

Hitachi Adaptable Modular Storage 2500 Dynamically Provisioned 20,800 Mailbox Exchange 2010 Mailbox Resiliency Storage Solution

Tested with: ESRP – Storage Version 3.0

Test Date: December 2010 -January 2011

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Overview

This document provides information on a Hitachi Adaptable Modular Storage 2500 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 20,800 users and eight Hitachi Compute Blade 2000 server blades. This testing used a Hitachi Adaptable Modular Storage 2500 (AMS 2500) storage system using Hitachi Dynamic Provisioning in a two-pool RAID-10 configuration (one for databases and one for logs) in a resiliency configuration. These results help answer questions about the kind of performance capabilities to expect with a large-scale Exchange deployment on an AMS 2500.

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

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

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

This solution includes Exchange 2010 Mailbox Resiliency by using the Database Availability Group (DAG) feature. This tested configuration uses eight DAGs, each containing two database copies and two servers. The test configuration was capable of supporting 32,000 users with a 0.18 IOPS per user profile and user mailbox size of 3GB.

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

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

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

Solution Description

Deploying Microsoft Exchange Server 2010 requires careful consideration of all aspects of the solution architecture. Host servers need to be configured so that they are robust enough to handle the required Exchange load. The storage solution must be designed to provide the necessary performance while also being reliable and easy to administer. Of course, an effective backup and recovery plan should be incorporated into the solution as well. The aim of this solution report is to provide a tested configuration that uses an AMS 2500 to meet the needs of a large Exchange Server 2010 deployment.

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

Hitachi Dynamic Provisioning also carries the side benefit of thin provisioning, where physical space is only assigned from the pool to the DP-VOL as needed using 1GB chunks per RAID group, up to the logical size specified for each DP-VOL. Space from a 1GB chunk is then allocated as needed as 32MB

pool pages to that DP-VOL's logical block address range (divided up into 32MB strides). A pool can also be dynamically expanded by adding more RAID groups without disruption or requiring downtime. Upon expansion, a pool can easily be rebalanced so that the data and workload is wide striped evenly across the current and newly added RAID groups that make up the pool.

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

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

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

This solution included two copies of each Exchange database using eight DAGs, with each DAG configured with two server blades (one simulated) that host active mailboxes in 11 databases.

To target the 20,800-user resiliency solution, a Hitachi Adaptable Modular Storage 2500 (AMS 2500) was configured with 176 disks (of a maximum of 480) for Exchange and 32 additional disks for those LUNs used as boot volumes by the blade servers. Eight servers (one per DAG) were used, with each server configured with 2,600 mailboxes. There were 88 active databases and simulated database copies for the tests.

Each DAG contained two copies of the 11 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 both high-availability and disaster-recovery scenarios when the active and passive database copies are allocated among both DAG members and dispersed across both AMS 2500 systems. Each simulated DAG server node in this solution maintains a mirrored configuration and possesses adequate capacity and performance capabilities to support the second set of replicated databases.

Figure 1 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](#).

