

# Hitachi Adaptable Modular Storage 2500 Dynamically Provisioned 15,200 Mailbox Exchange 2010 Mailbox Resiliency Storage Solution

*Tested with: ESRP – Storage Version 3.0*

*Test Date: January 2011*

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## Overview

This document provides information on a Hitachi Adaptable Modular Storage 2500 Mailbox 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 its 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 15,200 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-5 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 (one simulated). The test configuration was capable of supporting 15,200 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:

- 171 2TB 7.2k RPM SAS disks (in RAID-5 8D+1P)
- 32 450GB 15k RPM SAS disks (in RAID-10 2D+2D)
- 32GB of cache
- 16 4Gb/sec paths.

The 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 AMS 2500 to meet the needs of a large Exchange Server deployment.

This solution used Hitachi Dynamic Provisioning, which is enabled on AMS 2500 via a license key. In the most basic sense, Hitachi Dynamic Provisioning software is similar to the use of a host-based logical volume manager (LVM), but with several additional features available within 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.

Primarily, Hitachi Dynamic Provisioning is deployed to avoid the routine issue of hot spots that occur on logical units (LUs) from individual RAID groups when the host workload exceeds the IOPS or throughput capacity of that RAID group. By using many RAID groups as members of a striped Dynamic Provisioning pool underneath the virtual or logical volumes seen by the hosts, a host workload is distributed across many RAID groups, which provides a smoothing effect that dramatically reduces hot spots and results in fewer mailbox moves for the Exchange administrator.

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 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 eight RAID groups (RAID-10, 2D+2D) 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) to host active mailboxes in 15 databases.

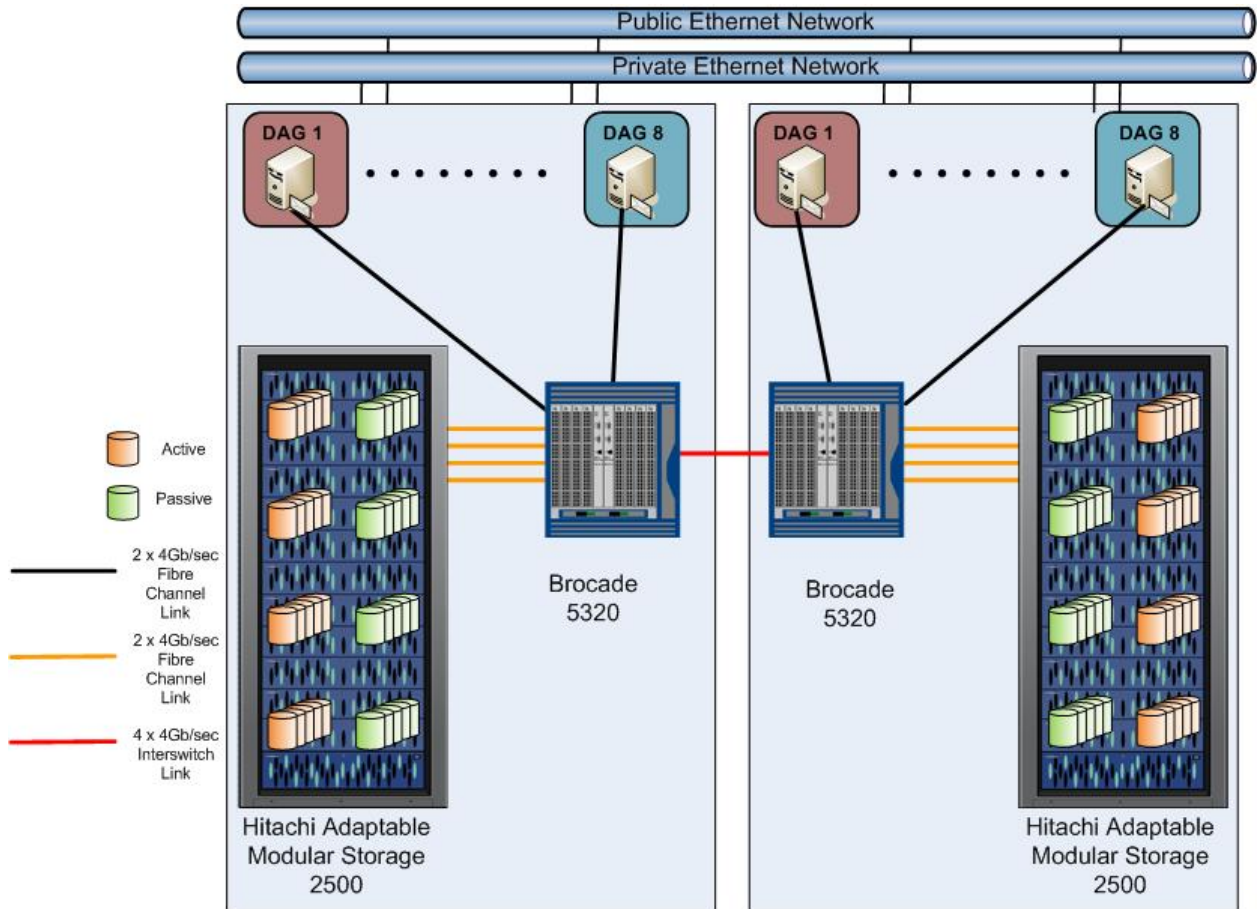
To target the 15,200-user resiliency solution, a Hitachi Adaptable Modular Storage 2500 (AMS 2500) was configured with 171 disks (of a maximum of 480) for Exchange and 32 additional disks for those LUNs used as boot volumes by the blade servers. Eight servers (one per DAG) were used, with each server configured with 1,900 mailboxes. There were 120 active databases and simulated database copies for the tests.

Each DAG contained two copies of the 15 databases hosted by that DAG;

- A local, active copy on a server connected to the primary AMS 2500
- A passive copy (simulated) on another server connected to a second AMS 2500 (simulated)

This recommended configuration can support high-availability and disaster-recovery scenarios when the active and passive database copies are allocated among both DAG members and dispersed across both storage 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 illustrates the two systems that make up the recommended DAG configuration that was simulated. For more information, see the Hitachi Data Systems [Storage Systems web page](#).



**Figure 1**


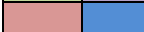
This solution enables organizations to consolidate Exchange Server 2010 DAG deployments on two AMS 2500 storage systems. Using identical hardware and software configurations guarantees that an active database and its replicated copy do not share storage paths, disk spindles or storage controllers, making 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 group. There were 171 2TB 7.2K RPM SAS disks used in these tests configured as 19 RAID groups (using RAID-5 8D+1P) for the Exchange databases and logs. Another 32 450GB 15K RPM SAS disks were used in these tests as eight RAID Groups (using RAID-10, 2D+2D) for the SAN boot volumes.

**Table 1. 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	18	19	19	19	19	19	19	19	19	19														
RKA 6	16	16	17	17	17	17	17	17	17	17	17	18	18	18	18	18	18	18	18					
RKA 5	14	14	14	14	14	14	14	14	15	15	15	15	15	15	15	15	15	16	16	16	16	16	16	16
RKA 4	11	11	11	11	12	12	12		12	12	12	12	12	12	13	13	13	13	13	13	13	13	13	14
RKA 3	8	9	9	9	9	9	9	9	9	9	10	10	10	10	10	10	10	10	10	11	11	11	11	11
RKA 2	6	6	6	6	6	6	6	7	7	7	7	7	7	7	7	7	8	8	8	8	8	8	8	8
RKA 1	3	3	3	4	4	4	4	4	4	4	4	4	5	5	5		5	5	5	5	5	5	6	6
RKA 0	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3

 Database RGs- Raid5 8D+1P added to Database DP Pool  
 Log RGs- Raid5 8D+1P 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 19 RAID-5 RAID groups and the log pool was created from two RAID-5 groups. From the database pool, 120 DP-VOLs (each specified to have a 2,000GB size limit) were created for 120 databases (15 per server). From the log pool, 120 DP-VOLs (each specified to have a size limit of 200GB) were created for 120 logs (15 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 (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.

**Table 2. 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 would be 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 1-15	8-23
0B	Databases 16-30	24-38
0C	Databases 31-45	39-53
0D	Databases 46-60	54-68
1A	Databases 61-75	69-83
1B	Databases 76-90	84-98
1C	Databases 91-105	99-113
1D	Databases 106-120	114-128

Table7 outlines the port layout with the log DP-VOL assignments for the primary storage and servers. An identical configuration would be 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 1-15	129-143
0B	Logs 16-30	144-158
0C	Logs 31-45	159-173
0D	Logs 46-60	174-188
1A	Logs 61-75	189-203
1B	Logs 76-90	204-218
1C	Logs 91-105	219-233
1D	Logs 106-120	234-248

Table 8 provides the detailed specifications for the storage configuration which uses RAID-5 (8D+1P) 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	8-23	2000	Databases 1-15
HBS 108	0	0B/1B	24-38	2000	Databases 16-30
HBS 109	0	0C/1C	39-53	2000	Databases 31-45
HBS 110	0	0D/1D	54-68	2000	Databases 46-60
HBS 111	0	1A/0A	69-83	2000	Databases 61-75
HBS 112	0	1B/0B	84-98	2000	Databases 76-90
HBS 113	0	1C/0C	99-113	2000	Databases 91-105
HBS 114	0	1D/0D	114-128	2000	Databases 106-120
HBS 107	1	0A/1A	129-143	200	Logs 1-15
HBS 108	1	0B/1B	144-158	200	Logs 16-30
HBS 109	1	0C/1C	159-173	200	Logs 31-45
HBS 110	1	0D/1D	174-188	200	Logs 46-60
HBS 111	1	1A/0A	189-203	200	Logs 61-75
HBS 112	1	1B/0B	204-218	200	Logs 76-90
HBS 113	1	1C/0C	219-233	200	Logs 91-105
HBS 114	1	1D/0D	234-248	200	Logs 106-120

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 15,200 Exchange users with the following specifications:

- 16 Exchange servers (eight servers tested, eight servers simulated for the database copies)
- 8 Database Availability Groups each with two servers (one simulated) and two copies per database
- 2 Adaptable Modular Storage 2500s (one tested, using 16 4Gb/sec paths, with eight used for the DB/Logs and eight 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.
- 24x7 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>	15,200
<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>	1,900
<i>Number of databases per host</i>	15
<i>Number of copies per database</i>	2
<i>Number of mailboxes per database</i>	126.7
<i>Simulated profile: I/Os per second per mailbox (IOPS, include 20% headroom)</i>	0.12
<i>Database LU size</i>	2000GB
<i>Log LU size</i>	200GB
<i>Total database size for performance testing</i>	15,200GB
<i>% storage capacity used by Exchange database**</i>	6.2%

\*\*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. 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>	171
<i>Maximum number of spindles that can be hosted in the storage</i>	480

**Table 11. 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>	153(dynamic provisioning pool)
<i>Total raw storage capacity (GB)</i>	306,000
<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-5 (8D+1P) at storage level
<i>Total formatted capacity</i>	246,840
<i>Storage capacity utilization</i>	80.7%
<i>Database capacity utilization</i>	78.4%

**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>	18 (dynamic provisioning pool)
<i>Total raw storage capacity (GB)</i>	36000
<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-5 (8D+1P) at storage level
<i>Total formatted capacity</i>	29,040

## 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 (1Gb/sec)

**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>	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 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>	153(dynamic provisioning pool)
<i>total raw storage capacity (GB)</i>	306,000
<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-5 (8D+1P) at storage level
<i>Total formatted capacity</i>	246,840
<i>Storage capacity utilization</i>	80.7%
<i>Database capacity utilization</i>	78.4%

**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>	18 (dynamic provisioning pool)
<i>Total raw storage capacity (GB)</i>	36000
<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-5 (8D+1P) at storage level
<i>Total formatted capacity</i>	29,040

## 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 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 AMS 2500.
13. Use fewer, larger LUs for Exchange 2010 databases (up to 2TB) with Background Database Maintenance (24x7) 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 there are 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>	256
<i>Database Disk Reads Per Second</i>	134
<i>Database Disk Writes Per Second</i>	122
<i>Average Database Disk Read Latency (ms)</i>	12.2
<i>Average Database Disk Write Latency (ms)</i>	1.9
<i>Transaction Log I/O</i>	
<i>Log Disk Writes Per Second</i>	118
<i>Average Log Disk Write Latency (ms)</i>	1.0

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

<i>Database I/O</i>	
<i>Database Disk Transfers Per Second</i>	258
<i>Database Disk Reads Per Second</i>	135
<i>Database Disk Writes Per Second</i>	123
<i>Average Database Disk Read Latency (ms)</i>	12.3
<i>Average Database Disk Write Latency (ms)</i>	2.0
<i>Transaction Log I/O</i>	
<i>Log Disk Writes Per Second</i>	119
<i>Average Log Disk Write Latency (ms)</i>	1.0

