001001.edb	17895986	0	0	0	559249 MBytes/ 28087 sec
C:\dbluns\db2\Jetstress002001.edb	17896242	0	0	0	559257 MBytes/ 26258 sec
C:\dbluns\db3\Jetstress003001.edb	17896242	0	0	0	559257 MBytes/ 27542 sec
C:\dbluns\db4\Jetstress004001.edb	17896242	0	0	0	559257 MBytes/ 20799 sec
C:\dbluns\db5\Jetstress005001.edb	17896498	0	0	0	559265 MBytes/ 27156 sec
C:\dbluns\db6\Jetstress006001.edb	17896242	0	0	0	559257 MBytes/ 26322 sec
C:\dbluns\db7\Jetstress007001.edb	17896242	0	0	0	559257 MBytes/ 27242 sec
C:\dbluns\db8\Jetstress008001.edb	17896242	0	0	0	559257 MBytes/ 20750 sec
C:\dbluns\db9\Jetstress009001.edb	17896242	0	0	0	559257 MBytes/ 27161 sec
C:\dbluns\db10\Jetstress010001.edb	17895986	0	0	0	559249 MBytes/ 26262 sec
C:\dbluns\db11\Jetstress011001.edb	17896242	0	0	0	559257 MBytes/ 27492 sec
<b>(Sum)</b>	196858406	0	0	0	6151825 MBytes/ 28087 sec

### Disk Subsystem Performance (of checksum)

<i>LogicalDisk</i>	<i>Avg. Disk sec/Read</i>	<i>Avg. Disk sec/Write</i>	<i>Disk Reads/sec</i>	<i>Disk Writes/sec</i>	<i>Avg. Disk Bytes/Read</i>
C:\dbluns\db1	0.092	0.000	316.797	0.000	65536.000
C:\dbluns\db2	0.079	0.000	340.403	0.000	65536.000
C:\dbluns\db3	0.083	0.000	324.015	0.000	65536.000
C:\dbluns\db4	0.064	0.000	430.206	0.000	65536.000
C:\dbluns\db5	0.081	0.000	329.323	0.000	65536.000
C:\dbluns\db6	0.079	0.000	339.964	0.000	65536.000
C:\dbluns\db7	0.083	0.000	327.377	0.000	65536.000
C:\dbluns\db8	0.064	0.000	431.199	0.000	65536.000
C:\dbluns\db9	0.081	0.000	329.241	0.000	65536.000
C:\dbluns\db10	0.079	0.000	340.730	0.000	65536.000
C:\dbluns\db11	0.082	0.000	325.043	0.000	65536.000

## Memory System Performance (of checksum)

Counter	Average	Minimum	Maximum
% Processor Time	0.794	0.000	2.241
Available MBytes	62116.891	62098.000	62136.000
Free System Page Table Entries	33555287.998	33555287.000	33555288.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	59891606.862	59883520.000	59908096.000
Pool Paged Bytes	81362746.866	81326080.000	81825792.000

Test Log12/9/2010 3:33:12 AM -- Jetstress testing begins ...

12/9/2010 3:33:12 AM -- Prepare testing begins ...

12/9/2010 3:34:02 AM -- Attaching databases ...

12/9/2010 3:34:02 AM -- Prepare testing ends.

12/9/2010 3:34:02 AM -- Dispatching transactions begins ...

12/9/2010 3:34:02 AM -- Database cache settings: (minimum: 352.0 MB, maximum: 2.8 GB)

12/9/2010 3:34:02 AM -- Database flush thresholds: (start: 28.2 MB, stop: 56.3 MB)

12/9/2010 3:34:17 AM -- Database read latency thresholds: (average: 20 msec/read, maximum: 100 msec/read).

12/9/2010 3:34:17 AM -- Log write latency thresholds: (average: 10 msec/write, maximum: 100 msec/write).

12/9/2010 3:34:26 AM -- Operation mix: Sessions 4, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.

12/9/2010 3:34:26 AM -- Performance logging begins (interval: 15000 ms).

12/9/2010 3:34:26 AM -- Attaining prerequisites:

12/9/2010 3:40:34 AM -- \MSExchange Database(JetstressWin)\Database Cache Size, Last: 2664661000.0 (lower bound: 2657511000.0, upper bound: none)

12/9/2010 5:40:35 AM -- Performance logging ends.

12/9/2010 8:27:47 AM -- JetInterop batch transaction stats: 33734, 33496, 33655, 33606, 33891, 33675, 33692, 33518, 33748, 33607 and 33724.

12/9/2010 8:27:50 AM -- Dispatching transactions ends.

12/9/2010 8:27:50 AM -- Shutting down databases ...

12/9/2010 8:28:16 AM -- Instance2248.1 (complete), Instance2248.2 (complete), Instance2248.3 (complete), Instance2248.4 (complete), Instance2248.5 (complete), Instance2248.6 (complete), Instance2248.7 (complete), Instance2248.8 (complete), Instance2248.9 (complete), Instance2248.10 (complete) and Instance2248.11 (complete)

12/9/2010 8:28:17 AM -- Performance logging begins (interval: 30000 ms).

12/9/2010 8:28:17 AM -- Verifying database checksums ...

12/9/2010 4:16:24 PM -- C:\dbluns\db1 (100% processed), C:\dbluns\db2 (100% processed), C:\dbluns\db3 (100% processed), C:\dbluns\db4 (100% processed), C:\dbluns\db5 (100% processed), C:\dbluns\db6 (100% processed), C:\dbluns\db7 (100% processed), C:\dbluns\db8 (100% processed), C:\dbluns\db9 (100% processed), C:\dbluns\db10 (100% processed) and C:\dbluns\db11 (100% processed)

12/9/2010 4:16:24 PM -- Performance logging ends.

12/9/2010 4:16:24 PM -- C:\ESRP3.0\_NL-SAS-

R10\_1GB\Performance\DBChecksum\_2010\_12\_9\_8\_28\_16.blg has 935 samples.

# Stress Test Result Report: HBS 107

## Test Summary

<i>Overall Test Result</i>	Pass
<i>Machine Name</i>	HBS107
<i>Test Description</i>	
<i>Test Start Time</i>	12/9/2010 8:14:06 PM
<i>Test End Time</i>	12/10/2010 9:22:42 PM
<i>Collection Start Time</i>	12/9/2010 8:20:40 PM
<i>Collection End Time</i>	12/10/2010 8:20:33 PM
<i>Jetstress Version</i>	14.01.0043.000
<i>Ese Version</i>	14.00.0639.019
<i>Operating System</i>	Windows Server 2008 R2 Enterprise (6.1.7600.0)
<i>Performance Log</i>	C:\ESRP3.0_NL-SAS-R10_1GB\Stress\Stress_2010_12_9_20_14_31.blg C:\ESRP3.0_NL-SAS-R10_1GB\Stress\DBChecksum_2010_12_10_21_22_42.blg

## Database Sizing and Throughput

<i>Achieved Transactional I/O per Second</i>	609.214
<i>Target Transactional I/O per Second</i>	480
<i>Initial Database Size (bytes)</i>	6450656247808
<i>Final Database Size (bytes)</i>	6475914346496
<i>Database Files (Count)</i>	11

## Jetstress System Parameters

<i>Thread Count</i>	4 (per database)
<i>Minimum Database Cache</i>	352.0 MB
<i>Maximum Database Cache</i>	2816.0 MB
<i>Insert Operations</i>	40%
<i>Delete Operations</i>	20%
<i>Replace Operations</i>	5%
<i>Read Operations</i>	35%
<i>Lazy Commits</i>	70%
<i>Run Background Database Maintenance</i>	True
<i>Number of Copies per Database</i>	2