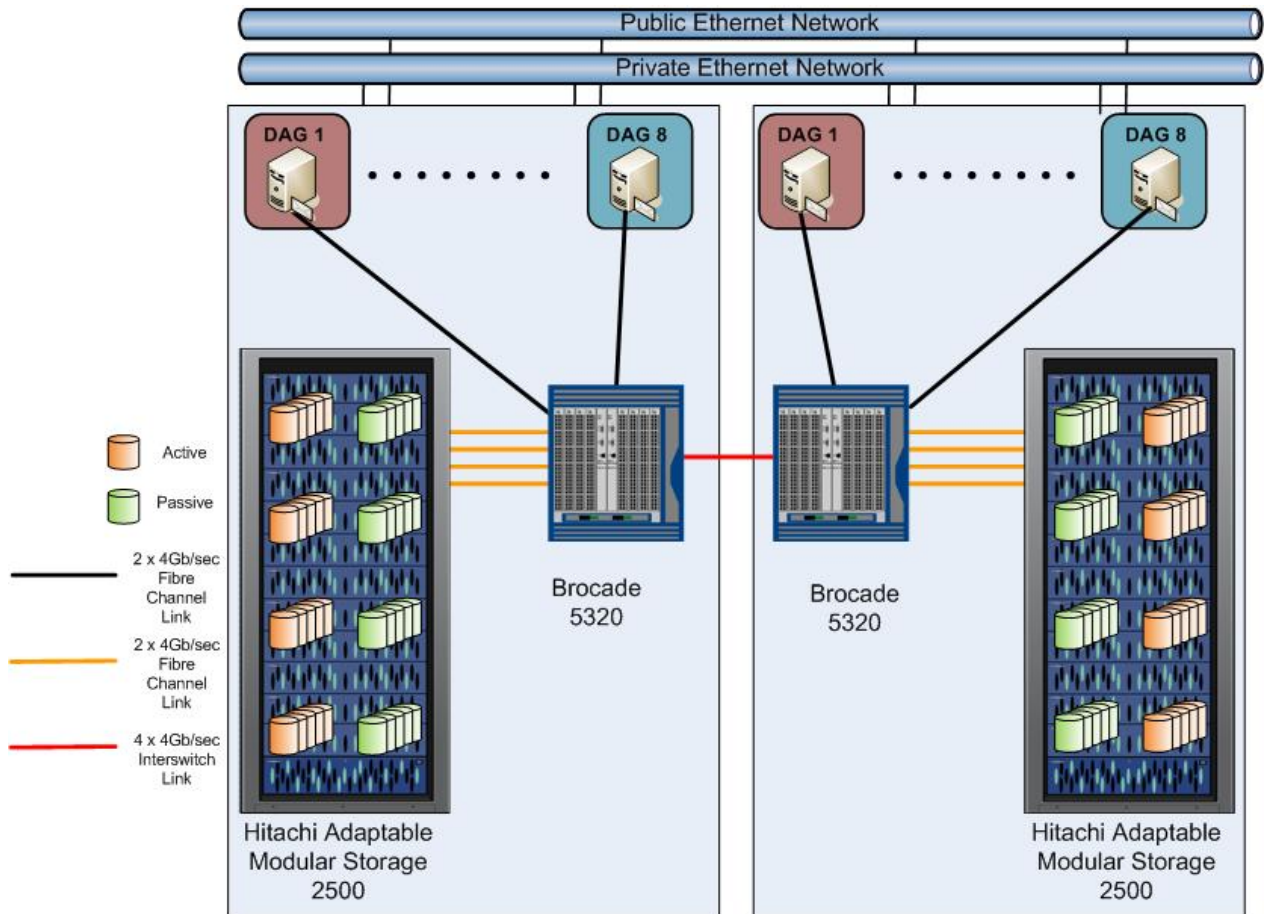


Figure 1

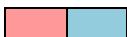

This solution enables organizations to consolidate Exchange Server 2010 DAG deployments on two 2500 storage systems. Using identical hardware and software configurations guarantees that an active database and its replicated copy do not share storage paths, disk spindles or storage controllers, making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

Table 1 illustrates how the disks in an AMS 2500 were organized into RAID groups for use by the databases, logs, or SAN boot. Each set of colored disks represents a RAID-10 (2D+ 2D) group. There were 176 2TB 7.2k RPM SAS disks used in these tests configured as 44 RAID groups for the Exchange databases and logs. Another 32 450GB 15k RPM SAS disks were used in these tests as eight RAID groups 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	41	41	41	42	42	42	42	43	43	43	43	44	44	44	44									
RKA 6	36	36	37	37	37	37	38	38	38	38	39	39	39	39	40	40	40	40	41					
RKA 5	30	30	31	31	31	31	32	32	32	32	33	33	33	33	34	34	34	34	35	35	35	35	36	36
RKA 4	23	25	25	25	25	26	26		26	26	27	27	27	27	28	28	28	28	29	29	29	29	30	30
RKA 3	18	19	19	19	19	20	20	20	20	21	21	21	21	22	22	22	22	23	23	23	23	24	24	24
RKA 2	12	13	13	13	13	14	14	14	14	15	15	15	15	16	16	16	16	17	17	17	17	18	18	18
RKA 1	7	7	7		8	8	8	8	9	9	9	9	10	10	10		10	11	11	11	11	12	12	12
RKA 0	1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	4	5	5	5	5	6	6	6	6