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

<i>Database I/O</i>	
<i>Database Disk Transfers Per Second</i>	258
<i>Database Disk Reads Per Second</i>	135
<i>Database Disk Writes Per Second</i>	123
<i>Average Database Disk Read Latency (ms)</i>	12.3
<i>Average Database Disk Write Latency (ms)</i>	1.9
<i>Transaction Log I/O</i>	
<i>Log Disk Writes Per Second</i>	119
<i>Average Log Disk Write Latency (ms)</i>	1.0

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

<i>Database I/O</i>	
<i>Database Disk Transfers Per Second</i>	254
<i>Database Disk Reads Per Second</i>	133
<i>Database Disk Writes Per Second</i>	121
<i>Average Database Disk Read Latency (ms)</i>	12.5
<i>Average Database Disk Write Latency (ms)</i>	2.0
<i>Transaction Log I/O</i>	
<i>Log Disk Writes Per Second</i>	117
<i>Average Log Disk Write Latency (ms)</i>	1.0

**Table 23. Individual Server Metrics for Exchange Server (HBS111)**

<i>Database I/O</i>	
<i>Database Disk Transfers Per Second</i>	254
<i>Database Disk Reads Per Second</i>	133
<i>Database Disk Writes Per Second</i>	121
<i>Average Database Disk Read Latency (ms)</i>	12.5
<i>Average Database Disk Write Latency (ms)</i>	1.9
<i>Transaction Log I/O</i>	
<i>Log Disk Writes Per Second</i>	117
<i>Average Log Disk Write Latency (ms)</i>	1.0

**Table 24. Individual Server Metrics for Exchange Server (HBS112)**

<i>Database I/O</i>	
<i>Database Disk Transfers Per Second</i>	255
<i>Database Disk Reads Per Second</i>	133
<i>Database Disk Writes Per Second</i>	122
<i>Average Database Disk Read Latency (ms)</i>	12.4
<i>Average Database Disk Write Latency (ms)</i>	2.0
<i>Transaction Log I/O</i>	
<i>Log Disk Writes Per Second</i>	118
<i>Average Log Disk Write Latency (ms)</i>	1.0

**Table 25. Individual Server Metrics for Exchange Server (HBS113)**

<i>Database I/O</i>	
<i>Database Disk Transfers Per Second</i>	252
<i>Database Disk Reads Per Second</i>	132
<i>Database Disk Writes Per Second</i>	120
<i>Average Database Disk Read Latency (ms)</i>	12.3
<i>Average Database Disk Write Latency (ms)</i>	1.8
<i>Transaction Log I/O</i>	
<i>Log Disk Writes Per Second</i>	115
<i>Average Log Disk Write Latency (ms)</i>	1.1

**Table 26. Individual Server Metrics for Exchange Server (SUN114)**

<i>Database I/O</i>	
<i>Database Disk Transfers Per Second</i>	254
<i>Database Disk Reads Per Second</i>	133
<i>Database Disk Writes Per Second</i>	121
<i>Average Database Disk Read Latency (ms)</i>	12.5
<i>Average Database Disk Write Latency (ms)</i>	1.9
<i>Transaction Log I/O</i>	
<i>Log Disk Writes Per Second</i>	118
<i>Average Log Disk Write Latency (ms)</i>	1.1

### *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 27. Aggregate Performance for Exchange Server 2010**

<i>Database I/O</i>	
<i>Database Disk Transfers Per Second</i>	2041
<i>Database Disk Reads Per Second</i>	1067
<i>Database Disk Writes Per Second</i>	974
<i>Average Database Disk Read Latency (ms)</i>	12.4
<i>Average Database Disk Write Latency (ms)</i>	1.9
<i>Transaction Log I/O</i>	
<i>Log Disk Writes Per Second</i>	940
<i>Average Log Disk Write Latency (ms)</i>	1.0

## 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 in to the database).

### *Database Read-only Performance*

This test measures [the maximum rate at which databases can be backed up via VSS](#). The following tables show the average rate for a single database file.

**Table 28. Database Read-only Performance**

<i>MB Read Per Second Per Database</i>	16.03
<i>MB Read Per Second Total Per Server</i>	240.51

## 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 29. Transaction Log Recovery/Replay Performance**

Average Time to Play One Log File (sec)	4.31
---	------

## Conclusion

This document details a tested and robust Exchange Server 2010 Resiliency solution capable of supporting 15,200 users with a 0.12 IOPS per user profile and user mailbox size of 1GB using eight DAGs, each configured with 2 server nodes (one simulated).

A Hitachi Adaptable Modular Storage 2500 (AMS 2500), with 32GB of cache and sixteen 4Gb/sec Fibre Channel host paths, using Hitachi Dynamic Provisioning (with two pools) and 171 2TB 7.2K RPM SAS disks in a RAID-5 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 15,200 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, it is focused on producing recommendations from vendors for Exchange application. Thus, 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

<b>Overall Test Result</b>	Pass
<b>Machine Name</b>	HBS107
<b>Test Description</b>	
<b>Test Start Time</b>	1/19/2011 3:32:32 AM
<b>Test End Time</b>	1/19/2011 6:22:18 AM
<b>Collection Start Time</b>	1/19/2011 3:53:35 AM
<b>Collection End Time</b>	1/19/2011 5:53:28 AM
<b>Jetstress Version</b>	14.01.0043.000
<b>Ese Version</b>	14.00.0639.019
<b>Operating System</b>	Windows Server 2008 R2 Enterprise (6.1.7600.0)
<b>Performance Log</b>	C:\ESRP3.0_NL-SAS-R5_1GB\Performance\Performance_2011_1_19_3_33_10.blg C:\ESRP3.0_NL-SAS-R5_1GB\Performance\DBChecksum_2011_1_19_6_22_18.blg

#### Database Sizing and Throughput

<b>Achieved Transactional I/O per Second</b>	255.661
<b>Target Transactional I/O per Second</b>	228
<b>Initial Database Size (bytes)</b>	2688347996160
<b>Final Database Size (bytes)</b>	2689782448128
<b>Database Files (Count)</b>	15

#### Jetstress System Parameters

<b>Thread Count</b>	2 (per database)
<b>Minimum Database Cache</b>	480.0 MB
<b>Maximum Database Cache</b>	3840.0 MB
<b>Insert Operations</b>	40%
<b>Delete Operations</b>	20%
<b>Replace Operations</b>	5%
<b>Read Operations</b>	35%
<b>Lazy Commits</b>	70%
<b>Run Background Database Maintenance</b>	True
<b>Number of Copies per Database</b>	2

## Database Configuration

<i>Instance1728.1</i>	Log Path: C:\logluns\log1 Database: C:\dbluns\db1\Jetstress001001.edb
<i>Instance1728.2</i>	Log Path: C:\logluns\log2 Database: C:\dbluns\db2\Jetstress002001.edb
<i>Instance1728.3</i>	Log Path: C:\logluns\log3 Database: C:\dbluns\db3\Jetstress003001.edb
<i>Instance1728.4</i>	Log Path: C:\logluns\log4 Database: C:\dbluns\db4\Jetstress004001.edb
<i>Instance1728.5</i>	Log Path: C:\logluns\log5 Database: C:\dbluns\db5\Jetstress005001.edb
<i>Instance1728.6</i>	Log Path: C:\logluns\log6 Database: C:\dbluns\db6\Jetstress006001.edb
<i>Instance1728.7</i>	Log Path: C:\logluns\log7 Database: C:\dbluns\db7\Jetstress007001.edb
<i>Instance1728.8</i>	Log Path: C:\logluns\log8 Database: C:\dbluns\db8\Jetstress008001.edb
<i>Instance1728.9</i>	Log Path: C:\logluns\log9 Database: C:\dbluns\db9\Jetstress009001.edb
<i>Instance1728.10</i>	Log Path: C:\logluns\log10 Database: C:\dbluns\db10\Jetstress010001.edb
<i>Instance1728.11</i>	Log Path: C:\logluns\log11 Database: C:\dbluns\db11\Jetstress011001.edb
<i>Instance1728.12</i>	Log Path: C:\logluns\log12 Database: C:\dbluns\db12\Jetstress012001.edb
<i>Instance1728.13</i>	Log Path: C:\logluns\log13 Database: C:\dbluns\db13\Jetstress013001.edb
<i>Instance1728.14</i>	Log Path: C:\logluns\log14 Database: C:\dbluns\db14\Jetstress014001.edb
<i>Instance1728.15</i>	Log Path: C:\logluns\log15 Database: C:\dbluns\db15\Jetstress015001.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>
Instance1728.1	13.349	1.741	8.993	8.223	41799.941	37190.108	0.000	0.979	0.000	7.927	0.000	4493.616
Instance1728.2	12.973	1.990	8.946	8.190	42443.444	36925.893	0.000	1.011	0.000	7.829	0.000	4605.907
Instance1728.3	13.261	1.924	9.122	8.237	41770.487	37100.991	0.000	1.057	0.000	7.987	0.000	4566.762
Instance1728.4	11.230	1.906	8.883	8.082	41428.855	37284.049	0.000	0.995	0.000	7.838	0.000	4700.176
Instance1728.5	10.926	1.760	8.688	8.008	41643.100	37058.711	0.000	1.005	0.000	7.833	0.000	4616.433
Instance1728.6	12.737	1.859	9.113	8.300	43269.209	37198.182	0.000	1.050	0.000	8.062	0.000	4580.103
Instance1728.7	12.417	1.912	8.913	8.055	41969.923	37143.389	0.000	1.025	0.000	7.861	0.000	4687.466
Instance1728.8	11.038	1.773	9.080	8.212	42252.862	37051.253	0.000	1.088	0.000	7.988	0.000	4577.061
Instance1728.9	10.820	1.690	8.938	8.099	41584.972	37049.324	0.000	0.991	0.000	7.726	0.000	4483.409
Instance1728.10	13.049	1.933	8.722	7.925	42896.495	37235.178	0.000	1.094	0.000	7.742	0.000	4702.234
Instance1728.11	12.683	1.923	9.188	8.331	42696.529	37259.554	0.000	1.059	0.000	7.913	0.000	4498.854
Instance1728.12	11.661	1.960	8.732	8.013	41644.389	37095.280	0.000	1.005	0.000	7.671	0.000	4841.165
Instance1728.13	10.868	1.741	8.680	7.834	41663.368	37132.903	0.000	0.952	0.000	7.686	0.000	4638.882
Instance1728.14	12.671	1.961	8.855	8.142	42477.876	36942.527	0.000	1.011	0.000	7.728	0.000	4549.113
Instance1728.15	12.974	1.867	8.933	8.227	42509.489	36995.705	0.000	1.037	0.000	7.733	0.000	4608.942

## 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>
Instance1728.1	26.303	259901.536
Instance1728.2	26.459	259896.804
Instance1728.3	26.205	259774.391
Instance1728.4	27.521	259784.386
Instance1728.5	27.697	259916.719
Instance1728.6	26.641	259788.989
Instance1728.7	26.795	259926.562
Instance1728.8	27.613	259684.022
Instance1728.9	27.770	259903.930
Instance1728.10	26.331	259913.331
Instance1728.11	26.645	259734.886
Instance1728.12	27.154	259768.445
Instance1728.13	27.684	259852.329
Instance1728.14	26.635	259800.201
Instance1728.15	26.417	259910.284

## 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>
Instance1728.1	0.144	56422.971
Instance1728.2	0.143	55464.524
Instance1728.3	0.146	57918.411
Instance1728.4	0.144	55951.055
Instance1728.5	0.143	55936.440
Instance1728.6	0.146	57396.033
Instance1728.7	0.145	56909.502
Instance1728.8	0.145	56437.586
Instance1728.9	0.140	54963.379
Instance1728.10	0.144	56422.971
Instance1728.11	0.143	55936.440
Instance1728.12	0.146	57396.033
Instance1728.13	0.139	54073.246
Instance1728.14	0.140	54491.463
Instance1728.15	0.141	55743.426