## Database Configuration

<i>Instance2208.1</i>	Log Path: C:\logluns\log1 Database: C:\dbluns\db1\Jetstress001001.edb
<i>Instance2208.2</i>	Log Path: C:\logluns\log2 Database: C:\dbluns\db2\Jetstress002001.edb
<i>Instance2208.3</i>	Log Path: C:\logluns\log3 Database: C:\dbluns\db3\Jetstress003001.edb
<i>Instance2208.4</i>	Log Path: C:\logluns\log4 Database: C:\dbluns\db4\Jetstress004001.edb
<i>Instance2208.5</i>	Log Path: C:\logluns\log5 Database: C:\dbluns\db5\Jetstress005001.edb
<i>Instance2208.6</i>	Log Path: C:\logluns\log6 Database: C:\dbluns\db6\Jetstress006001.edb
<i>Instance2208.7</i>	Log Path: C:\logluns\log7 Database: C:\dbluns\db7\Jetstress007001.edb
<i>Instance2208.8</i>	Log Path: C:\logluns\log8 Database: C:\dbluns\db8\Jetstress008001.edb
<i>Instance2208.9</i>	Log Path: C:\logluns\log9 Database: C:\dbluns\db9\Jetstress009001.edb
<i>Instance2208.10</i>	Log Path: C:\logluns\log10 Database: C:\dbluns\db10\Jetstress010001.edb
<i>Instance2208.11</i>	Log Path: C:\logluns\log11 Database: C:\dbluns\db11\Jetstress011001.edb

Transactional I/O Performance

<i>MSExchange Database ==&gt; Instances</i>	<i>I/O Database Reads Average Latency (msec)</i>	<i>I/O Database Writes Average Latency (msec)</i>	<i>I/O Database Reads/sec</i>	<i>I/O Database Writes/sec</i>	<i>I/O Database Reads Average Bytes</i>	<i>I/O Database Writes Average Bytes</i>	<i>I/O Log Reads Average Latency (msec)</i>	<i>I/O Log Writes Average Latency (msec)</i>	<i>I/O Log Reads/sec</i>	<i>I/O Log Writes/sec</i>	<i>I/O Log Reads Average Bytes</i>	<i>I/O Log Writes Average Bytes</i>
<b>Instance2208.1</b>	17.210	2.190	32.506	22.825	36434.164	36246.819	0.000	0.522	0.000	20.713	0.000	4524.073
<b>Instance2208.2</b>	15.435	2.351	32.555	22.868	36711.972	36215.308	0.000	0.591	0.000	20.675	0.000	4526.503
<b>Instance2208.3</b>	15.622	2.652	32.575	22.901	36780.352	36206.116	0.000	0.516	0.000	20.792	0.000	4517.097
<b>Instance2208.4</b>	15.497	2.531	32.536	22.865	36750.128	36248.229	0.000	0.617	0.000	20.625	0.000	4537.160
<b>Instance2208.5</b>	14.489	2.055	32.613	22.914	36677.075	36227.115	0.000	0.520	0.000	20.686	0.000	4520.958
<b>Instance2208.6</b>	15.409	2.180	32.559	22.874	36691.920	36217.719	0.000	0.597	0.000	20.649	0.000	4521.735
<b>Instance2208.7</b>	15.307	2.354	32.638	22.924	36956.484	36238.555	0.000	0.530	0.000	20.689	0.000	4520.937
<b>Instance2208.8</b>	15.454	2.124	32.310	22.652	36721.154	36218.765	0.000	0.623	0.000	20.483	0.000	4525.047
<b>Instance2208.9</b>	15.300	1.833	32.584	22.883	36866.533	36229.728	0.000	0.520	0.000	20.644	0.000	4522.022
<b>Instance2208.10</b>	14.682	1.967	32.574	22.896	36670.658	36264.921	0.000	0.601	0.000	20.674	0.000	4543.407
<b>Instance2208.11</b>	15.484	1.683	32.409	22.751	36869.937	36230.810	0.000	0.505	0.000	20.638	0.000	4537.570

## Background Database Maintenance I/O Performance

<i>MSExchange Database ==&gt; Instances</i>	<i>Database Maintenance IO Reads/sec</i>	<i>Database Maintenance IO Reads Average Bytes</i>
<b>Instance2208.1</b>	27.035	261370.294
<b>Instance2208.2</b>	27.584	261399.426
<b>Instance2208.3</b>	27.375	261406.765
<b>Instance2208.4</b>	27.465	261386.408
<b>Instance2208.5</b>	28.630	261368.706
<b>Instance2208.6</b>	27.563	261394.521
<b>Instance2208.7</b>	27.583	261370.210
<b>Instance2208.8</b>	27.427	261372.537
<b>Instance2208.9</b>	27.652	261393.248
<b>Instance2208.10</b>	28.537	261368.950
<b>Instance2208.11</b>	27.339	261362.421

## Log Replication I/O Performance

<i>MSExchange Database ==&gt; Instances</i>	<i>I/O Log Reads/sec</i>	<i>I/O Log Reads Average Bytes</i>
<b>Instance2208.1</b>	0.377	148291.060
<b>Instance2208.2</b>	0.376	147305.398
<b>Instance2208.3</b>	0.378	148065.102
<b>Instance2208.4</b>	0.377	148315.488
<b>Instance2208.5</b>	0.377	147119.188
<b>Instance2208.6</b>	0.376	147132.868
<b>Instance2208.7</b>	0.376	147286.390
<b>Instance2208.8</b>	0.373	145970.793
<b>Instance2208.9</b>	0.376	147936.082
<b>Instance2208.10</b>	0.378	148627.601
<b>Instance2208.11</b>	0.377	147766.679

Total I/O Performance

<i>MSExchange Database ==&gt; Instances</i>	<i>I/O Database Reads Average Latency (msec)</i>	<i>I/O Database Writes Average Latency (msec)</i>	<i>I/O Database Reads/sec</i>	<i>I/O Database Writes/sec</i>	<i>I/O Database Reads Average Bytes</i>	<i>I/O Database Writes Average Bytes</i>	<i>I/O Log Reads Average Latency (msec)</i>	<i>I/O Log Writes Average Latency (msec)</i>	<i>I/O Log Reads/sec</i>	<i>I/O Log Writes/sec</i>	<i>I/O Log Reads Average Bytes</i>	<i>I/O Log Writes Average Bytes</i>
<b>Instance2208.1</b>	17.210	2.190	59.541	22.825	138568.182	36246.819	18.357	0.522	0.377	20.713	148291.060	4524.073
<b>Instance2208.2</b>	15.435	2.351	60.139	22.868	139768.167	36215.308	16.952	0.591	0.376	20.675	147305.398	4526.503
<b>Instance2208.3</b>	15.622	2.652	59.950	22.901	139352.295	36206.116	17.002	0.516	0.378	20.792	148065.102	4517.097
<b>Instance2208.4</b>	15.497	2.531	60.001	22.865	139575.437	36248.229	20.765	0.617	0.377	20.625	148315.488	4537.160
<b>Instance2208.5</b>	14.489	2.055	61.243	22.914	141714.763	36227.115	16.505	0.520	0.377	20.686	147119.188	4520.958
<b>Instance2208.6</b>	15.409	2.180	60.121	22.874	139707.475	36217.719	18.357	0.597	0.376	20.649	147132.868	4521.735
<b>Instance2208.7</b>	15.307	2.354	60.221	22.924	139743.685	36238.555	16.287	0.530	0.376	20.689	147286.390	4520.937
<b>Instance2208.8</b>	15.454	2.124	59.737	22.652	139864.391	36218.765	19.022	0.623	0.373	20.483	145970.793	4525.047
<b>Instance2208.9</b>	15.300	1.833	60.236	22.883	139939.430	36229.728	19.999	0.520	0.376	20.644	147936.082	4522.022
<b>Instance2208.10</b>	14.682	1.967	61.111	22.896	141597.817	36264.921	19.950	0.601	0.378	20.674	148627.601	4543.407
<b>Instance2208.11</b>	15.484	1.683	59.749	22.751	139591.739	36230.810	19.295	0.505	0.377	20.638	147766.679	4537.570

## Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	0.651	0.000	3.863
Available MBytes	59157.491	59051.000	59553.000
Free System Page Table Entries	33555287.987	33555254.000	33555288.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	38484186.449	37134336.000	38756352.000
Pool Paged Bytes	82004344.672	80334848.000	84189184.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log12/9/2010 8:14:06 PM -- Jetstress testing begins ...  
 12/9/2010 8:14:06 PM -- Prepare testing begins ...  
 12/9/2010 8:14:18 PM -- Attaching databases ...  
 12/9/2010 8:14:18 PM -- Prepare testing ends.  
 12/9/2010 8:14:18 PM -- Dispatching transactions begins ...  
 12/9/2010 8:14:18 PM -- Database cache settings: (minimum: 352.0 MB, maximum: 2.8 GB)  
 12/9/2010 8:14:18 PM -- Database flush thresholds: (start: 28.2 MB, stop: 56.3 MB)  
 12/9/2010 8:14:31 PM -- Database read latency thresholds: (average: 20 msec/read, maximum: 200 msec/read).  
 12/9/2010 8:14:31 PM -- Log write latency thresholds: (average: 10 msec/write, maximum: 200 msec/write).  
 12/9/2010 8:14:41 PM -- Operation mix: Sessions 4, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.  
 12/9/2010 8:14:41 PM -- Performance logging begins (interval: 15000 ms).  
 12/9/2010 8:14:41 PM -- Attaining prerequisites:  
 12/9/2010 8:20:40 PM -- \MSEExchange Database(JetstressWin)\Database Cache Size, Last: 2660782000.0 (lower bound: 2657511000.0, upper bound: none)  
 12/10/2010 8:20:41 PM -- Performance logging ends.  
 12/10/2010 9:22:07 PM -- JetInterop batch transaction stats: 164114, 164234, 164506, 164338, 163871, 164619, 164246, 163734, 164458, 164708 and 164022.  
 12/10/2010 9:22:08 PM -- Dispatching transactions ends.  
 12/10/2010 9:22:08 PM -- Shutting down databases ...  
 12/10/2010 9:22:42 PM -- Instance2208.1 (complete), Instance2208.2 (complete), Instance2208.3 (complete), Instance2208.4 (complete), Instance2208.5 (complete), Instance2208.6 (complete), Instance2208.7 (complete), Instance2208.8 (complete), Instance2208.9 (complete), Instance2208.10 (complete) and Instance2208.11 (complete)  
 12/10/2010 9:22:43 PM -- Performance logging begins (interval: 30000 ms).  
 12/10/2010 9:22:43 PM -- Verifying database checksums ...  
 12/11/2010 5:25:21 AM -- C:\dbluns\db1 (100% processed), C:\dbluns\db2 (100% processed), C:\dbluns\db3 (100% processed), C:\dbluns\db4 (100% processed), C:\dbluns\db5 (100% processed), C:\dbluns\db6 (100% processed), C:\dbluns\db7 (100% processed), C:\dbluns\db8 (100% processed), C:\dbluns\db9 (100% processed), C:\dbluns\db10 (100% processed) and C:\dbluns\db11 (100% processed)  
 12/11/2010 5:25:21 AM -- Performance logging ends.  
 12/11/2010 5:25:21 AM -- C:\ESRP3.0\_NL-SAS-R10\_1GB\Stress\DBChecksum\_2010\_12\_10\_21\_22\_42.blg has 964 samples.  
 12/11/2010 5:25:30 AM -- C:\ESRP3.0\_NL-SAS-R10\_1GB\Stress\DBChecksum\_2010\_12\_10\_21\_22\_42.html is saved.  
 12/11/2010 5:25:30 AM -- Verifying log checksums ...  
 12/11/2010 5:25:33 AM -- C:\logluns\log1 (12 log(s) processed), C:\logluns\log2 (12 log(s)

processed), C:\logluns\log3 (12 log(s) processed), C:\logluns\log4 (12 log(s) processed), C:\logluns\log5 (12 log(s) processed), C:\logluns\log6 (11 log(s) processed), C:\logluns\log7 (11 log(s) processed), C:\logluns\log8 (12 log(s) processed), C:\logluns\log9 (12 log(s) processed), C:\logluns\log10 (12 log(s) processed) and C:\logluns\log11 (12 log(s) processed)  
12/11/2010 5:25:33 AM -- C:\ESRP3.0\_NL-SAS-R10\_1GB\Stress\Stress\_2010\_12\_9\_20\_14\_31.blg has 5770 samples.  
12/11/2010 5:25:33 AM -- Creating test report ...  
12/11/2010 5:26:13 AM -- Instance2208.1 has 17.2 for I/O Database Reads Average Latency.  
12/11/2010 5:26:13 AM -- Instance2208.1 has 0.5 for I/O Log Writes Average Latency.  
12/11/2010 5:26:13 AM -- Instance2208.1 has 0.5 for I/O Log Reads Average Latency.  
12/11/2010 5:26:13 AM -- Instance2208.2 has 15.4 for I/O Database Reads Average Latency.  
12/11/2010 5:26:13 AM -- Instance2208.2 has 0.6 for I/O Log Writes Average Latency.  
12/11/2010 5:26:13 AM -- Instance2208.2 has 0.6 for I/O Log Reads Average Latency.  
12/11/2010 5:26:13 AM -- Instance2208.3 has 15.6 for I/O Database Reads Average Latency.  
12/11/2010 5:26:13 AM -- Instance2208.3 has 0.5 for I/O Log Writes Average Latency.  
12/11/2010 5:26:13 AM -- Instance2208.3 has 0.5 for I/O Log Reads Average Latency.  
12/11/2010 5:26:13 AM -- Instance2208.4 has 15.5 for I/O Database Reads Average Latency.  
12/11/2010 5:26:13 AM -- Instance2208.4 has 0.6 for I/O Log Writes Average Latency.  
12/11/2010 5:26:13 AM -- Instance2208.4 has 0.6 for I/O Log Reads Average Latency.  
12/11/2010 5:26:13 AM -- Instance2208.5 has 14.5 for I/O Database Reads Average Latency.  
12/11/2010 5:26:13 AM -- Instance2208.5 has 0.5 for I/O Log Writes Average Latency.  
12/11/2010 5:26:13 AM -- Instance2208.5 has 0.5 for I/O Log Reads Average Latency.  
12/11/2010 5:26:13 AM -- Instance2208.6 has 15.4 for I/O Database Reads Average Latency.  
12/11/2010 5:26:13 AM -- Instance2208.6 has 0.6 for I/O Log Writes Average Latency.  
12/11/2010 5:26:13 AM -- Instance2208.6 has 0.6 for I/O Log Reads Average Latency.  
12/11/2010 5:26:13 AM -- Instance2208.7 has 15.3 for I/O Database Reads Average Latency.  
12/11/2010 5:26:13 AM -- Instance2208.7 has 0.5 for I/O Log Writes Average Latency.  
12/11/2010 5:26:13 AM -- Instance2208.7 has 0.5 for I/O Log Reads Average Latency.  
12/11/2010 5:26:13 AM -- Instance2208.8 has 15.5 for I/O Database Reads Average Latency.  
12/11/2010 5:26:13 AM -- Instance2208.8 has 0.6 for I/O Log Writes Average Latency.  
12/11/2010 5:26:13 AM -- Instance2208.8 has 0.6 for I/O Log Reads Average Latency.  
12/11/2010 5:26:13 AM -- Instance2208.9 has 15.3 for I/O Database Reads Average Latency.  
12/11/2010 5:26:13 AM -- Instance2208.9 has 0.5 for I/O Log Writes Average Latency.  
12/11/2010 5:26:13 AM -- Instance2208.9 has 0.5 for I/O Log Reads Average Latency.  
12/11/2010 5:26:13 AM -- Instance2208.10 has 14.7 for I/O Database Reads Average Latency.  
12/11/2010 5:26:13 AM -- Instance2208.10 has 0.6 for I/O Log Writes Average Latency.  
12/11/2010 5:26:13 AM -- Instance2208.10 has 0.6 for I/O Log Reads Average Latency.  
12/11/2010 5:26:13 AM -- Instance2208.11 has 15.5 for I/O Database Reads Average Latency.  
12/11/2010 5:26:13 AM -- Instance2208.11 has 0.5 for I/O Log Writes Average Latency.  
12/11/2010 5:26:13 AM -- Instance2208.11 has 0.5 for I/O Log Reads Average Latency.  
12/11/2010 5:26:13 AM -- Test has 0 Maximum Database Page Fault Stalls/sec.  
12/11/2010 5:26:13 AM -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.  
12/11/2010 5:26:13 AM -- C:\ESRP3.0\_NL-SAS-R10\_1GB\Stress\Stress\_2010\_12\_9\_20\_14\_31.xml has 5746 samples queried.