 Database RGs- Raid10 2+2 added to Database DP Pool
 Log RGs- Raid-10 2+2 added to Log DP Pool

 OS RGs- Raid-10 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 eight SAN boot volumes.

Two dynamic provisioning pools were created, one for the databases and the other for the logs. The database pool was created from 39 RAID-10 RAID groups and the log pool was created from five RAID-10 groups. From the database pool, 88 DP-VOLs (each specified to have a 1,600GB size limit) were created for 88 databases (11 per server). From the log pool, 88 DP-VOLs (each specified to have a size limit of 180GB) were created for 88 logs (11 per server).

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

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

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

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 1-11	96-106
0B	Logs 12-22	107-117
0C	Logs 23-33	118-128
0D	Logs 34-44	129-139
1A	Logs 45-55	140-150
1B	Logs 56-66	151-161

<i>Port</i>	<i>Log</i>	<i>Log DP-VOL</i>
1C	Logs 67-77	162-172
1D	Logs 78-88	173-183

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

Table 8. Adaptable Modular Storage 2500 Configuration Details

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

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

- Server processor utilization
- Server physical and virtual memory limitations
- Resource requirements for other applications
- Directory and network service latencies
- Network infrastructure limitations
- Replication and recovery requirements
- Client usage profiles

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

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

Targeted Customer Profile

This solution is designed for medium to large organizations that plan to consolidate their Exchange Server 2010 storage on high-performance, high-reliability storage systems. This configuration is designed to support 20,800 Exchange users with the following specifications:

- 16 Exchange servers (8 servers tested, 8 servers simulated for the database copies)
- 8 database availability groups each with two servers (one simulated) and two copies per database
- 2 Adaptable Modular Storage 2500s (one tested, using 16 4Gb/sec paths, with 8 used for the DB/Logs and 8 used for the SAN boot volumes)
- 0.15 IOPS per user (0.18 tested for 20 percent growth)
- 3GB 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>	20,800
<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>	2,600
<i>Number of databases per host</i>	11
<i>Number of copies per database</i>	2
<i>Number of mailboxes per database</i>	236 or 237
<i>Simulated profile: I/Os per second per mailbox (IOPS, include 20% headroom)</i>	0.18
<i>Database LU size</i>	1600GB
<i>Log LU size</i>	160GB
<i>Total database size for performance testing</i>	62,400
<i>% storage capacity used by Exchange database**</i>	44.1%

**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 (8 x 4Gb/sec ports)
<i>Switch type/model/firmware revision</i>	Brocade 5320, Fabric OS v6.4.0b
<i>HBA model and firmware</i>	HFCE0802 Firmware : 00300439
<i>Number of HBAs per host</i>	2 dual-ported HBA per host, 2 4Gb/sec port used per HBA
<i>Host server type</i>	Hitachi Compute Blade E55A2 2 2.93GHz six-core Intel Xeon X5670 CPU, 64GB memory
<i>Total number of disks tested in solution</i>	176
<i>Maximum number of spindles that can be hosted in the storage</i>	480

Table 11. Storage Software

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

Table 12. Storage Disk Configuration (Mailbox Store Disks)

<i>Disk type, speed and firmware revision</i>	SAS 2TB 7.2K 5C04
<i>Raw capacity per disk (GB)</i>	2TB
<i>Number of physical disks in test</i>	156 (dynamic provisioning pool)
<i>Total raw storage capacity (GB)</i>	312,000
<i>Disk slice size (GB)</i>	N /A
<i>Number of slices per LU or number of disks per LU</i>	N/A
<i>RAID level</i>	RAID-10 (2D+2D) at storage level
<i>Total formatted capacity</i>	141,570
<i>Storage capacity utilization</i>	45.4%
<i>Database capacity utilization</i>	45.1%