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>
Instance1728.1	13.349	1.741	35.296	8.223	204331.666	37190.108	3.999	0.979	0.144	7.927	56422.971	4493.616
Instance1728.2	12.973	1.990	35.405	8.190	204954.033	36925.893	3.991	1.011	0.143	7.829	55464.524	4605.907
Instance1728.3	13.261	1.924	35.327	8.237	203485.191	37100.991	4.025	1.057	0.146	7.987	57918.411	4566.762
Instance1728.4	11.230	1.906	36.403	8.082	206504.855	37284.049	3.341	0.995	0.144	7.838	55951.055	4700.176
Instance1728.5	10.926	1.760	36.385	8.008	207797.932	37058.711	3.240	1.005	0.143	7.833	55936.440	4616.433
Instance1728.6	12.737	1.859	35.754	8.300	204604.160	37198.182	3.629	1.050	0.146	8.062	57396.033	4580.103
Instance1728.7	12.417	1.912	35.708	8.055	205521.902	37143.389	3.365	1.025	0.145	7.861	56909.502	4687.466
Instance1728.8	11.038	1.773	36.693	8.212	205878.025	37051.253	3.626	1.088	0.145	7.988	56437.586	4577.061
Instance1728.9	10.820	1.690	36.708	8.099	206747.434	37049.324	3.595	0.991	0.140	7.726	54963.379	4483.409
Instance1728.10	13.049	1.933	35.053	7.925	205917.286	37235.178	3.508	1.094	0.144	7.742	56422.971	4702.234
Instance1728.11	12.683	1.923	35.832	8.331	204084.677	37259.554	3.557	1.059	0.143	7.913	55936.440	4498.854
Instance1728.12	11.661	1.960	35.886	8.013	206695.553	37095.280	3.708	1.005	0.146	7.671	57396.033	4841.165
Instance1728.13	10.868	1.741	36.364	7.834	207771.941	37132.903	3.413	0.952	0.139	7.686	54073.246	4638.882
Instance1728.14	12.671	1.961	35.490	8.142	205577.989	36942.527	2.662	1.011	0.140	7.728	54491.463	4549.113
Instance1728.15	12.974	1.867	35.350	8.227	204973.049	36995.705	3.044	1.037	0.141	7.733	55743.426	4608.942

## Host System Performance

<i>Counter</i>	Average	Minimum	Maximum
<i>% Processor Time</i>	0.479	0.000	2.874
<i>Available MBytes</i>	58239.630	58224.000	58622.000
<i>Free System Page Table Entries</i>	33555287.979	33555284.000	33555288.000
<i>Transition Pages RePurposed/sec</i>	0.000	0.000	0.000
<i>Pool Nonpaged Bytes</i>	38564438.580	38436864.000	38641664.000
<i>Pool Paged Bytes</i>	89063731.841	89014272.000	89112576.000
<i>Database Page Fault Stalls/sec</i>	0.000	0.000	0.000

Test Log 1/19/2011 3:32:32 AM -- Jetstress testing begins ...  
 1/19/2011 3:32:32 AM -- Prepare testing begins ...  
 1/19/2011 3:32:47 AM -- Attaching databases ...  
 1/19/2011 3:32:47 AM -- Prepare testing ends.  
 1/19/2011 3:32:47 AM -- Dispatching transactions begins ...  
 1/19/2011 3:32:47 AM -- Database cache settings: (minimum: 480.0 MB, maximum: 3.8 GB)  
 1/19/2011 3:32:47 AM -- Database flush thresholds: (start: 38.4 MB, stop: 76.8 MB)  
 1/19/2011 3:33:10 AM -- Database read latency thresholds: (average: 20 msec/read, maximum: 100 msec/read).  
 1/19/2011 3:33:10 AM -- Log write latency thresholds: (average: 10 msec/write, maximum: 100 msec/write).  
 1/19/2011 3:33:22 AM -- Operation mix: Sessions 2, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.  
 1/19/2011 3:33:22 AM -- Performance logging begins (interval: 15000 ms).  
 1/19/2011 3:33:22 AM -- Attaining prerequisites:  
 1/19/2011 3:53:35 AM -- \MSEExchange Database(JetstressWin)\Database Cache Size, Last: 3625366000.0 (lower bound: 3623879000.0, upper bound: none)  
 1/19/2011 5:53:36 AM -- Performance logging ends.  
 1/19/2011 6:18:51 AM -- JetInterop batch transaction stats: 6934, 7014, 6894, 6949, 6865, 6951, 6901, 6976, 6911, 6912, 7001, 6941, 6909, 6864 and 6832.  
 1/19/2011 6:18:51 AM -- Dispatching transactions ends.  
 1/19/2011 6:18:51 AM -- Shutting down databases ...  
 1/19/2011 6:22:18 AM -- Instance1728.1 (complete), Instance1728.2 (complete), Instance1728.3 (complete), Instance1728.4 (complete), Instance1728.5 (complete), Instance1728.6 (complete), Instance1728.7 (complete), Instance1728.8 (complete), Instance1728.9 (complete), Instance1728.10 (complete), Instance1728.11 (complete), Instance1728.12 (complete), Instance1728.13 (complete), Instance1728.14 (complete) and Instance1728.15 (complete)  
 1/19/2011 6:22:19 AM -- Performance logging begins (interval: 30000 ms).  
 1/19/2011 6:22:19 AM -- Verifying database checksums ...  
 1/19/2011 11:16:06 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), C:\dbluns\db11 (100% processed), C:\dbluns\db12 (100% processed), C:\dbluns\db13 (100% processed), C:\dbluns\db14 (100% processed) and C:\dbluns\db15 (100% processed)

1/19/2011 11:16:06 AM -- Performance logging ends.  
1/19/2011 11:16:06 AM -- C:\ESRP3.0\_NL-SAS-R5\_1GB\Performance\DBChecksum\_2011\_1\_19\_6\_22\_18.blg has 587 samples.  
1/19/2011 11:16:17 AM -- C:\ESRP3.0\_NL-SAS-R5\_1GB\Performance\DBChecksum\_2011\_1\_19\_6\_22\_18.html is saved.  
1/19/2011 11:16:17 AM -- Verifying log checksums ...  
1/19/2011 11:16:18 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 (11 log(s) processed), C:\logluns\log5 (13 log(s) processed), C:\logluns\log6 (12 log(s) processed), C:\logluns\log7 (12 log(s) processed), C:\logluns\log8 (12 log(s) processed), C:\logluns\log9 (11 log(s) processed), C:\logluns\log10 (13 log(s) processed), C:\logluns\log11 (13 log(s) processed), C:\logluns\log12 (12 log(s) processed), C:\logluns\log13 (11 log(s) processed), C:\logluns\log14 (12 log(s) processed) and C:\logluns\log15 (12 log(s) processed)  
1/19/2011 11:16:18 AM -- C:\ESRP3.0\_NL-SAS-R5\_1GB\Performance\Performance\_2011\_1\_19\_3\_33\_10.blg has 559 samples.  
1/19/2011 11:16:18 AM -- Creating test report ...  
1/19/2011 11:16:24 AM -- Instance1728.1 has 13.3 for I/O Database Reads Average Latency.  
1/19/2011 11:16:24 AM -- Instance1728.1 has 1.0 for I/O Log Writes Average Latency.  
1/19/2011 11:16:24 AM -- Instance1728.1 has 1.0 for I/O Log Reads Average Latency.  
1/19/2011 11:16:24 AM -- Instance1728.2 has 13.0 for I/O Database Reads Average Latency.  
1/19/2011 11:16:24 AM -- Instance1728.2 has 1.0 for I/O Log Writes Average Latency.  
1/19/2011 11:16:24 AM -- Instance1728.2 has 1.0 for I/O Log Reads Average Latency.  
1/19/2011 11:16:24 AM -- Instance1728.3 has 13.3 for I/O Database Reads Average Latency.  
1/19/2011 11:16:24 AM -- Instance1728.3 has 1.1 for I/O Log Writes Average Latency.  
1/19/2011 11:16:24 AM -- Instance1728.3 has 1.1 for I/O Log Reads Average Latency.  
1/19/2011 11:16:24 AM -- Instance1728.4 has 11.2 for I/O Database Reads Average Latency.  
1/19/2011 11:16:24 AM -- Instance1728.4 has 1.0 for I/O Log Writes Average Latency.  
1/19/2011 11:16:24 AM -- Instance1728.4 has 1.0 for I/O Log Reads Average Latency.  
1/19/2011 11:16:24 AM -- Instance1728.5 has 10.9 for I/O Database Reads Average Latency.  
1/19/2011 11:16:24 AM -- Instance1728.5 has 1.0 for I/O Log Writes Average Latency.  
1/19/2011 11:16:24 AM -- Instance1728.5 has 1.0 for I/O Log Reads Average Latency.  
1/19/2011 11:16:24 AM -- Instance1728.6 has 12.7 for I/O Database Reads Average Latency.  
1/19/2011 11:16:24 AM -- Instance1728.6 has 1.0 for I/O Log Writes Average Latency.  
1/19/2011 11:16:24 AM -- Instance1728.6 has 1.0 for I/O Log Reads Average Latency.  
1/19/2011 11:16:24 AM -- Instance1728.7 has 12.4 for I/O Database Reads Average Latency.  
1/19/2011 11:16:24 AM -- Instance1728.7 has 1.0 for I/O Log Writes Average Latency.  
1/19/2011 11:16:24 AM -- Instance1728.7 has 1.0 for I/O Log Reads Average Latency.  
1/19/2011 11:16:24 AM -- Instance1728.8 has 11.0 for I/O Database Reads Average Latency.  
1/19/2011 11:16:24 AM -- Instance1728.8 has 1.1 for I/O Log Writes Average Latency.  
1/19/2011 11:16:24 AM -- Instance1728.8 has 1.1 for I/O Log Reads Average Latency.  
1/19/2011 11:16:24 AM -- Instance1728.9 has 10.8 for I/O Database Reads Average Latency.  
1/19/2011 11:16:24 AM -- Instance1728.9 has 1.0 for I/O Log Writes Average Latency.  
1/19/2011 11:16:24 AM -- Instance1728.9 has 1.0 for I/O Log Reads Average Latency.  
1/19/2011 11:16:24 AM -- Instance1728.10 has 13.0 for I/O Database Reads Average Latency.  
1/19/2011 11:16:24 AM -- Instance1728.10 has 1.1 for I/O Log Writes Average Latency.  
1/19/2011 11:16:24 AM -- Instance1728.10 has 1.1 for I/O Log Reads Average Latency.  
1/19/2011 11:16:24 AM -- Instance1728.11 has 12.7 for I/O Database Reads Average Latency.  
1/19/2011 11:16:24 AM -- Instance1728.11 has 1.1 for I/O Log Writes Average Latency.  
1/19/2011 11:16:24 AM -- Instance1728.11 has 1.1 for I/O Log Reads Average Latency.  
1/19/2011 11:16:24 AM -- Instance1728.12 has 11.7 for I/O Database Reads Average Latency.  
1/19/2011 11:16:24 AM -- Instance1728.12 has 1.0 for I/O Log Writes Average Latency.  
1/19/2011 11:16:24 AM -- Instance1728.12 has 1.0 for I/O Log Reads Average Latency.  
1/19/2011 11:16:24 AM -- Instance1728.13 has 10.9 for I/O Database Reads Average Latency.

1/19/2011 11:16:24 AM -- Instance1728.13 has 1.0 for I/O Log Writes Average Latency.  
 1/19/2011 11:16:24 AM -- Instance1728.13 has 1.0 for I/O Log Reads Average Latency.  
 1/19/2011 11:16:24 AM -- Instance1728.14 has 12.7 for I/O Database Reads Average Latency.  
 1/19/2011 11:16:24 AM -- Instance1728.14 has 1.0 for I/O Log Writes Average Latency.  
 1/19/2011 11:16:24 AM -- Instance1728.14 has 1.0 for I/O Log Reads Average Latency.  
 1/19/2011 11:16:24 AM -- Instance1728.15 has 13.0 for I/O Database Reads Average Latency.  
 1/19/2011 11:16:24 AM -- Instance1728.15 has 1.0 for I/O Log Writes Average Latency.  
 1/19/2011 11:16:24 AM -- Instance1728.15 has 1.0 for I/O Log Reads Average Latency.  
 1/19/2011 11:16:24 AM -- Test has 0 Maximum Database Page Fault Stalls/sec.  
 1/19/2011 11:16:24 AM -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.  
 1/19/2011 11:16:24 AM -- C:\ESRP3.0\_NL-SAS-R5\_1GB\Performance\Performance\_2011\_1\_19\_3\_33\_10.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	5472530	0	0	0	171016 MBytes / 15651 sec
C:\dbluns\db2\Jetstress002001.edb	5472530	0	0	0	171016 MBytes / 17626 sec
C:\dbluns\db3\Jetstress003001.edb	5472274	0	0	0	171008 MBytes / 17025 sec
C:\dbluns\db4\Jetstress004001.edb	5472274	0	0	0	171008 MBytes / 13610 sec
C:\dbluns\db5\Jetstress005001.edb	5472274	0	0	0	171008 MBytes / 15171 sec
C:\dbluns\db6\Jetstress006001.edb	5472274	0	0	0	171008 MBytes / 17591 sec
C:\dbluns\db7\Jetstress007001.edb	5472274	0	0	0	171008 MBytes / 17065 sec
C:\dbluns\db8\Jetstress008001.edb	5472274	0	0	0	171008 MBytes / 13473 sec
C:\dbluns\db9\Jetstress009001.edb	5472530	0	0	0	171016 MBytes / 15250 sec
C:\dbluns\db10\Jetstress010001.edb	5472274	0	0	0	171008 MBytes / 17622 sec
C:\dbluns\db11\Jetstress011001.edb	5472786	0	0	0	171024 MBytes / 16943 sec
C:\dbluns\db12\Jetstress012001.edb	5472274	0	0	0	171008 MBytes / 13447 sec
C:\dbluns\db13\Jetstress013001.edb	5472274	0	0	0	171008 MBytes / 15340 sec
C:\dbluns\db14\Jetstress014001.edb	5472274	0	0	0	171008 MBytes / 17617 sec
C:\dbluns\db15\Jetstress015001.edb	5472530	0	0	0	171016 MBytes / 17015 sec