## Stress Test Database Checksums Result: HBS 107

### Checksum Statistics - All

<i>Database</i>	<i>Seen pages</i>	<i>Bad pages</i>	<i>Correctable pages</i>	<i>Wrong page-number pages</i>	<i>File length/seconds taken</i>
C:\dbluns\db1\Jetstress001001.edb	17966130	0	0	0	561441 MBytes/ 27212 sec
C:\dbluns\db2\Jetstress002001.edb	17966130	0	0	0	561441 MBytes/ 28957 sec
C:\dbluns\db3\Jetstress003001.edb	17966642	0	0	0	561457 MBytes/ 27658 sec
C:\dbluns\db4\Jetstress004001.edb	17966386	0	0	0	561449 MBytes/ 27985 sec
C:\dbluns\db5\Jetstress005001.edb	17966386	0	0	0	561449 MBytes/ 26323 sec
C:\dbluns\db6\Jetstress006001.edb	17966386	0	0	0	561449 MBytes/ 28944 sec
C:\dbluns\db7\Jetstress007001.edb	17966386	0	0	0	561449 MBytes/ 27607 sec
C:\dbluns\db8\Jetstress008001.edb	17965874	0	0	0	561433 MBytes/ 27633 sec
C:\dbluns\db9\Jetstress009001.edb	17966130	0	0	0	561441 MBytes/ 26316 sec
C:\dbluns\db10\Jetstress010001.edb	17966386	0	0	0	561449 MBytes/ 28647 sec
C:\dbluns\db11\Jetstress011001.edb	17966386	0	0	0	561449 MBytes/ 18867 sec
<b>(Sum)</b>	197629222	0	0	0	6175913 MBytes/ 28957 sec

### Disk Subsystem Performance (of checksum)

<i>LogicalDisk</i>	<i>Avg. Disk sec/Read</i>	<i>Avg. Disk sec/Write</i>	<i>Disk Reads/sec</i>	<i>Disk Writes/sec</i>	<i>Avg. Disk Bytes/Read</i>
C:\dbluns\db1	0.094	0.000	328.933	0.000	65536.000
C:\dbluns\db2	0.089	0.000	309.658	0.000	65467.946
C:\dbluns\db3	0.083	0.000	324.239	0.000	65536.000
C:\dbluns\db4	0.083	0.000	320.936	0.000	65536.000
C:\dbluns\db5	0.081	0.000	341.267	0.000	65536.000
C:\dbluns\db6	0.089	0.000	310.105	0.000	65536.000
C:\dbluns\db7	0.082	0.000	325.158	0.000	65536.000
C:\dbluns\db8	0.082	0.000	324.797	0.000	65536.000
C:\dbluns\db9	0.081	0.000	340.722	0.000	65536.000
C:\dbluns\db10	0.088	0.000	313.320	0.000	65536.000
C:\dbluns\db11	0.059	0.000	475.891	0.000	65536.000

## Memory System Performance (of checksum)

Counter	Average	Minimum	Maximum
% Processor Time	0.768	0.000	2.276
Available MBytes	61957.949	61942.000	61973.000
Free System Page Table Entries	33555287.998	33555287.000	33555288.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	43552695.768	43216896.000	43847680.000
Pool Paged Bytes	83813342.008	83464192.000	84336640.000

Test Log 12/9/2010 8:14:06 PM -- Jetstress testing begins ...  
 12/9/2010 8:14:06 PM -- Prepare testing begins ...  
 12/9/2010 8:14:18 PM -- Attaching databases ...  
 12/9/2010 8:14:18 PM -- Prepare testing ends.  
 12/9/2010 8:14:18 PM -- Dispatching transactions begins ...  
 12/9/2010 8:14:18 PM -- Database cache settings: (minimum: 352.0 MB, maximum: 2.8 GB)  
 12/9/2010 8:14:18 PM -- Database flush thresholds: (start: 28.2 MB, stop: 56.3 MB)  
 12/9/2010 8:14:31 PM -- Database read latency thresholds: (average: 20 msec/read, maximum: 200 msec/read).  
 12/9/2010 8:14:31 PM -- Log write latency thresholds: (average: 10 msec/write, maximum: 200 msec/write).  
 12/9/2010 8:14:41 PM -- Operation mix: Sessions 4, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.  
 12/9/2010 8:14:41 PM -- Performance logging begins (interval: 15000 ms).  
 12/9/2010 8:14:41 PM -- Attaining prerequisites:  
 12/9/2010 8:20:40 PM -- \MSEExchange Database(JetstressWin)\Database Cache Size, Last: 2660782000.0 (lower bound: 2657511000.0, upper bound: none)  
 12/10/2010 8:20:41 PM -- Performance logging ends.  
 12/10/2010 9:22:07 PM -- JetInterop batch transaction stats: 164114, 164234, 164506, 164338, 163871, 164619, 164246, 163734, 164458, 164708 and 164022.  
 12/10/2010 9:22:08 PM -- Dispatching transactions ends.  
 12/10/2010 9:22:08 PM -- Shutting down databases ...  
 12/10/2010 9:22:42 PM -- Instance2208.1 (complete), Instance2208.2 (complete), Instance2208.3 (complete), Instance2208.4 (complete), Instance2208.5 (complete), Instance2208.6 (complete), Instance2208.7 (complete), Instance2208.8 (complete), Instance2208.9 (complete), Instance2208.10 (complete) and Instance2208.11 (complete)  
 12/10/2010 9:22:43 PM -- Performance logging begins (interval: 30000 ms).  
 12/10/2010 9:22:43 PM -- Verifying database checksums ...  
 12/11/2010 5:25:21 AM -- C:\dbluns\db1 (100% processed), C:\dbluns\db2 (100% processed), C:\dbluns\db3 (100% processed), C:\dbluns\db4 (100% processed), C:\dbluns\db5 (100% processed), C:\dbluns\db6 (100% processed), C:\dbluns\db7 (100% processed), C:\dbluns\db8 (100% processed), C:\dbluns\db9 (100% processed), C:\dbluns\db10 (100% processed) and C:\dbluns\db11 (100% processed)  
 12/11/2010 5:25:21 AM -- Performance logging ends.  
 12/11/2010 5:25:21 AM -- C:\ESRP3.0\_NL-SAS-R10\_1GB\Stress\DBChecksum\_2010\_12\_10\_21\_22\_42.blg has 964 samples.

## Backup Test Result Report: HBS 107

### Database Backup Statistics - All

<i>Database Instance</i>	<i>Database Size (MBytes)</i>	<i>Elapsed Backup Time</i>	<i>MBytes Transferred/sec</i>
<b>Instance2104.1</b>	561433.59	07:17:26	21.39
<b>Instance2104.2</b>	561433.59	06:16:32	24.85
<b>Instance2104.3</b>	561449.59	06:46:15	23.03
<b>Instance2104.4</b>	561441.59	06:29:07	24.05
<b>Instance2104.5</b>	561441.59	06:01:32	25.88
<b>Instance2104.6</b>	561441.59	06:04:00	25.71
<b>Instance2104.7</b>	561441.59	06:08:39	25.38
<b>Instance2104.8</b>	561425.59	06:11:38	25.18
<b>Instance2104.9</b>	561433.59	05:58:22	26.11
<b>Instance2104.10</b>	561441.59	06:04:55	25.64
<b>Instance2104.11</b>	561441.59	07:08:53	21.82

### Jetstress System Parameters

<i>Thread Count</i>	4 (per database)
<i>Minimum Database Cache</i>	352.0 MB
<i>Maximum Database Cache</i>	2816.0 MB
<i>Insert Operations</i>	40%
<i>Delete Operations</i>	20%
<i>Replace Operations</i>	5%
<i>Read Operations</i>	35%
<i>Lazy Commits</i>	70%

## Database Configuration

<i>Instance2104.1</i>	Log Path: C:\logluns\log1 Database: C:\dbluns\db1\Jetstress001001.edb
<i>Instance2104.2</i>	Log Path: C:\logluns\log2 Database: C:\dbluns\db2\Jetstress002001.edb
<i>Instance2104.3</i>	Log Path: C:\logluns\log3 Database: C:\dbluns\db3\Jetstress003001.edb
<i>Instance2104.4</i>	Log Path: C:\logluns\log4 Database: C:\dbluns\db4\Jetstress004001.edb
<i>Instance2104.5</i>	Log Path: C:\logluns\log5 Database: C:\dbluns\db5\Jetstress005001.edb
<i>Instance2104.6</i>	Log Path: C:\logluns\log6 Database: C:\dbluns\db6\Jetstress006001.edb
<i>Instance2104.7</i>	Log Path: C:\logluns\log7 Database: C:\dbluns\db7\Jetstress007001.edb
<i>Instance2104.8</i>	Log Path: C:\logluns\log8 Database: C:\dbluns\db8\Jetstress008001.edb
<i>Instance2104.9</i>	Log Path: C:\logluns\log9 Database: C:\dbluns\db9\Jetstress009001.edb
<i>Instance2104.10</i>	Log Path: C:\logluns\log10 Database: C:\dbluns\db10\Jetstress010001.edb
<i>Instance2104.11</i>	Log Path: C:\logluns\log11 Database: C:\dbluns\db11\Jetstress011001.edb