Table 13. Storage Disk Configuration (Transaction Log Disks)

<i>Disk type, speed and firmware revision</i>	SAS 2TB 7.2K 5C04
<i>Raw capacity per disk (GB)</i>	2TB
<i>Number of spindles in test</i>	20 (dynamic provisioning pool)
<i>Total raw storage capacity (GB)</i>	40000
<i>Disk slice size (GB)</i>	N/A
<i>Number of slices per LU or number of disks per LU</i>	N/A
<i>RAID level</i>	RAID-10 (2D+2D) at storage level
<i>Total formatted capacity</i>	18,150

Replication Configuration

Table 14. Replication Configuration

<i>Replication mechanism</i>	Exchange Server 2010 Database Availability Group (DAG)
<i>Number of links</i>	2
<i>Simulated link distance</i>	N/A
<i>Link type</i>	IP
<i>Link bandwidth</i>	GigE (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>	156 (dynamic provisioning pool)
<i>total raw storage capacity (GB)</i>	312,000
<i>Disk slice size (GB)</i>	N /A
<i>Number of slices per LU or number of disks per LU</i>	N/A
<i>Raid level</i>	RAID-10 (2D+2D) at storage level
<i>Total formatted capacity</i>	141,570
<i>Storage capacity utilization</i>	45.4%
<i>Database capacity utilization</i>	45.1%

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

<i>Disk type, speed and firmware revision</i>	SAS 2TB 7.2K 5C04
<i>Raw capacity per disk (GB)</i>	2TB
<i>Number of spindles in test</i>	20 (dynamic provisioning pool)
<i>Total raw storage capacity (GB)</i>	40000
<i>Disk slice size (GB)</i>	N/A
<i>Number of slices per LU or number of disks per LU</i>	N/A
<i>Raid level</i>	RAID-10 (2D+2D) at storage level
<i>Total formatted capacity</i>	18,150

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

Individual server metrics show the sum of the I/Os 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>	614
<i>Database Disk Reads Per Second</i>	360
<i>Database Disk Writes Per Second</i>	254
<i>Average Database Disk Read Latency (ms)</i>	15.6
<i>Average Database Disk Write Latency (ms)</i>	2.3
<i>Transaction Log I/O</i>	
<i>Log Disk Writes Per Second</i>	225
<i>Average Log Disk Write Latency (ms)</i>	0.6

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

<i>Database I/O</i>	
<i>Database Disk Transfers Per Second</i>	607
<i>Database Disk Reads Per Second</i>	356
<i>Database Disk Writes Per Second</i>	251
<i>Average Database Disk Read Latency (ms)</i>	15.3
<i>Average Database Disk Write Latency (ms)</i>	2.1
<i>Transaction Log I/O</i>	
<i>Log Disk Writes Per Second</i>	222
<i>Average Log Disk Write Latency (ms)</i>	0.6

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

<i>Database I/O</i>	
<i>Database Disk Transfers Per Second</i>	503
<i>Database Disk Reads Per Second</i>	296
<i>Database Disk Writes Per Second</i>	207
<i>Average Database Disk Read Latency (ms)</i>	17.4
<i>Average Database Disk Write Latency (ms)</i>	1.9
<i>Transaction Log I/O</i>	
<i>Log Disk Writes Per Second</i>	185
<i>Average Log Disk Write Latency (ms)</i>	0.6

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

<i>Database I/O</i>	
<i>Database Disk Transfers Per Second</i>	616
<i>Database Disk Reads Per Second</i>	361
<i>Database Disk Writes Per Second</i>	255
<i>Average Database Disk Read Latency (ms)</i>	15.4
<i>Average Database Disk Write Latency (ms)</i>	2.2
<i>Transaction Log I/O</i>	
<i>Log Disk Writes Per Second</i>	226
<i>Average Log Disk Write Latency (ms)</i>	0.6