<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>
(Sum)	82085646	0	0	0	2565176 MBytes / 17626 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	0.133	0.000	172.582	0.000	65536.000
C:\dbluns\db2	0.136	0.000	154.143	0.000	65536.000
C:\dbluns\db3	0.145	0.000	160.559	0.000	65536.000
C:\dbluns\db4	0.108	0.000	198.914	0.000	65536.000
C:\dbluns\db5	0.120	0.000	178.470	0.000	65536.000
C:\dbluns\db6	0.136	0.000	155.294	0.000	65536.000
C:\dbluns\db7	0.145	0.000	159.198	0.000	65536.000
C:\dbluns\db8	0.108	0.000	200.725	0.000	65536.000
C:\dbluns\db9	0.121	0.000	178.117	0.000	65536.000
C:\dbluns\db10	0.137	0.000	154.616	0.000	65536.000
C:\dbluns\db11	0.146	0.000	159.899	0.000	65536.000
C:\dbluns\db12	0.106	0.000	201.524	0.000	65536.000
C:\dbluns\db13	0.122	0.000	176.874	0.000	65536.000
C:\dbluns\db14	0.139	0.000	151.981	0.000	65536.000
C:\dbluns\db15	0.147	0.000	159.584	0.000	65536.000

#### Memory System Performance (of checksum)

<i>Counter</i>	<i>Average</i>	<i>Minimum</i>	<i>Maximum</i>
<i>% Processor Time</i>	0.535	0.000	1.998
<i>Available MBytes</i>	62143.232	62126.000	62162.000
<i>Free System Page Table Entries</i>	33555288.382	33555287.000	33555290.000
<i>Transition Pages RePurposed/sec</i>	0.000	0.000	0.000
<i>Pool Nonpaged Bytes</i>	46842351.428	46669824.000	47226880.000
<i>Pool Paged Bytes</i>	89305443.871	89079808.000	89493504.000

Test Log1/19/2011 3:32:32 AM -- Jetstress testing begins ...

1/19/2011 3:32:32 AM -- Prepare testing begins ...

1/19/2011 3:32:47 AM -- Attaching databases ...

1/19/2011 3:32:47 AM -- Prepare testing ends.

1/19/2011 3:32:47 AM -- Dispatching transactions begins ...

1/19/2011 3:32:47 AM -- Database cache settings: (minimum: 480.0 MB, maximum: 3.8 GB)

1/19/2011 3:32:47 AM -- Database flush thresholds: (start: 38.4 MB, stop: 76.8 MB)

1/19/2011 3:33:10 AM -- Database read latency thresholds: (average: 20 msec/read, maximum: 100 msec/read).

1/19/2011 3:33:10 AM -- Log write latency thresholds: (average: 10 msec/write, maximum: 100 msec/write).

1/19/2011 3:33:22 AM -- Operation mix: Sessions 2, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.

1/19/2011 3:33:22 AM -- Performance logging begins (interval: 15000 ms).

1/19/2011 3:33:22 AM -- Attaining prerequisites:

1/19/2011 3:53:35 AM -- \MSEExchange Database(JetstressWin)\Database Cache Size, Last: 3625366000.0 (lower bound: 3623879000.0, upper bound: none)

1/19/2011 5:53:36 AM -- Performance logging ends.

1/19/2011 6:18:51 AM -- JetInterop batch transaction stats: 6934, 7014, 6894, 6949, 6865, 6951, 6901, 6976, 6911, 6912, 7001, 6941, 6909, 6864 and 6832.

1/19/2011 6:18:51 AM -- Dispatching transactions ends.

1/19/2011 6:18:51 AM -- Shutting down databases ...

1/19/2011 6:22:18 AM -- Instance1728.1 (complete), Instance1728.2 (complete), Instance1728.3 (complete), Instance1728.4 (complete), Instance1728.5 (complete), Instance1728.6 (complete), Instance1728.7 (complete), Instance1728.8 (complete), Instance1728.9 (complete), Instance1728.10 (complete), Instance1728.11 (complete), Instance1728.12 (complete), Instance1728.13 (complete), Instance1728.14 (complete) and Instance1728.15 (complete)

1/19/2011 6:22:19 AM -- Performance logging begins (interval: 30000 ms).

1/19/2011 6:22:19 AM -- Verifying database checksums ...

1/19/2011 11:16:06 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), C:\dbluns\db11 (100% processed), C:\dbluns\db12 (100% processed), C:\dbluns\db13 (100% processed), C:\dbluns\db14 (100% processed) and C:\dbluns\db15 (100% processed)

1/19/2011 11:16:06 AM -- Performance logging ends.

1/19/2011 11:16:06 AM -- C:\ESRP3.0\_NL-SAS-R5\_1GB\Performance\DBChecksum\_2011\_1\_19\_6\_22\_18.blg has 587 samples.

## Stress Test Result Report: HBS 107

### Test Summary

<b>Overall Test Result</b>	Pass
<b>Machine Name</b>	HBS107
<b>Test Description</b>	
<b>Test Start Time</b>	1/19/2011 8:43:44 PM
<b>Test End Time</b>	1/20/2011 9:17:16 PM
<b>Collection Start Time</b>	1/19/2011 9:05:47 PM
<b>Collection End Time</b>	1/20/2011 9:05:33 PM
<b>Jetstress Version</b>	14.01.0043.000
<b>Ese Version</b>	14.00.0639.019
<b>Operating System</b>	Windows Server 2008 R2 Enterprise (6.1.7600.0)
<b>Performance Log</b>	C:\ESRP3.0_NL-SAS-R5_1GB\Stress\Stress_2011_1_19_20_44_21.blg C:\ESRP3.0_NL-SAS-R5_1GB\Stress\DBChecksum_2011_1_20_21_17_16.blg

## Database Sizing and Throughput

<i>Achieved Transactional I/O per Second</i>	255.283
<i>Target Transactional I/O per Second</i>	228
<i>Initial Database Size (bytes)</i>	2689782448128
<i>Final Database Size (bytes)</i>	2702088536064
<i>Database Files (Count)</i>	15

## Jetstress System Parameters

<i>Thread Count</i>	2 (per database)
<i>Minimum Database Cache</i>	480.0 MB
<i>Maximum Database Cache</i>	3840.0 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>Instance2668.1</i>	Log Path: C:\logluns\log1 Database: C:\dbluns\db1\Jetstress001001.edb
<i>Instance2668.2</i>	Log Path: C:\logluns\log2 Database: C:\dbluns\db2\Jetstress002001.edb
<i>Instance2668.3</i>	Log Path: C:\logluns\log3 Database: C:\dbluns\db3\Jetstress003001.edb
<i>Instance2668.4</i>	Log Path: C:\logluns\log4 Database: C:\dbluns\db4\Jetstress004001.edb
<i>Instance2668.5</i>	Log Path: C:\logluns\log5 Database: C:\dbluns\db5\Jetstress005001.edb
<i>Instance2668.6</i>	Log Path: C:\logluns\log6 Database: C:\dbluns\db6\Jetstress006001.edb
<i>Instance2668.7</i>	Log Path: C:\logluns\log7 Database: C:\dbluns\db7\Jetstress007001.edb
<i>Instance2668.8</i>	Log Path: C:\logluns\log8 Database: C:\dbluns\db8\Jetstress008001.edb
<i>Instance2668.9</i>	Log Path: C:\logluns\log9 Database: C:\dbluns\db9\Jetstress009001.edb
<i>Instance2668.10</i>	Log Path: C:\logluns\log10 Database: C:\dbluns\db10\Jetstress010001.edb

<i>Instance2668.11</i>	Log Path: C:\logluns\log11 Database: C:\dbluns\db11\Jetstress011001.edb
<i>Instance2668.12</i>	Log Path: C:\logluns\log12 Database: C:\dbluns\db12\Jetstress012001.edb
<i>Instance2668.13</i>	Log Path: C:\logluns\log13 Database: C:\dbluns\db13\Jetstress013001.edb
<i>Instance2668.14</i>	Log Path: C:\logluns\log14 Database: C:\dbluns\db14\Jetstress014001.edb
<i>Instance2668.15</i>	Log Path: C:\logluns\log15 Database: C:\dbluns\db15\Jetstress015001.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>
Instance2668.1	14.746	1.704	8.931	8.059	42038.763	37022.112	0.000	1.020	0.000	7.537	0.000	4586.552
Instance2668.2	12.534	1.900	9.004	8.162	42196.381	37003.125	0.000	1.077	0.000	7.611	0.000	4591.239
Instance2668.3	12.530	1.757	8.961	8.092	41958.163	36994.601	0.000	1.005	0.000	7.554	0.000	4554.364
Instance2668.4	12.524	1.822	8.955	8.099	42405.122	37005.000	0.000	1.045	0.000	7.547	0.000	4607.892
Instance2668.5	12.380	1.698	8.911	8.055	41986.953	37024.632	0.000	0.998	0.000	7.548	0.000	4641.933
Instance2668.6	12.733	1.923	8.950	8.089	42071.010	36999.205	0.000	1.065	0.000	7.561	0.000	4603.103
Instance2668.7	12.544	1.766	8.916	8.044	42220.289	37012.696	0.000	1.013	0.000	7.528	0.000	4617.344
Instance2668.8	12.430	1.800	8.977	8.121	41972.910	36964.267	0.000	1.012	0.000	7.590	0.000	4615.754
Instance2668.9	12.268	1.678	8.928	8.071	42219.856	37002.201	0.000	0.994	0.000	7.562	0.000	4626.360
Instance2668.10	12.595	1.871	8.946	8.079	42228.410	36978.102	0.000	1.032	0.000	7.548	0.000	4622.436
Instance2668.11	12.399	1.724	8.947	8.087	42236.385	36992.301	0.000	1.015	0.000	7.524	0.000	4638.834
Instance2668.12	12.528	1.803	8.932	8.067	42281.721	36983.305	0.000	1.017	0.000	7.503	0.000	4578.928
Instance2668.13	12.222	1.659	8.857	7.993	42283.533	36974.355	0.000	1.021	0.000	7.467	0.000	4622.125
Instance2668.14	12.649	1.851	8.917	8.058	42191.885	36992.789	0.000	1.032	0.000	7.507	0.000	4593.878
Instance2668.15	12.508	1.725	8.969	8.105	42060.617	37030.871	0.000	0.988	0.000	7.545	0.000	4623.571

## 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>
Instance2668.1	25.393	259761.664
Instance2668.2	26.691	259716.480
Instance2668.3	26.676	259705.119
Instance2668.4	26.638	259759.155
Instance2668.5	26.773	259722.473
Instance2668.6	26.538	259739.116
Instance2668.7	26.621	259760.032
Instance2668.8	26.745	259745.557
Instance2668.9	26.841	259759.671
Instance2668.10	26.608	259751.267
Instance2668.11	26.748	259691.535
Instance2668.12	26.661	259774.452
Instance2668.13	26.854	259750.964
Instance2668.14	26.623	259740.481
Instance2668.15	26.659	259724.217

## 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>
Instance2668.1	0.138	53855.270
Instance2668.2	0.139	54560.029
Instance2668.3	0.138	53940.051
Instance2668.4	0.138	54084.787
Instance2668.5	0.138	54108.852
Instance2668.6	0.138	54144.367
Instance2668.7	0.138	54241.100
Instance2668.8	0.139	54214.723
Instance2668.9	0.139	54595.582
Instance2668.10	0.139	54250.986
Instance2668.11	0.138	54135.903
Instance2668.12	0.137	53602.933
Instance2668.13	0.137	53599.423
Instance2668.14	0.137	53753.626
Instance2668.15	0.138	53939.343