Transactional I/O Performance

<i>MSExchange Database ==&gt; Instances</i>	<i>I/O Database Reads Average Latency (msec)</i>	<i>I/O Database Writes Average Latency (msec)</i>	<i>I/O Database Reads/sec</i>	<i>I/O Database Writes/sec</i>	<i>I/O Database Reads Average Bytes</i>	<i>I/O Database Writes Average Bytes</i>	<i>I/O Log Reads Average Latency (msec)</i>	<i>I/O Log Writes Average Latency (msec)</i>	<i>I/O Log Reads/sec</i>	<i>I/O Log Writes/sec</i>	<i>I/O Log Reads Average Bytes</i>	<i>I/O Log Writes Average Bytes</i>
Instance2104.1	245.124	0.000	85.574	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance2104.2	148.982	0.000	99.471	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance2104.3	174.621	0.000	91.937	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance2104.4	227.368	0.000	96.005	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance2104.5	153.725	0.000	103.362	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance2104.6	170.973	0.000	102.492	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance2104.7	240.361	0.000	101.228	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance2104.8	260.164	0.000	100.258	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance2104.9	148.236	0.000	104.555	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance2104.10	151.356	0.000	102.419	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance2104.11	217.376	0.000	86.556	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

## Host System Performance

<i>Counter</i>	<i>Average</i>	<i>Minimum</i>	<i>Maximum</i>
<i>% Processor Time</i>	0.443	0.000	1.571
<i>Available MBytes</i>	62214.389	62199.000	62216.000
<i>Free System Page Table Entries</i>	33555800.000	33555800.000	33555800.000
<i>Transition Pages RePurposed/sec</i>	0.000	0.000	0.000
<i>Pool Nonpaged Bytes</i>	37263383.432	37257216.000	37277696.000
<i>Pool Paged Bytes</i>	87846635.497	87810048.000	88178688.000
<i>Database Page Fault Stalls/sec</i>	0.000	0.000	0.000

Test Log 12/12/2010 8:08:17 PM -- Jetstress testing begins ...

12/12/2010 8:08:17 PM -- Prepare testing begins ...

12/12/2010 8:08:29 PM -- Attaching databases ...

12/12/2010 8:08:29 PM -- Prepare testing ends.

12/12/2010 8:08:44 PM -- Performance logging begins (interval: 30000 ms).

12/12/2010 8:08:44 PM -- Backing up databases ...

12/13/2010 3:26:11 AM -- Performance logging ends.

12/13/2010 3:26:11 AM -- Instance2104.1 (100% processed), Instance2104.2 (100% processed), Instance2104.3 (100% processed), Instance2104.4 (100% processed), Instance2104.5 (100% processed), Instance2104.6 (100% processed), Instance2104.7 (100% processed), Instance2104.8 (100% processed), Instance2104.9 (100% processed), Instance2104.10 (100% processed) and Instance2104.11 (100% processed)

12/13/2010 3:26:11 AM -- C:\ESRP3.0\_NL-SAS-

R10\_1GB\BackupTest\DatabaseBackup\_2010\_12\_12\_20\_8\_29.blg has 874 samples.

12/13/2010 3:26:11 AM -- Creating test report ...

## Soft Recovery Test Result Report: HBS 107

### Soft-Recovery Statistics - All

<i>Database Instance</i>	<i>Log files replayed</i>	<i>Elapsed seconds</i>
<b>Instance2092.1</b>	507	1990.3294959
<b>Instance2092.2</b>	513	1780.0255265
<b>Instance2092.3</b>	500	1214.6181334
<b>Instance2092.4</b>	513	1842.8780369
<b>Instance2092.5</b>	501	1685.3489602
<b>Instance2092.6</b>	506	1636.0216735
<b>Instance2092.7</b>	504	1879.4757012
<b>Instance2092.8</b>	512	1868.0720811
<b>Instance2092.9</b>	502	1786.6555381
<b>Instance2092.10</b>	502	1917.1341673
<b>Instance2092.11</b>	504	1811.8495824

## Database Configuration

<i>Instance2092.1</i>	Log Path: C:\logluns\log1 Database: C:\dbluns\db1\Jetstress001001.edb
<i>Instance2092.2</i>	Log Path: C:\logluns\log2 Database: C:\dbluns\db2\Jetstress002001.edb
<i>Instance2092.3</i>	Log Path: C:\logluns\log3 Database: C:\dbluns\db3\Jetstress003001.edb
<i>Instance2092.4</i>	Log Path: C:\logluns\log4 Database: C:\dbluns\db4\Jetstress004001.edb
<i>Instance2092.5</i>	Log Path: C:\logluns\log5 Database: C:\dbluns\db5\Jetstress005001.edb
<i>Instance2092.6</i>	Log Path: C:\logluns\log6 Database: C:\dbluns\db6\Jetstress006001.edb
<i>Instance2092.7</i>	Log Path: C:\logluns\log7 Database: C:\dbluns\db7\Jetstress007001.edb
<i>Instance2092.8</i>	Log Path: C:\logluns\log8 Database: C:\dbluns\db8\Jetstress008001.edb
<i>Instance2092.9</i>	Log Path: C:\logluns\log9 Database: C:\dbluns\db9\Jetstress009001.edb
<i>Instance2092.10</i>	Log Path: C:\logluns\log10 Database: C:\dbluns\db10\Jetstress010001.edb
<i>Instance2092.11</i>	Log Path: C:\logluns\log11 Database: C:\dbluns\db11\Jetstress011001.edb

Transactional I/O Performance

<i>MSExchange Database ==&gt; Instances</i>	<i>I/O Database Reads Average Latency (msec)</i>	<i>I/O Database Writes Average Latency (msec)</i>	<i>I/O Database Reads/sec</i>	<i>I/O Database Writes/sec</i>	<i>I/O Database Reads Average Bytes</i>	<i>I/O Database Writes Average Bytes</i>	<i>I/O Log Reads Average Latency (msec)</i>	<i>I/O Log Writes Average Latency (msec)</i>	<i>I/O Log Reads/sec</i>	<i>I/O Log Writes/sec</i>	<i>I/O Log Reads Average Bytes</i>	<i>I/O Log Writes Average Bytes</i>
<b>Instance2092.1</b>	138.577	17.247	159.613	1.519	83479.135	11498.710	2.490	0.000	2.281	0.000	76931.970	0.000
<b>Instance2092.2</b>	92.829	8.687	185.139	1.724	76049.146	13226.086	2.812	0.000	2.586	0.000	90227.519	0.000
<b>Instance2092.3</b>	130.228	19.534	251.020	2.462	74066.039	17148.587	3.089	0.000	3.697	0.000	114809.116	0.000
<b>Instance2092.4</b>	97.085	10.222	181.784	1.648	76519.320	12431.719	2.520	0.000	2.472	0.000	81587.115	0.000
<b>Instance2092.5</b>	116.112	13.032	192.273	1.777	76106.845	14380.201	2.706	0.000	2.665	0.000	95353.508	0.000
<b>Instance2092.6</b>	98.248	12.329	197.625	1.849	77802.259	13997.195	3.652	0.000	2.777	0.000	93118.183	0.000
<b>Instance2092.7</b>	124.084	20.287	178.481	1.611	76017.493	12235.262	2.214	0.001	2.419	0.006	82208.008	1.099
<b>Instance2092.8</b>	90.951	10.192	180.087	1.642	77819.843	12668.406	2.342	0.000	2.463	0.000	83873.986	0.000
<b>Instance2092.9</b>	109.681	16.708	182.227	1.673	77656.397	14085.792	2.591	0.000	2.509	0.000	91753.848	0.000
<b>Instance2092.10</b>	141.609	12.596	173.083	1.564	77953.999	12417.347	2.381	0.000	2.345	0.000	81749.581	0.000
<b>Instance2092.11</b>	126.287	19.171	183.455	1.670	76995.603	13574.272	2.526	0.001	2.505	0.002	86438.540	1.140