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

<i>Database I/O</i>	
<i>Database Disk Transfers Per Second</i>	619
<i>Database Disk Reads Per Second</i>	363
<i>Database Disk Writes Per Second</i>	256
<i>Average Database Disk Read Latency (ms)</i>	15.4
<i>Average Database Disk Write Latency (ms)</i>	2.4
<i>Transaction Log I/O</i>	
<i>Log Disk Writes Per Second</i>	227
<i>Average Log Disk Write Latency (ms)</i>	0.6

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

<i>Database I/O</i>	
<i>Database Disk Transfers Per Second</i>	611
<i>Database Disk Reads Per Second</i>	358
<i>Database Disk Writes Per Second</i>	253
<i>Average Database Disk Read Latency (ms)</i>	15.4
<i>Average Database Disk Write Latency (ms)</i>	2.2
<i>Transaction Log I/O</i>	
<i>Log Disk Writes Per Second</i>	225
<i>Average Log Disk Write Latency (ms)</i>	0.6

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

<i>Database I/O</i>	
<i>Database Disk Transfers Per Second</i>	507
<i>Database Disk Reads Per Second</i>	298
<i>Database Disk Writes Per Second</i>	209
<i>Average Database Disk Read Latency (ms)</i>	17.3
<i>Average Database Disk Write Latency (ms)</i>	2.1
<i>Transaction Log I/O</i>	
<i>Log Disk Writes Per Second</i>	187
<i>Average Log Disk Write Latency (ms)</i>	0.6

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

<i>Database I/O</i>	
<i>Database Disk Transfers Per Second</i>	618
<i>Database Disk Reads Per Second</i>	362
<i>Database Disk Writes Per Second</i>	256
<i>Average Database Disk Read Latency (ms)</i>	15.3
<i>Average Database Disk Write Latency (ms)</i>	2.3
<i>Transaction Log I/O</i>	
<i>Log Disk Writes Per Second</i>	227
<i>Average Log Disk Write Latency (ms)</i>	0.6

Aggregate Performance Across All Servers Metric

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

Table 27. Aggregate Performance for Exchange Server 2010

<i>Database I/O</i>	
<i>Database Disk Transfers Per Second</i>	4697
<i>Database Disk Reads Per Second</i>	2755
<i>Database Disk Writes Per Second</i>	1942
<i>Average Database Disk Read Latency (ms)</i>	15.9
<i>Average Database Disk Write Latency (ms)</i>	2.2
<i>Transaction Log I/O</i>	
<i>Log Disk Writes Per Second</i>	1723
<i>Average Log Disk Write Latency (ms)</i>	0.6

Database Backup and Recovery Performance

This section has two tests: The first measures the sequential read rate of the database files and the second measures recovery/replay performance (playing transaction logs 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>	22.90
<i>MB Read Per Second Total Per Server</i>	251.89

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)	3.78
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Conclusion

This document details a tested and robust Exchange Server 2010 Resiliency solution capable of supporting 20,800 users with a 0.18 IOPS per user profile and user mailbox size of 3GB using eight DAGs each configured with two server nodes (one simulated).

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

Testing confirmed that an AMS 2500 is more than capable of delivering the IOPS and capacity requirements needed to support the active and replicated databases for 20,800 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 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

Overall Test Result	Pass
Machine Name	HBS107
Test Description	
Test Start Time	12/15/2010 12:17:04 AM
Test End Time	12/15/2010 2:42:51 AM
Collection Start Time	12/15/2010 12:23:54 AM
Collection End Time	12/15/2010 2:23:42 AM
Jetstress Version	14.01.0043.000
Ese Version	14.00.0639.019
Operating System	Windows Server 2008 R2 Enterprise (6.1.7600.0)
Performance Log	C:\ESRP3.0_NL-SAS-R10_3GB\Performance\Performance_2010_12_15_0_17_29.blg C:\ESRP3.0_NL-SAS-R10_3GB\Performance\DBChecksum_2010_12_15_2_42_51.blg