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>
Instance2668.1	14.746	1.704	34.324	8.059	203113.061	37022.112	3.429	1.020	0.138	7.537	53855.270	4586.552
Instance2668.2	12.534	1.900	35.694	8.162	204847.298	37003.125	3.601	1.077	0.139	7.611	54560.029	4591.239
Instance2668.3	12.530	1.757	35.637	8.092	204949.599	36994.601	3.747	1.005	0.138	7.554	53940.051	4554.364
Instance2668.4	12.524	1.822	35.592	8.099	205075.204	37005.000	3.519	1.045	0.138	7.547	54084.787	4607.892
Instance2668.5	12.380	1.698	35.684	8.055	205349.819	37024.632	3.573	0.998	0.138	7.548	54108.852	4641.933
Instance2668.6	12.733	1.923	35.488	8.089	204845.006	36999.205	3.529	1.065	0.138	7.561	54144.367	4603.103
Instance2668.7	12.544	1.766	35.538	8.044	205180.448	37012.696	3.349	1.013	0.138	7.528	54241.100	4617.344
Instance2668.8	12.430	1.800	35.721	8.121	205020.451	36964.267	3.384	1.012	0.139	7.590	54214.723	4615.754
Instance2668.9	12.268	1.678	35.769	8.071	205461.350	37002.201	3.343	0.994	0.139	7.562	54595.582	4626.360
Instance2668.10	12.595	1.871	35.554	8.079	205019.268	36978.102	3.343	1.032	0.139	7.548	54250.986	4622.436
Instance2668.11	12.399	1.724	35.695	8.087	205186.916	36992.301	3.555	1.015	0.138	7.524	54135.903	4638.834
Instance2668.12	12.528	1.803	35.593	8.067	205195.256	36983.305	3.330	1.017	0.137	7.503	53602.933	4578.928
Instance2668.13	12.222	1.659	35.712	7.993	205813.921	36974.355	3.368	1.021	0.137	7.467	53599.423	4622.125
Instance2668.14	12.649	1.851	35.540	8.058	205159.337	36992.789	3.154	1.032	0.137	7.507	53753.626	4593.878
Instance2668.15	12.508	1.725	35.628	8.105	204929.674	37030.871	3.463	0.988	0.138	7.545	53939.343	4623.571

## Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	0.475	0.000	3.138
Available MBytes	58162.406	58087.000	58623.000
Free System Page Table Entries	33555287.981	33555284.000	33555288.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	39709839.485	39104512.000	39968768.000
Pool Paged Bytes	90769486.783	89145344.000	93216768.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log1/19/2011 8:43:44 PM -- Jetstress testing begins ...  
 1/19/2011 8:43:44 PM -- Prepare testing begins ...  
 1/19/2011 8:44:00 PM -- Attaching databases ...  
 1/19/2011 8:44:00 PM -- Prepare testing ends.  
 1/19/2011 8:44:00 PM -- Dispatching transactions begins ...  
 1/19/2011 8:44:00 PM -- Database cache settings: (minimum: 480.0 MB, maximum: 3.8 GB)  
 1/19/2011 8:44:00 PM -- Database flush thresholds: (start: 38.4 MB, stop: 76.8 MB)  
 1/19/2011 8:44:21 PM -- Database read latency thresholds: (average: 20 msec/read, maximum: 200 msec/read).  
 1/19/2011 8:44:21 PM -- Log write latency thresholds: (average: 10 msec/write, maximum: 200 msec/write).  
 1/19/2011 8:44:33 PM -- Operation mix: Sessions 2, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.  
 1/19/2011 8:44:33 PM -- Performance logging begins (interval: 15000 ms).  
 1/19/2011 8:44:33 PM -- Attaining prerequisites:  
 1/19/2011 9:05:47 PM -- \MSEExchange Database(JetstressWin)\Database Cache Size, Last: 3624653000.0 (lower bound: 3623879000.0, upper bound: none)  
 1/20/2011 9:05:47 PM -- Performance logging ends.  
 1/20/2011 9:13:49 PM -- JetInterop batch transaction stats: 58347, 59002, 58742, 58702, 58612, 58877, 58621, 58809, 58826, 58609, 58702, 58324, 58275, 58360 and 58785.  
 1/20/2011 9:13:49 PM -- Dispatching transactions ends.  
 1/20/2011 9:13:49 PM -- Shutting down databases ...  
 1/20/2011 9:17:16 PM -- Instance2668.1 (complete), Instance2668.2 (complete), Instance2668.3 (complete), Instance2668.4 (complete), Instance2668.5 (complete), Instance2668.6 (complete), Instance2668.7 (complete), Instance2668.8 (complete), Instance2668.9 (complete), Instance2668.10 (complete), Instance2668.11 (complete), Instance2668.12 (complete), Instance2668.13 (complete), Instance2668.14 (complete) and Instance2668.15 (complete)  
 1/20/2011 9:17:17 PM -- Performance logging begins (interval: 30000 ms).  
 1/20/2011 9:17:17 PM -- Verifying database checksums ...  
 1/21/2011 2:03:45 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), C:\dbluns\db11 (100% processed), C:\dbluns\db12 (100% processed), C:\dbluns\db13 (100% processed), C:\dbluns\db14 (100% processed) and C:\dbluns\db15 (100% processed)  
 1/21/2011 2:03:45 AM -- Performance logging ends.  
 1/21/2011 2:03:45 AM -- C:\ESRP3.0\_NL-SAS-R5\_1GB\Stress\DBChecksum\_2011\_1\_20\_21\_17\_16.blg has 572 samples.

1/21/2011 2:03:55 AM -- C:\ESRP3.0\_NL-SAS-R5\_1GB\Stress\DBChecksum\_2011\_1\_20\_21\_17\_16.html is saved.  
1/21/2011 2:03:55 AM -- Verifying log checksums ...  
1/21/2011 2:03:56 AM -- C:\logluns\log1 (12 log(s) processed), C:\logluns\log2 (13 log(s) processed), C:\logluns\log3 (13 log(s) processed), C:\logluns\log4 (12 log(s) processed), C:\logluns\log5 (12 log(s) processed), C:\logluns\log6 (13 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 (11 log(s) processed), C:\logluns\log11 (13 log(s) processed), C:\logluns\log12 (12 log(s) processed), C:\logluns\log13 (13 log(s) processed), C:\logluns\log14 (12 log(s) processed) and C:\logluns\log15 (12 log(s) processed)  
1/21/2011 2:03:56 AM -- C:\ESRP3.0\_NL-SAS-R5\_1GB\Stress\Stress\_2011\_1\_19\_20\_44\_21.blg has 5829 samples.  
1/21/2011 2:03:56 AM -- Creating test report ...  
1/21/2011 2:04:53 AM -- Instance2668.1 has 14.7 for I/O Database Reads Average Latency.  
1/21/2011 2:04:53 AM -- Instance2668.1 has 1.0 for I/O Log Writes Average Latency.  
1/21/2011 2:04:53 AM -- Instance2668.1 has 1.0 for I/O Log Reads Average Latency.  
1/21/2011 2:04:53 AM -- Instance2668.2 has 12.5 for I/O Database Reads Average Latency.  
1/21/2011 2:04:53 AM -- Instance2668.2 has 1.1 for I/O Log Writes Average Latency.  
1/21/2011 2:04:53 AM -- Instance2668.2 has 1.1 for I/O Log Reads Average Latency.  
1/21/2011 2:04:53 AM -- Instance2668.3 has 12.5 for I/O Database Reads Average Latency.  
1/21/2011 2:04:53 AM -- Instance2668.3 has 1.0 for I/O Log Writes Average Latency.  
1/21/2011 2:04:53 AM -- Instance2668.3 has 1.0 for I/O Log Reads Average Latency.  
1/21/2011 2:04:53 AM -- Instance2668.4 has 12.5 for I/O Database Reads Average Latency.  
1/21/2011 2:04:53 AM -- Instance2668.4 has 1.0 for I/O Log Writes Average Latency.  
1/21/2011 2:04:53 AM -- Instance2668.4 has 1.0 for I/O Log Reads Average Latency.  
1/21/2011 2:04:53 AM -- Instance2668.5 has 12.4 for I/O Database Reads Average Latency.  
1/21/2011 2:04:53 AM -- Instance2668.5 has 1.0 for I/O Log Writes Average Latency.  
1/21/2011 2:04:53 AM -- Instance2668.5 has 1.0 for I/O Log Reads Average Latency.  
1/21/2011 2:04:53 AM -- Instance2668.6 has 12.7 for I/O Database Reads Average Latency.  
1/21/2011 2:04:53 AM -- Instance2668.6 has 1.1 for I/O Log Writes Average Latency.  
1/21/2011 2:04:53 AM -- Instance2668.6 has 1.1 for I/O Log Reads Average Latency.  
1/21/2011 2:04:53 AM -- Instance2668.7 has 12.5 for I/O Database Reads Average Latency.  
1/21/2011 2:04:53 AM -- Instance2668.7 has 1.0 for I/O Log Writes Average Latency.  
1/21/2011 2:04:53 AM -- Instance2668.7 has 1.0 for I/O Log Reads Average Latency.  
1/21/2011 2:04:53 AM -- Instance2668.8 has 12.4 for I/O Database Reads Average Latency.  
1/21/2011 2:04:53 AM -- Instance2668.8 has 1.0 for I/O Log Writes Average Latency.  
1/21/2011 2:04:53 AM -- Instance2668.8 has 1.0 for I/O Log Reads Average Latency.  
1/21/2011 2:04:53 AM -- Instance2668.9 has 12.3 for I/O Database Reads Average Latency.  
1/21/2011 2:04:53 AM -- Instance2668.9 has 1.0 for I/O Log Writes Average Latency.  
1/21/2011 2:04:53 AM -- Instance2668.9 has 1.0 for I/O Log Reads Average Latency.  
1/21/2011 2:04:53 AM -- Instance2668.10 has 12.6 for I/O Database Reads Average Latency.  
1/21/2011 2:04:53 AM -- Instance2668.10 has 1.0 for I/O Log Writes Average Latency.  
1/21/2011 2:04:53 AM -- Instance2668.10 has 1.0 for I/O Log Reads Average Latency.  
1/21/2011 2:04:53 AM -- Instance2668.11 has 12.4 for I/O Database Reads Average Latency.  
1/21/2011 2:04:53 AM -- Instance2668.11 has 1.0 for I/O Log Writes Average Latency.  
1/21/2011 2:04:53 AM -- Instance2668.11 has 1.0 for I/O Log Reads Average Latency.  
1/21/2011 2:04:53 AM -- Instance2668.12 has 12.5 for I/O Database Reads Average Latency.  
1/21/2011 2:04:53 AM -- Instance2668.12 has 1.0 for I/O Log Writes Average Latency.  
1/21/2011 2:04:53 AM -- Instance2668.12 has 1.0 for I/O Log Reads Average Latency.  
1/21/2011 2:04:53 AM -- Instance2668.13 has 12.2 for I/O Database Reads Average Latency.  
1/21/2011 2:04:53 AM -- Instance2668.13 has 1.0 for I/O Log Writes Average Latency.  
1/21/2011 2:04:53 AM -- Instance2668.13 has 1.0 for I/O Log Reads Average Latency.  
1/21/2011 2:04:53 AM -- Instance2668.14 has 12.6 for I/O Database Reads Average Latency.

1/21/2011 2:04:53 AM -- Instance2668.14 has 1.0 for I/O Log Writes Average Latency.  
 1/21/2011 2:04:53 AM -- Instance2668.14 has 1.0 for I/O Log Reads Average Latency.  
 1/21/2011 2:04:53 AM -- Instance2668.15 has 12.5 for I/O Database Reads Average Latency.  
 1/21/2011 2:04:53 AM -- Instance2668.15 has 1.0 for I/O Log Writes Average Latency.  
 1/21/2011 2:04:53 AM -- Instance2668.15 has 1.0 for I/O Log Reads Average Latency.  
 1/21/2011 2:04:53 AM -- Test has 0 Maximum Database Page Fault Stalls/sec.  
 1/21/2011 2:04:53 AM -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.  
 1/21/2011 2:04:53 AM -- C:\ESRP3.0\_NL-SAS-R5\_1GB\Stress\Stress\_2011\_1\_19\_20\_44\_21.xml  
 has 5744 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	5497362	0	0	0	171792 MBytes / 17188 sec
C:\dbluns\db2\Jetstress002001.edb	5497618	0	0	0	171800 MBytes / 16439 sec
C:\dbluns\db3\Jetstress003001.edb	5497362	0	0	0	171792 MBytes / 17081 sec
C:\dbluns\db4\Jetstress004001.edb	5497362	0	0	0	171792 MBytes / 14226 sec
C:\dbluns\db5\Jetstress005001.edb	5497362	0	0	0	171792 MBytes / 16939 sec
C:\dbluns\db6\Jetstress006001.edb	5497618	0	0	0	171800 MBytes / 16368 sec
C:\dbluns\db7\Jetstress007001.edb	5497106	0	0	0	171784 MBytes / 17091 sec
C:\dbluns\db8\Jetstress008001.edb	5497362	0	0	0	171792 MBytes / 14171 sec
C:\dbluns\db9\Jetstress009001.edb	5497618	0	0	0	171800 MBytes / 16648 sec
C:\dbluns\db10\Jetstress010001.edb	5497618	0	0	0	171800 MBytes / 16394 sec
C:\dbluns\db11\Jetstress011001.edb	5497874	0	0	0	171808 MBytes / 17087 sec
C:\dbluns\db12\Jetstress012001.edb	5497106	0	0	0	171784 MBytes / 14057 sec
C:\dbluns\db13\Jetstress013001.edb	5497106	0	0	0	171784 MBytes / 16686 sec
C:\dbluns\db14\Jetstress014001.edb	5497106	0	0	0	171784 MBytes / 16472 sec
C:\dbluns\db15\Jetstress015001.edb	5497618	0	0	0	171800 MBytes / 17056 sec
(Sum)	82461198	0	0	0	2576912 MBytes / 17188 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	0.150	0.000	157.085	0.000	65536.000
C:\dbluns\db2	0.133	0.000	165.540	0.000	65536.000
C:\dbluns\db3	0.135	0.000	160.436	0.000	65536.000
C:\dbluns\db4	0.111	0.000	192.404	0.000	65536.000
C:\dbluns\db5	0.135	0.000	162.135	0.000	65536.000
C:\dbluns\db6	0.133	0.000	167.116	0.000	65536.000
C:\dbluns\db7	0.137	0.000	159.759	0.000	65536.000
C:\dbluns\db8	0.115	0.000	193.154	0.000	65536.000
C:\dbluns\db9	0.133	0.000	163.684	0.000	65536.000
C:\dbluns\db10	0.133	0.000	167.028	0.000	65536.000
C:\dbluns\db11	0.138	0.000	160.286	0.000	65536.000
C:\dbluns\db12	0.110	0.000	194.814	0.000	65536.000
C:\dbluns\db13	0.138	0.000	161.539	0.000	65536.000
C:\dbluns\db14	0.132	0.000	165.451	0.000	65536.000
C:\dbluns\db15	0.139	0.000	160.641	0.000	65536.000