## Background Database Maintenance I/O Performance

<i>MSExchange Database ==&gt; Instances</i>	<i>Database Maintenance IO Reads/sec</i>	<i>Database Maintenance IO Reads Average Bytes</i>
<b>Instance2092.1</b>	19.340	260668.453
<b>Instance2092.2</b>	22.688	260851.183
<b>Instance2092.3</b>	22.922	261421.326
<b>Instance2092.4</b>	22.805	260487.807
<b>Instance2092.5</b>	23.247	260724.087
<b>Instance2092.6</b>	22.915	261273.349
<b>Instance2092.7</b>	22.339	260348.210
<b>Instance2092.8</b>	22.230	261565.257
<b>Instance2092.9</b>	23.450	261561.915
<b>Instance2092.10</b>	22.656	260919.375
<b>Instance2092.11</b>	23.919	260259.149

Total I/O Performance

<i>MSExchange Database ==&gt; Instances</i>	<i>I/O Database Reads Average Latency (msec)</i>	<i>I/O Database Writes Average Latency (msec)</i>	<i>I/O Database Reads/sec</i>	<i>I/O Database Writes/sec</i>	<i>I/O Database Reads Average Bytes</i>	<i>I/O Database Writes Average Bytes</i>	<i>I/O Log Reads Average Latency (msec)</i>	<i>I/O Log Writes Average Latency (msec)</i>	<i>I/O Log Reads/sec</i>	<i>I/O Log Writes/sec</i>	<i>I/O Log Reads Average Bytes</i>	<i>I/O Log Writes Average Bytes</i>
<b>Instance2092.1</b>	138.577	17.247	178.953	1.519	102628.528	11498.710	2.490	0.000	2.281	0.000	76931.970	0.000
<b>Instance2092.2</b>	92.829	8.687	207.827	1.724	96223.590	13226.086	2.812	0.000	2.586	0.000	90227.519	0.000
<b>Instance2092.3</b>	130.228	19.534	273.942	2.462	89742.725	17148.587	3.089	0.000	3.697	0.000	114809.116	0.000
<b>Instance2092.4</b>	97.085	10.222	204.589	1.648	97026.060	12431.719	2.520	0.000	2.472	0.000	81587.115	0.000
<b>Instance2092.5</b>	116.112	13.032	215.521	1.777	96020.645	14380.201	2.706	0.000	2.665	0.000	95353.508	0.000
<b>Instance2092.6</b>	98.248	12.329	220.541	1.849	96865.748	13997.195	3.652	0.000	2.777	0.000	93118.183	0.000
<b>Instance2092.7</b>	124.084	20.287	200.820	1.611	96522.132	12235.262	2.214	0.001	2.419	0.006	82208.008	1.099
<b>Instance2092.8</b>	90.951	10.192	202.318	1.642	98009.470	12668.406	2.342	0.000	2.463	0.000	83873.986	0.000
<b>Instance2092.9</b>	109.681	16.708	205.677	1.673	98623.774	14085.792	2.591	0.000	2.509	0.000	91753.848	0.000
<b>Instance2092.10</b>	141.609	12.596	195.739	1.564	99131.392	12417.347	2.381	0.000	2.345	0.000	81749.581	0.000
<b>Instance2092.11</b>	126.287	19.171	207.374	1.670	98133.604	13574.272	2.526	0.001	2.505	0.002	86438.540	1.140

## Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	1.469	0.000	8.026
Available MBytes	59292.298	59221.000	61761.000
Free System Page Table Entries	33555287.992	33555285.000	33555288.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	60462092.437	44679168.000	61321216.000
Pool Paged Bytes	86669104.713	86638592.000	86773760.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log12/13/2010 8:14:46 PM -- Jetstress testing begins ...

12/13/2010 8:14:46 PM -- Prepare testing begins ...

12/13/2010 8:14:57 PM -- Attaching databases ...

12/13/2010 8:14:57 PM -- Prepare testing ends.

12/13/2010 8:14:57 PM -- Dispatching transactions begins ...

12/13/2010 8:14:58 PM -- Database cache settings: (minimum: 352.0 MB, maximum: 2.8 GB)

12/13/2010 8:14:58 PM -- Database flush thresholds: (start: 28.2 MB, stop: 56.3 MB)

12/13/2010 8:15:09 PM -- Database read latency thresholds: (average: 20 msec/read, maximum: 100 msec/read).

12/13/2010 8:15:09 PM -- Log write latency thresholds: (average: 10 msec/write, maximum: 100 msec/write).

12/13/2010 8:15:15 PM -- Operation mix: Sessions 4, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.

12/13/2010 8:15:15 PM -- Performance logging begins (interval: 15000 ms).

12/13/2010 8:15:15 PM -- Generating log files ...

12/13/2010 11:19:20 PM -- C:\logluns\log1 (101.6% generated), C:\logluns\log2 (102.8% generated), C:\logluns\log3 (100.2% generated), C:\logluns\log4 (102.8% generated), C:\logluns\log5 (100.4% generated), C:\logluns\log6 (101.4% generated), C:\logluns\log7 (101.0% generated), C:\logluns\log8 (102.6% generated), C:\logluns\log9 (100.6% generated), C:\logluns\log10 (100.6% generated) and C:\logluns\log11 (101.0% generated)

12/13/2010 11:19:20 PM -- Performance logging ends.

12/13/2010 11:19:20 PM -- JetInterop batch transaction stats: 22139, 22150, 21929, 22352, 21866, 22185, 22147, 22227, 21747, 21901 and 22130.

12/13/2010 11:19:21 PM -- Dispatching transactions ends.

12/13/2010 11:19:21 PM -- Shutting down databases ...

12/13/2010 11:19:27 PM -- Instance2092.1 (complete), Instance2092.2 (complete), Instance2092.3 (complete), Instance2092.4 (complete), Instance2092.5 (complete), Instance2092.6 (complete), Instance2092.7 (complete), Instance2092.8 (complete), Instance2092.9 (complete), Instance2092.10 (complete) and Instance2092.11 (complete)

12/13/2010 11:19:27 PM -- C:\ESRP3.0\_NL-SAS-R10\_1GB\SoftRecovery\Performance\_2010\_12\_13\_20\_15\_9.blg has 735 samples.

12/13/2010 11:19:27 PM -- Creating test report ...

12/13/2010 11:19:31 PM -- Instance2092.1 has 22.1 for I/O Database Reads Average Latency.

12/13/2010 11:19:31 PM -- Instance2092.1 has 0.4 for I/O Log Writes Average Latency.

12/13/2010 11:19:31 PM -- Instance2092.1 has 0.4 for I/O Log Reads Average Latency.

12/13/2010 11:19:31 PM -- Instance2092.2 has 19.8 for I/O Database Reads Average Latency.

12/13/2010 11:19:31 PM -- Instance2092.2 has 0.4 for I/O Log Writes Average Latency.

12/13/2010 11:19:31 PM -- Instance2092.2 has 0.4 for I/O Log Reads Average Latency.

12/13/2010 11:19:31 PM -- Instance2092.3 has 19.9 for I/O Database Reads Average Latency.

12/13/2010 11:19:31 PM -- Instance2092.3 has 0.4 for I/O Log Writes Average Latency.