### Memory System Performance (of checksum)

<i>Counter</i>	<i>Average</i>	<i>Minimum</i>	<i>Maximum</i>
<i>% Processor Time</i>	0.564	0.000	1.862
<i>Available MBytes</i>	62001.572	61937.000	62018.000
<i>Free System Page Table Entries</i>	33555289.344	33555288.000	33555290.000
<i>Transition Pages RePurposed/sec</i>	0.000	0.000	0.000
<i>Pool Nonpaged Bytes</i>	48117580.979	47652864.000	48787456.000
<i>Pool Paged Bytes</i>	98482634.294	91594752.000	102244352.000

Test Log1/19/2011 8:43:44 PM -- Jetstress testing begins ...  
 1/19/2011 8:43:44 PM -- Prepare testing begins ...  
 1/19/2011 8:44:00 PM -- Attaching databases ...  
 1/19/2011 8:44:00 PM -- Prepare testing ends.  
 1/19/2011 8:44:00 PM -- Dispatching transactions begins ...  
 1/19/2011 8:44:00 PM -- Database cache settings: (minimum: 480.0 MB, maximum: 3.8 GB)  
 1/19/2011 8:44:00 PM -- Database flush thresholds: (start: 38.4 MB, stop: 76.8 MB)  
 1/19/2011 8:44:21 PM -- Database read latency thresholds: (average: 20 msec/read, maximum: 200 msec/read).  
 1/19/2011 8:44:21 PM -- Log write latency thresholds: (average: 10 msec/write, maximum: 200 msec/write).  
 1/19/2011 8:44:33 PM -- Operation mix: Sessions 2, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.  
 1/19/2011 8:44:33 PM -- Performance logging begins (interval: 15000 ms).  
 1/19/2011 8:44:33 PM -- Attaining prerequisites:

1/19/2011 9:05:47 PM -- \MSEExchange Database(JetstressWin)\Database Cache Size, Last: 3624653000.0 (lower bound: 3623879000.0, upper bound: none)  
1/20/2011 9:05:47 PM -- Performance logging ends.  
1/20/2011 9:13:49 PM -- JetInterop batch transaction stats: 58347, 59002, 58742, 58702, 58612, 58877, 58621, 58809, 58826, 58609, 58702, 58324, 58275, 58360 and 58785.  
1/20/2011 9:13:49 PM -- Dispatching transactions ends.  
1/20/2011 9:13:49 PM -- Shutting down databases ...  
1/20/2011 9:17:16 PM -- Instance2668.1 (complete), Instance2668.2 (complete), Instance2668.3 (complete), Instance2668.4 (complete), Instance2668.5 (complete), Instance2668.6 (complete), Instance2668.7 (complete), Instance2668.8 (complete), Instance2668.9 (complete), Instance2668.10 (complete), Instance2668.11 (complete), Instance2668.12 (complete), Instance2668.13 (complete), Instance2668.14 (complete) and Instance2668.15 (complete)  
1/20/2011 9:17:17 PM -- Performance logging begins (interval: 30000 ms).  
1/20/2011 9:17:17 PM -- Verifying database checksums ...  
1/21/2011 2:03:45 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), C:\dbluns\db11 (100% processed), C:\dbluns\db12 (100% processed), C:\dbluns\db13 (100% processed), C:\dbluns\db14 (100% processed) and C:\dbluns\db15 (100% processed)  
1/21/2011 2:03:45 AM -- Performance logging ends.  
1/21/2011 2:03:45 AM -- C:\ESRP3.0\_NL-SAS-R5\_1GB\Stress\DBChecksum\_2011\_1\_20\_21\_17\_16.blg has 572 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>
Instance1304.1	171784.59	03:10:28	15.03
Instance1304.2	171792.59	02:51:22	16.71
Instance1304.3	171784.59	02:46:24	17.21
Instance1304.4	171784.59	03:18:19	14.44
Instance1304.5	171784.59	02:47:10	17.13
Instance1304.6	171792.59	02:56:16	16.24
Instance1304.7	171776.59	02:52:32	16.59
Instance1304.8	171784.59	03:13:01	14.83
Instance1304.9	171792.59	03:16:37	14.56
Instance1304.10	171792.59	02:51:45	16.67
Instance1304.11	171800.59	02:44:10	17.44
Instance1304.12	171776.59	03:11:15	14.97
Instance1304.13	171776.59	03:14:43	14.70
Instance1304.14	171776.59	02:58:25	16.04
Instance1304.15	171792.59	02:50:37	16.78

## Jetstress System Parameters

<i>Thread Count</i>	2 (per database)
<i>Minimum Database Cache</i>	480.0 MB
<i>Maximum Database Cache</i>	3840.0 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>Instance1304.1</i>	Log Path: C:\logluns\log1 Database: C:\dbluns\db1\Jetstress001001.edb
<i>Instance1304.2</i>	Log Path: C:\logluns\log2 Database: C:\dbluns\db2\Jetstress002001.edb
<i>Instance1304.3</i>	Log Path: C:\logluns\log3 Database: C:\dbluns\db3\Jetstress003001.edb
<i>Instance1304.4</i>	Log Path: C:\logluns\log4 Database: C:\dbluns\db4\Jetstress004001.edb
<i>Instance1304.5</i>	Log Path: C:\logluns\log5 Database: C:\dbluns\db5\Jetstress005001.edb
<i>Instance1304.6</i>	Log Path: C:\logluns\log6 Database: C:\dbluns\db6\Jetstress006001.edb
<i>Instance1304.7</i>	Log Path: C:\logluns\log7 Database: C:\dbluns\db7\Jetstress007001.edb
<i>Instance1304.8</i>	Log Path: C:\logluns\log8 Database: C:\dbluns\db8\Jetstress008001.edb
<i>Instance1304.9</i>	Log Path: C:\logluns\log9 Database: C:\dbluns\db9\Jetstress009001.edb
<i>Instance1304.10</i>	Log Path: C:\logluns\log10 Database: C:\dbluns\db10\Jetstress010001.edb
<i>Instance1304.11</i>	Log Path: C:\logluns\log11 Database: C:\dbluns\db11\Jetstress011001.edb
<i>Instance1304.12</i>	Log Path: C:\logluns\log12 Database: C:\dbluns\db12\Jetstress012001.edb
<i>Instance1304.13</i>	Log Path: C:\logluns\log13 Database: C:\dbluns\db13\Jetstress013001.edb
<i>Instance1304.14</i>	Log Path: C:\logluns\log14 Database: C:\dbluns\db14\Jetstress014001.edb
<i>Instance1304.15</i>	Log Path: C:\logluns\log15 Database: C:\dbluns\db15\Jetstress015001.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>
Instance1304.1	373.029	0.000	59.222	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance1304.2	224.595	0.000	66.058	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance1304.3	211.667	0.000	67.873	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance1304.4	235.888	0.000	57.380	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance1304.5	220.839	0.000	68.439	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance1304.6	226.417	0.000	64.965	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance1304.7	224.057	0.000	66.033	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance1304.8	234.311	0.000	58.711	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance1304.9	242.714	0.000	57.223	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance1304.10	222.437	0.000	66.456	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance1304.11	214.572	0.000	69.391	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance1304.12	226.457	0.000	59.764	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance1304.13	250.077	0.000	58.600	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance1304.14	217.097	0.000	63.671	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance1304.15	215.761	0.000	66.007	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

## Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	0.508	0.000	1.647
Available MBytes	62026.414	62007.000	62029.000
Free System Page Table Entries	33555289.631	33555288.000	33555290.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	48051282.747	48046080.000	48070656.000
Pool Paged Bytes	108544620.606	108408832.000	108666880.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log1/21/2011 4:26:46 AM -- Jetstress testing begins ...

1/21/2011 4:26:46 AM -- Prepare testing begins ...

1/21/2011 4:27:01 AM -- Attaching databases ...

1/21/2011 4:27:01 AM -- Prepare testing ends.

1/21/2011 4:27:22 AM -- Performance logging begins (interval: 30000 ms).

1/21/2011 4:27:22 AM -- Backing up databases ...

1/21/2011 7:45:42 AM -- Performance logging ends.

1/21/2011 7:45:42 AM -- Instance1304.1 (100% processed), Instance1304.2 (100% processed), Instance1304.3 (100% processed), Instance1304.4 (100% processed), Instance1304.5 (100% processed), Instance1304.6 (100% processed), Instance1304.7 (100% processed), Instance1304.8 (100% processed), Instance1304.9 (100% processed), Instance1304.10 (100% processed), Instance1304.11 (100% processed), Instance1304.12 (100% processed), Instance1304.13 (100% processed), Instance1304.14 (100% processed) and Instance1304.15 (100% processed)

1/21/2011 7:45:42 AM -- C:\ESRP3.0\_NL-SAS-

R5\_1GB\BackupTest\DatabaseBackup\_2011\_1\_21\_4\_27\_1.blg has 396 samples.

## Soft Recovery Test Result Report: HBS 107

### Soft-Recovery Statistics - All

Database Instance	Log files replayed	Elapsed seconds
Instance1304.1	510	2253.4239579
Instance1304.2	510	2106.2376994
Instance1304.3	516	1982.1238814
Instance1304.4	510	1917.1497673
Instance1304.5	500	2207.5442773
Instance1304.6	514	2188.9802447
Instance1304.7	509	1982.1238814
Instance1304.8	519	2153.4433823
Instance1304.9	512	2103.8508952
Instance1304.10	518	2154.5041842
Instance1304.11	528	2063.5404244
Instance1304.12	513	2194.5494545

<i>Database Instance</i>	<i>Log files replayed</i>	<i>Elapsed seconds</i>
Instance1304.13	512	2111.0113078
Instance1304.14	523	2197.2014592
Instance1304.15	526	2186.3282401

## Database Configuration

<i>Instance1304.1</i>	Log Path: C:\logluns\log1 Database: C:\dbluns\db1\Jetstress001001.edb
<i>Instance1304.2</i>	Log Path: C:\logluns\log2 Database: C:\dbluns\db2\Jetstress002001.edb
<i>Instance1304.3</i>	Log Path: C:\logluns\log3 Database: C:\dbluns\db3\Jetstress003001.edb
<i>Instance1304.4</i>	Log Path: C:\logluns\log4 Database: C:\dbluns\db4\Jetstress004001.edb
<i>Instance1304.5</i>	Log Path: C:\logluns\log5 Database: C:\dbluns\db5\Jetstress005001.edb
<i>Instance1304.6</i>	Log Path: C:\logluns\log6 Database: C:\dbluns\db6\Jetstress006001.edb
<i>Instance1304.7</i>	Log Path: C:\logluns\log7 Database: C:\dbluns\db7\Jetstress007001.edb
<i>Instance1304.8</i>	Log Path: C:\logluns\log8 Database: C:\dbluns\db8\Jetstress008001.edb
<i>Instance1304.9</i>	Log Path: C:\logluns\log9 Database: C:\dbluns\db9\Jetstress009001.edb
<i>Instance1304.10</i>	Log Path: C:\logluns\log10 Database: C:\dbluns\db10\Jetstress010001.edb
<i>Instance1304.11</i>	Log Path: C:\logluns\log11 Database: C:\dbluns\db11\Jetstress011001.edb
<i>Instance1304.12</i>	Log Path: C:\logluns\log12 Database: C:\dbluns\db12\Jetstress012001.edb
<i>Instance1304.13</i>	Log Path: C:\logluns\log13 Database: C:\dbluns\db13\Jetstress013001.edb
<i>Instance1304.14</i>	Log Path: C:\logluns\log14 Database: C:\dbluns\db14\Jetstress014001.edb
<i>Instance1304.15</i>	Log Path: C:\logluns\log15 Database: C:\dbluns\db15\Jetstress015001.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>
Instance1304.1	391.160	35.110	128.810	1.343	67374.553	20964.473	7.925	0.000	2.016	0.000	129241.230	0.000
Instance1304.2	333.697	24.884	141.145	1.449	65062.930	22598.621	7.104	0.000	2.172	0.000	135282.617	0.000
Instance1304.3	342.874	38.321	156.371	1.564	66981.069	22090.037	7.611	0.001	2.345	0.002	133069.706	1.043
Instance1304.4	320.038	35.372	157.720	1.594	64647.802	22075.284	9.155	0.000	2.392	0.000	137423.185	0.000
Instance1304.5	394.715	38.203	135.718	1.349	63903.747	21326.157	7.106	0.000	2.024	0.000	128157.253	0.000
Instance1304.6	360.025	32.992	138.409	1.397	65050.697	22067.011	6.782	0.000	2.096	0.000	129873.727	0.000
Instance1304.7	344.593	40.063	152.138	1.542	67807.207	21689.613	7.332	0.001	2.316	0.003	127261.972	2.086
Instance1304.8	343.694	32.706	142.457	1.448	64341.791	22152.150	6.887	0.004	2.173	0.006	131545.058	0.959
Instance1304.9	371.742	51.433	142.457	1.461	64702.257	21970.881	7.275	0.001	2.193	0.006	134701.630	0.981
Instance1304.10	393.605	38.311	140.879	1.443	62437.956	22274.876	7.864	0.001	2.165	0.001	136818.655	0.959
Instance1304.11	334.268	42.115	148.274	1.536	65050.022	23360.000	8.212	0.001	2.306	0.006	140754.030	2.000
Instance1304.12	349.708	27.066	136.984	1.401	65389.115	21624.471	6.444	0.000	2.101	0.000	131249.399	0.000
Instance1304.13	340.631	32.412	141.915	1.456	64852.896	21803.564	6.886	0.002	2.185	0.001	133809.577	0.979
Instance1304.14	348.518	43.864	139.334	1.417	65998.772	21744.941	7.464	0.000	2.125	0.000	127317.623	0.000
Instance1304.15	334.095	31.595	142.301	1.444	65683.109	22792.502	7.544	0.001	2.166	0.001	134764.970	0.945

## 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>
Instance1304.1	18.312	257149.606
Instance1304.2	19.681	258392.677
Instance1304.3	20.341	258827.299
Instance1304.4	19.554	258313.278
Instance1304.5	18.826	256700.300
Instance1304.6	18.918	258735.737
Instance1304.7	19.359	256094.186
Instance1304.8	18.991	257989.282
Instance1304.9	19.562	255157.734
Instance1304.10	18.515	258124.410
Instance1304.11	19.005	258012.856
Instance1304.12	19.392	257754.404
Instance1304.13	18.482	257252.613
Instance1304.14	19.454	255888.819
Instance1304.15	19.743	258511.597

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>
Instance1304.1	391.160	35.110	147.122	1.343	90996.038	20964.473	7.925	0.000	2.016	0.000	129241.230	0.000
Instance1304.2	333.697	24.884	160.827	1.449	88721.964	22598.621	7.104	0.000	2.172	0.000	135282.617	0.000
Instance1304.3	342.874	38.321	176.712	1.564	89064.268	22090.037	7.611	0.001	2.345	0.002	133069.706	1.043
Instance1304.4	320.038	35.372	177.273	1.594	86009.654	22075.284	9.155	0.000	2.392	0.000	137423.185	0.000
Instance1304.5	394.715	38.203	154.543	1.349	87389.073	21326.157	7.106	0.000	2.024	0.000	128157.253	0.000
Instance1304.6	360.025	32.992	157.327	1.397	88340.702	22067.011	6.782	0.000	2.096	0.000	129873.727	0.000
Instance1304.7	344.593	40.063	171.496	1.542	89061.345	21689.613	7.332	0.001	2.316	0.003	127261.972	2.086
Instance1304.8	343.694	32.706	161.448	1.448	87120.598	22152.150	6.887	0.004	2.173	0.006	131545.058	0.959
Instance1304.9	371.742	51.433	162.019	1.461	87697.623	21970.881	7.275	0.001	2.193	0.006	134701.630	0.981
Instance1304.10	393.605	38.311	159.394	1.443	85168.822	22274.876	7.864	0.001	2.165	0.001	136818.655	0.959
Instance1304.11	334.268	42.115	167.279	1.536	86973.073	23360.000	8.212	0.001	2.306	0.006	140754.030	2.000
Instance1304.12	349.708	27.066	156.376	1.401	89244.184	21624.471	6.444	0.000	2.101	0.000	131249.399	0.000
Instance1304.13	340.631	32.412	160.396	1.456	87022.299	21803.564	6.886	0.002	2.185	0.001	133809.577	0.979
Instance1304.14	348.518	43.864	158.789	1.417	89263.294	21744.941	7.464	0.000	2.125	0.000	127317.623	0.000
Instance1304.15	334.095	31.595	162.044	1.444	89176.984	22792.502	7.544	0.001	2.166	0.001	134764.970	0.945

## Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	1.643	0.000	10.578
Available MBytes	58073.662	58002.000	61417.000
Free System Page Table Entries	33555289.767	33555288.000	33555290.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	71177628.165	48447488.000	73203712.000
Pool Paged Bytes	111383605.123	111337472.000	111529984.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log1/21/2011 8:30:28 AM -- Jetstress testing begins ...

1/21/2011 8:30:28 AM -- Prepare testing begins ...

1/21/2011 8:30:44 AM -- Attaching databases ...

1/21/2011 8:30:44 AM -- Prepare testing ends.

1/21/2011 8:30:44 AM -- Dispatching transactions begins ...

1/21/2011 8:30:44 AM -- Database cache settings: (minimum: 480.0 MB, maximum: 3.8 GB)

1/21/2011 8:30:44 AM -- Database flush thresholds: (start: 38.4 MB, stop: 76.8 MB)

1/21/2011 8:31:01 AM -- Database read latency thresholds: (average: 20 msec/read, maximum: 100 msec/read).

1/21/2011 8:31:01 AM -- Log write latency thresholds: (average: 10 msec/write, maximum: 100 msec/write).

1/21/2011 8:31:08 AM -- Operation mix: Sessions 2, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.

1/21/2011 8:31:08 AM -- Performance logging begins (interval: 15000 ms).

1/21/2011 8:31:08 AM -- Generating log files ...

1/21/2011 4:17:30 PM -- C:\logluns\log1 (102.2% generated), C:\logluns\log2 (102.2% generated), C:\logluns\log3 (103.4% generated), C:\logluns\log4 (102.2% generated), C:\logluns\log5 (100.2% generated), C:\logluns\log6 (103.0% generated), C:\logluns\log7 (102.0% generated), C:\logluns\log8 (104.0% generated), C:\logluns\log9 (102.6% generated), C:\logluns\log10 (103.8% generated), C:\logluns\log11 (105.8% generated), C:\logluns\log12 (102.8% generated), C:\logluns\log13 (102.6% generated), C:\logluns\log14 (104.8% generated) and C:\logluns\log15 (105.4% generated)

1/21/2011 4:17:31 PM -- Performance logging ends.

1/21/2011 4:17:31 PM -- JetInterop batch transaction stats: 22426, 22228, 22544, 22392, 22240, 22551, 22460, 22541, 22110, 22492, 22740, 22428, 22296, 22635 and 22882.

1/21/2011 4:17:31 PM -- Dispatching transactions ends.

1/21/2011 4:17:31 PM -- Shutting down databases ...

1/21/2011 4:18:35 PM -- Instance1304.1 (complete), Instance1304.2 (complete), Instance1304.3 (complete), Instance1304.4 (complete), Instance1304.5 (complete), Instance1304.6 (complete), Instance1304.7 (complete), Instance1304.8 (complete), Instance1304.9 (complete), Instance1304.10 (complete), Instance1304.11 (complete), Instance1304.12 (complete), Instance1304.13 (complete), Instance1304.14 (complete) and Instance1304.15 (complete)

1/21/2011 4:18:35 PM -- C:\ESRP3.0\_NL-SAS-R5\_1GB\SoftRecovery\Performance\_2011\_1\_21\_8\_31\_1.blg has 1862 samples.

1/21/2011 4:18:35 PM -- Creating test report ...

1/21/2011 4:18:46 PM -- Instance1304.1 has 20.2 for I/O Database Reads Average Latency.

1/21/2011 4:18:46 PM -- Instance1304.1 has 2.3 for I/O Log Writes Average Latency.

1/21/2011 4:18:46 PM -- Instance1304.1 has 2.3 for I/O Log Reads Average Latency.

1/21/2011 4:18:46 PM -- Instance1304.2 has 18.6 for I/O Database Reads Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.2 has 3.3 for I/O Log Writes Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.2 has 3.3 for I/O Log Reads Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.3 has 17.2 for I/O Database Reads Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.3 has 2.5 for I/O Log Writes Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.3 has 2.5 for I/O Log Reads Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.4 has 24.1 for I/O Database Reads Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.4 has 2.8 for I/O Log Writes Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.4 has 2.8 for I/O Log Reads Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.5 has 17.3 for I/O Database Reads Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.5 has 1.1 for I/O Log Writes Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.5 has 1.1 for I/O Log Reads Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.6 has 19.3 for I/O Database Reads Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.6 has 1.1 for I/O Log Writes Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.6 has 1.1 for I/O Log Reads Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.7 has 16.3 for I/O Database Reads Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.7 has 0.8 for I/O Log Writes Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.7 has 0.8 for I/O Log Reads Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.8 has 22.1 for I/O Database Reads Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.8 has 1.4 for I/O Log Writes Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.8 has 1.4 for I/O Log Reads Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.9 has 20.8 for I/O Database Reads Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.9 has 2.5 for I/O Log Writes Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.9 has 2.5 for I/O Log Reads Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.10 has 19.1 for I/O Database Reads Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.10 has 2.2 for I/O Log Writes Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.10 has 2.2 for I/O Log Reads Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.11 has 16.3 for I/O Database Reads Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.11 has 0.8 for I/O Log Writes Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.11 has 0.8 for I/O Log Reads Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.12 has 19.6 for I/O Database Reads Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.12 has 1.6 for I/O Log Writes Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.12 has 1.6 for I/O Log Reads Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.13 has 21.2 for I/O Database Reads Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.13 has 1.5 for I/O Log Writes Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.13 has 1.5 for I/O Log Reads Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.14 has 20.4 for I/O Database Reads Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.14 has 1.2 for I/O Log Writes Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.14 has 1.2 for I/O Log Reads Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.15 has 16.4 for I/O Database Reads Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.15 has 0.9 for I/O Log Writes Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.15 has 0.9 for I/O Log Reads Average Latency.  
1/21/2011 4:18:46 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.  
1/21/2011 4:18:46 PM -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.  
1/21/2011 4:18:46 PM -- C:\ESRP3.0\_NL-SAS-R5\_1GB\SoftRecovery\Performance\_2011\_1\_21\_8\_31\_1.xml has 1861 samples queried.  
1/21/2011 4:18:46 PM -- C:\ESRP3.0\_NL-SAS-R5\_1GB\SoftRecovery\Performance\_2011\_1\_21\_8\_31\_1.html is saved.  
1/21/2011 11:56:44 PM -- Performance logging begins (interval: 4000 ms).  
1/21/2011 11:56:44 PM -- Recovering databases ...  
1/22/2011 12:34:18 AM -- Performance logging ends.  
1/22/2011 12:34:18 AM -- Instance1304.1 (2253.4239579), Instance1304.2 (2106.2376994), Instance1304.3 (1982.1238814), Instance1304.4 (1917.1497673), Instance1304.5

(2207.5442773), Instance1304.6 (2188.9802447), Instance1304.7 (1982.1238814), Instance1304.8 (2153.4433823), Instance1304.9 (2103.8508952), Instance1304.10 (2154.5041842), Instance1304.11 (2063.5404244), Instance1304.12 (2194.5494545), Instance1304.13 (2111.0113078), Instance1304.14 (2197.2014592) and Instance1304.15 (2186.3282401)

1/22/2011 12:34:18 AM -- C:\ESRP3.0\_NL-SAS-

R5\_1GB\SoftRecovery\SoftRecovery\_2011\_1\_21\_23\_56\_39.blg has 559 samples.