12/13/2010 11:19:31 PM -- Instance2092.3 has 0.4 for I/O Log Reads Average Latency.  
12/13/2010 11:19:31 PM -- Instance2092.4 has 19.6 for I/O Database Reads Average Latency.  
12/13/2010 11:19:31 PM -- Instance2092.4 has 0.4 for I/O Log Writes Average Latency.  
12/13/2010 11:19:31 PM -- Instance2092.4 has 0.4 for I/O Log Reads Average Latency.  
12/13/2010 11:19:31 PM -- Instance2092.5 has 19.7 for I/O Database Reads Average Latency.  
12/13/2010 11:19:31 PM -- Instance2092.5 has 0.4 for I/O Log Writes Average Latency.  
12/13/2010 11:19:31 PM -- Instance2092.5 has 0.4 for I/O Log Reads Average Latency.  
12/13/2010 11:19:31 PM -- Instance2092.6 has 19.6 for I/O Database Reads Average Latency.  
12/13/2010 11:19:31 PM -- Instance2092.6 has 0.4 for I/O Log Writes Average Latency.  
12/13/2010 11:19:31 PM -- Instance2092.6 has 0.4 for I/O Log Reads Average Latency.  
12/13/2010 11:19:31 PM -- Instance2092.7 has 19.6 for I/O Database Reads Average Latency.  
12/13/2010 11:19:31 PM -- Instance2092.7 has 0.4 for I/O Log Writes Average Latency.  
12/13/2010 11:19:31 PM -- Instance2092.7 has 0.4 for I/O Log Reads Average Latency.  
12/13/2010 11:19:31 PM -- Instance2092.8 has 19.6 for I/O Database Reads Average Latency.  
12/13/2010 11:19:31 PM -- Instance2092.8 has 0.4 for I/O Log Writes Average Latency.  
12/13/2010 11:19:31 PM -- Instance2092.8 has 0.4 for I/O Log Reads Average Latency.  
12/13/2010 11:19:31 PM -- Instance2092.9 has 19.8 for I/O Database Reads Average Latency.  
12/13/2010 11:19:31 PM -- Instance2092.9 has 0.4 for I/O Log Writes Average Latency.  
12/13/2010 11:19:31 PM -- Instance2092.9 has 0.4 for I/O Log Reads Average Latency.  
12/13/2010 11:19:31 PM -- Instance2092.10 has 19.8 for I/O Database Reads Average Latency.  
12/13/2010 11:19:31 PM -- Instance2092.10 has 0.4 for I/O Log Writes Average Latency.  
12/13/2010 11:19:31 PM -- Instance2092.10 has 0.4 for I/O Log Reads Average Latency.  
12/13/2010 11:19:31 PM -- Instance2092.11 has 19.7 for I/O Database Reads Average Latency.  
12/13/2010 11:19:31 PM -- Instance2092.11 has 0.4 for I/O Log Writes Average Latency.  
12/13/2010 11:19:31 PM -- Instance2092.11 has 0.4 for I/O Log Reads Average Latency.  
12/13/2010 11:19:31 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.  
12/13/2010 11:19:31 PM -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.  
12/13/2010 11:19:31 PM -- C:\ESRP3.0\_NL-SAS-R10\_1GB\SoftRecovery\Performance\_2010\_12\_13\_20\_15\_9.xml has 734 samples queried.  
12/13/2010 11:19:32 PM -- C:\ESRP3.0\_NL-SAS-R10\_1GB\SoftRecovery\Performance\_2010\_12\_13\_20\_15\_9.html is saved.  
12/14/2010 12:13:12 AM -- Performance logging begins (interval: 4000 ms).  
12/14/2010 12:13:12 AM -- Recovering databases ...  
12/14/2010 12:46:23 AM -- Performance logging ends.  
12/14/2010 12:46:23 AM -- Instance2092.1 (1990.3294959), Instance2092.2 (1780.0255265), Instance2092.3 (1214.6181334), Instance2092.4 (1842.8780369), Instance2092.5 (1685.3489602), Instance2092.6 (1636.0216735), Instance2092.7 (1879.4757012), Instance2092.8 (1868.0720811), Instance2092.9 (1786.6555381), Instance2092.10 (1917.1341673) and Instance2092.11 (1811.8495824)  
12/14/2010 12:46:23 AM -- C:\ESRP3.0\_NL-SAS-R10\_1GB\SoftRecovery\SoftRecovery\_2010\_12\_14\_0\_13\_8.blg has 494 samples.  
12/14/2010 12:46:23 AM -- Creating test report ...

## Soft Recovery Test Performance Result: HBS 107

### Test Summary

<i>Overall Test Result</i>	<b>Fail</b>
<i>Machine Name</i>	HBS107
<i>Test Description</i>	
<i>Test Start Time</i>	12/13/2010 8:14:46 PM
<i>Test End Time</i>	12/13/2010 11:19:27 PM
<i>Collection Start Time</i>	12/13/2010 8:15:30 PM
<i>Collection End Time</i>	12/13/2010 11:19:17 PM
<i>Jetstress Version</i>	14.01.0043.000
<i>Ese Version</i>	14.00.0639.019
<i>Operating System</i>	Windows Server 2008 R2 Enterprise (6.1.7600.0)
<i>Performance Log</i>	C:\ESRP3.0_NL-SAS-R10_1GB\SoftRecovery\Performance_2010_12_13_20_15_9.blg

### Test Issues

<b>Fail</b>	Process has average database read latencies higher than 20.000 msec.
-------------	--

### Database Sizing and Throughput

<i>Achieved Transactional I/O per Second</i>	677.19
<i>Capacity Percentage</i>	100%
<i>Throughput Percentage</i>	100%
<i>Initial Database Size (bytes)</i>	6475914346496
<i>Final Database Size (bytes)</i>	6479294955520
<i>Database Files (Count)</i>	11

### Jetstress System Parameters

<i>Thread Count</i>	4 (per database)
<i>Minimum Database Cache</i>	352.0 MB
<i>Maximum Database Cache</i>	2816.0 MB
<i>Insert Operations</i>	40%
<i>Delete Operations</i>	20%
<i>Replace Operations</i>	5%
<i>Read Operations</i>	35%
<i>Lazy Commits</i>	70%

## Database Configuration

<i>Instance2092.1</i>	Log Path: C:\logluns\log1 Database: C:\dbluns\db1\Jetstress001001.edb
<i>Instance2092.2</i>	Log Path: C:\logluns\log2 Database: C:\dbluns\db2\Jetstress002001.edb
<i>Instance2092.3</i>	Log Path: C:\logluns\log3 Database: C:\dbluns\db3\Jetstress003001.edb
<i>Instance2092.4</i>	Log Path: C:\logluns\log4 Database: C:\dbluns\db4\Jetstress004001.edb
<i>Instance2092.5</i>	Log Path: C:\logluns\log5 Database: C:\dbluns\db5\Jetstress005001.edb
<i>Instance2092.6</i>	Log Path: C:\logluns\log6 Database: C:\dbluns\db6\Jetstress006001.edb
<i>Instance2092.7</i>	Log Path: C:\logluns\log7 Database: C:\dbluns\db7\Jetstress007001.edb
<i>Instance2092.8</i>	Log Path: C:\logluns\log8 Database: C:\dbluns\db8\Jetstress008001.edb
<i>Instance2092.9</i>	Log Path: C:\logluns\log9 Database: C:\dbluns\db9\Jetstress009001.edb
<i>Instance2092.10</i>	Log Path: C:\logluns\log10 Database: C:\dbluns\db10\Jetstress010001.edb
<i>Instance2092.11</i>	Log Path: C:\logluns\log11 Database: C:\dbluns\db11\Jetstress011001.edb

### Transactional I/O Performance

<i>MSExchange Database ==&gt; Instances</i>	<i>I/O Database Reads Average Latency (msec)</i>	<i>I/O Database Writes Average Latency (msec)</i>	<i>I/O Database Reads/sec</i>	<i>I/O Database Writes/sec</i>	<i>I/O Database Reads Average Bytes</i>	<i>I/O Database Writes Average Bytes</i>	<i>I/O Log Reads Average Latency (msec)</i>	<i>I/O Log Writes Average Latency (msec)</i>	<i>I/O Log Reads/sec</i>	<i>I/O Log Writes/sec</i>	<i>I/O Log Reads Average Bytes</i>	<i>I/O Log Writes Average Bytes</i>
<b>Instance2092.1</b>	<b>22.145</b>	3.216	36.374	25.341	32768.000	35737.713	0.000	0.432	0.000	22.780	0.000	4487.274
<b>Instance2092.2</b>	19.785	3.534	36.380	25.405	32768.000	35804.288	0.000	0.398	0.000	22.846	0.000	4543.049
<b>Instance2092.3</b>	19.852	2.408	35.991	24.992	32768.000	35715.665	0.000	0.365	0.000	22.448	0.000	4497.582
<b>Instance2092.4</b>	19.643	3.430	36.674	25.655	32768.000	35746.384	0.000	0.400	0.000	23.108	0.000	4492.276
<b>Instance2092.5</b>	19.657	3.079	35.895	24.947	32768.000	35817.147	0.000	0.436	0.000	22.326	0.000	4539.034
<b>Instance2092.6</b>	19.617	3.560	36.299	25.297	32768.000	35752.200	0.000	0.398	0.000	22.695	0.000	4502.677
<b>Instance2092.7</b>	19.625	3.458	36.232	25.261	32768.000	35742.799	0.000	0.389	0.000	22.825	0.000	4465.712
<b>Instance2092.8</b>	19.595	3.337	36.459	25.467	32768.000	35757.213	0.000	0.401	0.000	23.004	0.000	4500.640
<b>Instance2092.9</b>	19.820	3.626	36.024	25.115	32768.000	35759.264	0.000	0.431	0.000	22.433	0.000	4527.097
<b>Instance2092.10</b>	19.789	4.033	36.319	25.329	32768.000	35757.735	0.000	0.401	0.000	22.631	0.000	4489.289
<b>Instance2092.11</b>	19.723	4.114	36.415	25.319	32768.000	35741.665	0.000	0.393	0.000	22.787	0.000	4467.493

## Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	0.748	0.000	2.868
Available MBytes	59311.590	59249.000	61751.000
Free System Page Table Entries	33555288.000	33555286.000	33555290.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	41578958.541	36823040.000	42180608.000
Pool Paged Bytes	86207715.091	85843968.000	113614848.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log12/13/2010 8:14:46 PM -- Jetstress testing begins ...

12/13/2010 8:14:46 PM -- Prepare testing begins ...

12/13/2010 8:14:57 PM -- Attaching databases ...

12/13/2010 8:14:57 PM -- Prepare testing ends.

12/13/2010 8:14:57 PM -- Dispatching transactions begins ...

12/13/2010 8:14:58 PM -- Database cache settings: (minimum: 352.0 MB, maximum: 2.8 GB)

12/13/2010 8:14:58 PM -- Database flush thresholds: (start: 28.2 MB, stop: 56.3 MB)

12/13/2010 8:15:09 PM -- Database read latency thresholds: (average: 20 msec/read, maximum: 100 msec/read).

12/13/2010 8:15:09 PM -- Log write latency thresholds: (average: 10 msec/write, maximum: 100 msec/write).

12/13/2010 8:15:15 PM -- Operation mix: Sessions 4, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.

12/13/2010 8:15:15 PM -- Performance logging begins (interval: 15000 ms).

12/13/2010 8:15:15 PM -- Generating log files ...

12/13/2010 11:19:20 PM -- C:\logluns\log1 (101.6% generated), C:\logluns\log2 (102.8% generated), C:\logluns\log3 (100.2% generated), C:\logluns\log4 (102.8% generated), C:\logluns\log5 (100.4% generated), C:\logluns\log6 (101.4% generated), C:\logluns\log7 (101.0% generated), C:\logluns\log8 (102.6% generated), C:\logluns\log9 (100.6% generated), C:\logluns\log10 (100.6% generated) and C:\logluns\log11 (101.0% generated)

12/13/2010 11:19:20 PM -- Performance logging ends.

12/13/2010 11:19:20 PM -- JetInterop batch transaction stats: 22139, 22150, 21929, 22352, 21866, 22185, 22147, 22227, 21747, 21901 and 22130.

12/13/2010 11:19:21 PM -- Dispatching transactions ends.

12/13/2010 11:19:21 PM -- Shutting down databases ...

12/13/2010 11:19:27 PM -- Instance2092.1 (complete), Instance2092.2 (complete), Instance2092.3 (complete), Instance2092.4 (complete), Instance2092.5 (complete), Instance2092.6 (complete), Instance2092.7 (complete), Instance2092.8 (complete), Instance2092.9 (complete), Instance2092.10 (complete) and Instance2092.11 (complete)

12/13/2010 11:19:27 PM -- C:\ESRP3.0\_NL-SAS-R10\_1GB\SoftRecovery\Performance\_2010\_12\_13\_20\_15\_9.blg has 735 samples.

12/13/2010 11:19:27 PM -- Creating test report ...

12/13/2010 11:19:31 PM -- Instance2092.1 has 22.1 for I/O Database Reads Average Latency.

12/13/2010 11:19:31 PM -- Instance2092.1 has 0.4 for I/O Log Writes Average Latency.

12/13/2010 11:19:31 PM -- Instance2092.1 has 0.4 for I/O Log Reads Average Latency.

12/13/2010 11:19:31 PM -- Instance2092.2 has 19.8 for I/O Database Reads Average Latency.

12/13/2010 11:19:31 PM -- Instance2092.2 has 0.4 for I/O Log Writes Average Latency.

12/13/2010 11:19:31 PM -- Instance2092.2 has 0.4 for I/O Log Reads Average Latency.

12/13/2010 11:19:31 PM -- Instance2092.3 has 19.9 for I/O Database Reads Average Latency.

12/13/2010 11:19:31 PM -- Instance2092.3 has 0.4 for I/O Log Writes Average Latency.

12/13/2010 11:19:31 PM -- Instance2092.3 has 0.4 for I/O Log Reads Average Latency.  
12/13/2010 11:19:31 PM -- Instance2092.4 has 19.6 for I/O Database Reads Average Latency.  
12/13/2010 11:19:31 PM -- Instance2092.4 has 0.4 for I/O Log Writes Average Latency.  
12/13/2010 11:19:31 PM -- Instance2092.4 has 0.4 for I/O Log Reads Average Latency.  
12/13/2010 11:19:31 PM -- Instance2092.5 has 19.7 for I/O Database Reads Average Latency.  
12/13/2010 11:19:31 PM -- Instance2092.5 has 0.4 for I/O Log Writes Average Latency.  
12/13/2010 11:19:31 PM -- Instance2092.5 has 0.4 for I/O Log Reads Average Latency.  
12/13/2010 11:19:31 PM -- Instance2092.6 has 19.6 for I/O Database Reads Average Latency.  
12/13/2010 11:19:31 PM -- Instance2092.6 has 0.4 for I/O Log Writes Average Latency.  
12/13/2010 11:19:31 PM -- Instance2092.6 has 0.4 for I/O Log Reads Average Latency.  
12/13/2010 11:19:31 PM -- Instance2092.7 has 19.6 for I/O Database Reads Average Latency.  
12/13/2010 11:19:31 PM -- Instance2092.7 has 0.4 for I/O Log Writes Average Latency.  
12/13/2010 11:19:31 PM -- Instance2092.7 has 0.4 for I/O Log Reads Average Latency.  
12/13/2010 11:19:31 PM -- Instance2092.8 has 19.6 for I/O Database Reads Average Latency.  
12/13/2010 11:19:31 PM -- Instance2092.8 has 0.4 for I/O Log Writes Average Latency.  
12/13/2010 11:19:31 PM -- Instance2092.8 has 0.4 for I/O Log Reads Average Latency.  
12/13/2010 11:19:31 PM -- Instance2092.9 has 19.8 for I/O Database Reads Average Latency.  
12/13/2010 11:19:31 PM -- Instance2092.9 has 0.4 for I/O Log Writes Average Latency.  
12/13/2010 11:19:31 PM -- Instance2092.9 has 0.4 for I/O Log Reads Average Latency.  
12/13/2010 11:19:31 PM -- Instance2092.10 has 19.8 for I/O Database Reads Average Latency.  
12/13/2010 11:19:31 PM -- Instance2092.10 has 0.4 for I/O Log Writes Average Latency.  
12/13/2010 11:19:31 PM -- Instance2092.10 has 0.4 for I/O Log Reads Average Latency.  
12/13/2010 11:19:31 PM -- Instance2092.11 has 19.7 for I/O Database Reads Average Latency.  
12/13/2010 11:19:31 PM -- Instance2092.11 has 0.4 for I/O Log Writes Average Latency.  
12/13/2010 11:19:31 PM -- Instance2092.11 has 0.4 for I/O Log Reads Average Latency.  
12/13/2010 11:19:31 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.  
12/13/2010 11:19:31 PM -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.  
12/13/2010 11:19:31 PM -- C:\ESRP3.0\_NL-SAS-  
R10\_1GB\SoftRecovery\Performance\_2010\_12\_13\_20\_15\_9.xml has 734 samples queried.

 **Hitachi Data Systems Corporation**

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