## Soft Recovery Test Performance Result: HBS 107

### Test Summary

<b>Overall Test Result</b>	<b>Fail</b>
<b>Machine Name</b>	HBS107
<b>Test Description</b>	
<b>Test Start Time</b>	1/21/2011 8:30:28 AM
<b>Test End Time</b>	1/21/2011 4:18:35 PM
<b>Collection Start Time</b>	1/21/2011 8:31:23 AM
<b>Collection End Time</b>	1/21/2011 4:17:20 PM
<b>Jetstress Version</b>	14.01.0043.000
<b>Ese Version</b>	14.00.0639.019
<b>Operating System</b>	Windows Server 2008 R2 Enterprise (6.1.7600.0)
<b>Performance Log</b>	C:\ESRP3.0_NL-SAS-R5_1GB\SoftRecovery\Performance_2011_1_21_8_31_1.blg

### Test Issues

<b>Fail</b>	Instance1304.1 has 10 maximum database read latency errors.
<b>Fail</b>	Instance1304.2 has 9 maximum database read latency errors.
<b>Fail</b>	Instance1304.2 has 7 maximum log write latency errors.
<b>Fail</b>	Instance1304.3 has 10 maximum database read latency errors.
<b>Fail</b>	Instance1304.3 has 8 maximum log write latency errors.
<b>Fail</b>	Instance1304.4 has 17 maximum database read latency errors.
<b>Fail</b>	Instance1304.6 has 10 maximum database read latency errors.
<b>Fail</b>	Instance1304.8 has 19 maximum database read latency errors.
<b>Fail</b>	Instance1304.9 has 13 maximum database read latency errors.
<b>Fail</b>	Instance1304.10 has 8 maximum database read latency errors.
<b>Fail</b>	Instance1304.12 has 14 maximum database read latency errors.
<b>Fail</b>	Instance1304.12 has 7 maximum log write latency errors.
<b>Fail</b>	Instance1304.13 has 20 maximum database read latency errors.
<b>Fail</b>	Instance1304.14 has 12 maximum database read latency errors.
<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>	317.035
<i>Capacity Percentage</i>	100%
<i>Throughput Percentage</i>	100%
<i>Initial Database Size (bytes)</i>	2702088536064
<i>Final Database Size (bytes)</i>	2706828099584
<i>Database Files (Count)</i>	15

## Jetstress System Parameters

<i>Thread Count</i>	2 (per database)
<i>Minimum Database Cache</i>	480.0 MB
<i>Maximum Database Cache</i>	3840.0 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>Instance1304.1</i>	Log Path: C:\logluns\log1 Database: C:\dbluns\db1\Jetstress001001.edb
<i>Instance1304.2</i>	Log Path: C:\logluns\log2 Database: C:\dbluns\db2\Jetstress002001.edb
<i>Instance1304.3</i>	Log Path: C:\logluns\log3 Database: C:\dbluns\db3\Jetstress003001.edb
<i>Instance1304.4</i>	Log Path: C:\logluns\log4 Database: C:\dbluns\db4\Jetstress004001.edb
<i>Instance1304.5</i>	Log Path: C:\logluns\log5 Database: C:\dbluns\db5\Jetstress005001.edb
<i>Instance1304.6</i>	Log Path: C:\logluns\log6 Database: C:\dbluns\db6\Jetstress006001.edb
<i>Instance1304.7</i>	Log Path: C:\logluns\log7 Database: C:\dbluns\db7\Jetstress007001.edb
<i>Instance1304.8</i>	Log Path: C:\logluns\log8 Database: C:\dbluns\db8\Jetstress008001.edb
<i>Instance1304.9</i>	Log Path: C:\logluns\log9 Database: C:\dbluns\db9\Jetstress009001.edb
<i>Instance1304.10</i>	Log Path: C:\logluns\log10 Database: C:\dbluns\db10\Jetstress010001.edb
<i>Instance1304.11</i>	Log Path: C:\logluns\log11 Database: C:\dbluns\db11\Jetstress011001.edb

<i>Instance1304.12</i>	Log Path: C:\logluns\log12 Database: C:\dbluns\db12\Jetstress012001.edb
<i>Instance1304.13</i>	Log Path: C:\logluns\log13 Database: C:\dbluns\db13\Jetstress013001.edb
<i>Instance1304.14</i>	Log Path: C:\logluns\log14 Database: C:\dbluns\db14\Jetstress014001.edb
<i>Instance1304.15</i>	Log Path: C:\logluns\log15 Database: C:\dbluns\db15\Jetstress015001.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>
Instance1304.1	20.201	9.422	11.279	9.689	32574.315	36628.602	0.000	2.330	0.000	8.985	0.000	4517.270
Instance1304.2	18.625	9.047	11.165	9.581	32556.707	36717.044	0.000	3.289	0.000	8.930	0.000	4517.759
Instance1304.3	17.229	6.554	11.536	9.947	32556.707	36617.444	0.000	2.464	0.000	9.186	0.000	4459.293
Instance1304.4	24.137	12.912	11.370	9.796	32591.923	36635.651	0.000	2.791	0.000	9.045	0.000	4513.321
Instance1304.5	17.343	8.114	11.207	9.617	32521.492	36637.171	0.000	1.081	0.000	8.871	0.000	4563.418
Instance1304.6	19.267	9.275	11.416	9.841	32574.315	36594.929	0.000	1.053	0.000	9.095	0.000	4510.309
Instance1304.7	16.281	6.899	11.353	9.794	32451.061	36594.619	0.000	0.798	0.000	8.999	0.000	4489.804
Instance1304.8	22.118	13.059	11.502	9.906	32609.524	36608.889	0.000	1.407	0.000	9.157	0.000	4528.983
Instance1304.9	20.789	12.723	11.217	9.640	32574.315	36596.629	0.000	2.510	0.000	8.954	0.000	4598.816
Instance1304.10	19.115	8.764	11.382	9.837	32468.668	36557.542	0.000	2.231	0.000	9.112	0.000	4567.901
Instance1304.11	16.273	6.652	11.484	9.922	32415.845	36660.785	0.000	0.793	0.000	9.268	0.000	4557.821
Instance1304.12	19.558	12.604	11.245	9.660	32556.707	36737.097	0.000	1.611	0.000	9.001	0.000	4546.620
Instance1304.13	21.241	12.682	11.246	9.681	32644.746	36781.287	0.000	1.488	0.000	8.963	0.000	4591.105
Instance1304.14	20.368	8.960	11.455	9.886	32574.742	36631.085	0.000	1.162	0.000	9.244	0.000	4527.824
Instance1304.15	16.448	6.567	11.466	9.912	32451.061	36663.975	0.000	0.904	0.000	9.213	0.000	4543.166

## Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	0.504	0.000	3.102
Available MBytes	58136.408	58036.000	61799.000
Free System Page Table Entries	33555288.190	33555284.000	33555290.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	48142828.752	48037888.000	48181248.000
Pool Paged Bytes	110138107.325	108822528.000	110829568.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log1/21/2011 8:30:28 AM -- Jetstress testing begins ...

1/21/2011 8:30:28 AM -- Prepare testing begins ...

1/21/2011 8:30:44 AM -- Attaching databases ...

1/21/2011 8:30:44 AM -- Prepare testing ends.

1/21/2011 8:30:44 AM -- Dispatching transactions begins ...

1/21/2011 8:30:44 AM -- Database cache settings: (minimum: 480.0 MB, maximum: 3.8 GB)

1/21/2011 8:30:44 AM -- Database flush thresholds: (start: 38.4 MB, stop: 76.8 MB)

1/21/2011 8:31:01 AM -- Database read latency thresholds: (average: 20 msec/read, maximum: 100 msec/read).

1/21/2011 8:31:01 AM -- Log write latency thresholds: (average: 10 msec/write, maximum: 100 msec/write).

1/21/2011 8:31:08 AM -- Operation mix: Sessions 2, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.

1/21/2011 8:31:08 AM -- Performance logging begins (interval: 15000 ms).

1/21/2011 8:31:08 AM -- Generating log files ...

1/21/2011 4:17:30 PM -- C:\logluns\log1 (102.2% generated), C:\logluns\log2 (102.2% generated), C:\logluns\log3 (103.4% generated), C:\logluns\log4 (102.2% generated), C:\logluns\log5 (100.2% generated), C:\logluns\log6 (103.0% generated), C:\logluns\log7 (102.0% generated), C:\logluns\log8 (104.0% generated), C:\logluns\log9 (102.6% generated), C:\logluns\log10 (103.8% generated), C:\logluns\log11 (105.8% generated), C:\logluns\log12 (102.8% generated), C:\logluns\log13 (102.6% generated), C:\logluns\log14 (104.8% generated) and C:\logluns\log15 (105.4% generated)

1/21/2011 4:17:31 PM -- Performance logging ends.

1/21/2011 4:17:31 PM -- JetInterop batch transaction stats: 22426, 22228, 22544, 22392, 22240, 22551, 22460, 22541, 22110, 22492, 22740, 22428, 22296, 22635 and 22882.

1/21/2011 4:17:31 PM -- Dispatching transactions ends.

1/21/2011 4:17:31 PM -- Shutting down databases ...

1/21/2011 4:18:35 PM -- Instance1304.1 (complete), Instance1304.2 (complete), Instance1304.3 (complete), Instance1304.4 (complete), Instance1304.5 (complete), Instance1304.6 (complete), Instance1304.7 (complete), Instance1304.8 (complete), Instance1304.9 (complete), Instance1304.10 (complete), Instance1304.11 (complete), Instance1304.12 (complete), Instance1304.13 (complete), Instance1304.14 (complete) and Instance1304.15 (complete)

1/21/2011 4:18:35 PM -- C:\ESRP3.0\_NL-SAS-

R5\_1GB\SoftRecovery\Performance\_2011\_1\_21\_8\_31\_1.blg has 1862 samples.

1/21/2011 4:18:35 PM -- Creating test report ...

1/21/2011 4:18:46 PM -- Instance1304.1 has 20.2 for I/O Database Reads Average Latency.

1/21/2011 4:18:46 PM -- Instance1304.1 has 2.3 for I/O Log Writes Average Latency.

1/21/2011 4:18:46 PM -- Instance1304.1 has 2.3 for I/O Log Reads Average Latency.

1/21/2011 4:18:46 PM -- Instance1304.2 has 18.6 for I/O Database Reads Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.2 has 3.3 for I/O Log Writes Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.2 has 3.3 for I/O Log Reads Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.3 has 17.2 for I/O Database Reads Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.3 has 2.5 for I/O Log Writes Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.3 has 2.5 for I/O Log Reads Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.4 has 24.1 for I/O Database Reads Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.4 has 2.8 for I/O Log Writes Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.4 has 2.8 for I/O Log Reads Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.5 has 17.3 for I/O Database Reads Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.5 has 1.1 for I/O Log Writes Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.5 has 1.1 for I/O Log Reads Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.6 has 19.3 for I/O Database Reads Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.6 has 1.1 for I/O Log Writes Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.6 has 1.1 for I/O Log Reads Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.7 has 16.3 for I/O Database Reads Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.7 has 0.8 for I/O Log Writes Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.7 has 0.8 for I/O Log Reads Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.8 has 22.1 for I/O Database Reads Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.8 has 1.4 for I/O Log Writes Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.8 has 1.4 for I/O Log Reads Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.9 has 20.8 for I/O Database Reads Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.9 has 2.5 for I/O Log Writes Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.9 has 2.5 for I/O Log Reads Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.10 has 19.1 for I/O Database Reads Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.10 has 2.2 for I/O Log Writes Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.10 has 2.2 for I/O Log Reads Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.11 has 16.3 for I/O Database Reads Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.11 has 0.8 for I/O Log Writes Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.11 has 0.8 for I/O Log Reads Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.12 has 19.6 for I/O Database Reads Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.12 has 1.6 for I/O Log Writes Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.12 has 1.6 for I/O Log Reads Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.13 has 21.2 for I/O Database Reads Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.13 has 1.5 for I/O Log Writes Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.13 has 1.5 for I/O Log Reads Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.14 has 20.4 for I/O Database Reads Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.14 has 1.2 for I/O Log Writes Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.14 has 1.2 for I/O Log Reads Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.15 has 16.4 for I/O Database Reads Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.15 has 0.9 for I/O Log Writes Average Latency.  
1/21/2011 4:18:46 PM -- Instance1304.15 has 0.9 for I/O Log Reads Average Latency.  
1/21/2011 4:18:46 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.  
1/21/2011 4:18:46 PM -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.  
1/21/2011 4:18:46 PM -- C:\ESRP3.0\_NL-SAS-  
R5\_1GB\SoftRecovery\Performance\_2011\_1\_21\_8\_31\_1.xml has 1861 samples queried.

 **Hitachi Data Systems Corporation**

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