Database Sizing and Throughput

Achieved Transactional I/O per Second	614.44
Target Transactional I/O per Second	468
Initial Database Size (bytes)	6481400496128
Final Database Size (bytes)	6483799638016
Database Files (Count)	11

Jetstress System Parameters

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

Database Configuration

<i>Instance1012.1</i>	Log Path: C:\logluns\log1 Database: C:\dbluns\db1\Jetstress001001.edb
<i>Instance1012.2</i>	Log Path: C:\logluns\log2 Database: C:\dbluns\db2\Jetstress002001.edb
<i>Instance1012.3</i>	Log Path: C:\logluns\log3 Database: C:\dbluns\db3\Jetstress003001.edb
<i>Instance1012.4</i>	Log Path: C:\logluns\log4 Database: C:\dbluns\db4\Jetstress004001.edb
<i>Instance1012.5</i>	Log Path: C:\logluns\log5 Database: C:\dbluns\db5\Jetstress005001.edb
<i>Instance1012.6</i>	Log Path: C:\logluns\log6 Database: C:\dbluns\db6\Jetstress006001.edb
<i>Instance1012.7</i>	Log Path: C:\logluns\log7 Database: C:\dbluns\db7\Jetstress007001.edb
<i>Instance1012.8</i>	Log Path: C:\logluns\log8 Database: C:\dbluns\db8\Jetstress008001.edb
<i>Instance1012.9</i>	Log Path: C:\logluns\log9 Database: C:\dbluns\db9\Jetstress009001.edb
<i>Instance1012.10</i>	Log Path: C:\logluns\log10 Database: C:\dbluns\db10\Jetstress010001.edb
<i>Instance1012.11</i>	Log Path: C:\logluns\log11 Database: C:\dbluns\db11\Jetstress011001.edb

Transactional I/O Performance

<i>MSExchange Database => 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>
Instance1012.1	17.631	2.341	32.921	23.200	35951.304	35758.802	0.000	0.559	0.000	20.753	0.000	4494.404
Instance1012.2	15.735	2.620	32.640	22.959	36389.833	35719.677	0.000	0.616	0.000	20.276	0.000	4541.703
Instance1012.3	14.890	1.768	32.789	23.112	36643.247	35718.017	0.000	0.525	0.000	20.366	0.000	4545.419
Instance1012.4	14.974	2.480	32.691	23.217	36745.253	35676.194	0.000	0.634	0.000	20.262	0.000	4507.125
Instance1012.5	15.028	2.172	32.974	23.260	36953.847	35781.616	0.000	0.553	0.000	20.625	0.000	4563.913
Instance1012.6	15.314	2.545	32.887	23.329	36707.868	35757.489	0.000	0.634	0.000	20.672	0.000	4563.718
Instance1012.7	15.571	2.327	32.691	22.952	36414.927	35734.777	0.000	0.544	0.000	20.453	0.000	4542.762
Instance1012.8	15.382	2.086	32.001	22.644	37134.807	35763.018	0.000	0.643	0.000	20.097	0.000	4538.834
Instance1012.9	15.613	1.986	32.625	22.982	37126.565	35675.414	0.000	0.562	0.000	20.411	0.000	4523.791
Instance1012.10	15.570	2.312	33.230	23.412	36803.923	35650.100	0.000	0.639	0.000	20.687	0.000	4503.225
Instance1012.11	15.449	2.168	32.745	23.180	36685.764	35672.929	0.000	0.533	0.000	20.206	0.000	4505.563

Background Database Maintenance I/O Performance

<i>MSExchange Database ==> Instances</i>	<i>Database Maintenance IO Reads/sec</i>	<i>Database Maintenance IO Reads Average Bytes</i>
Instance1012.1	26.714	261356.715
Instance1012.2	27.357	261455.237
Instance1012.3	28.000	261473.628
Instance1012.4	28.062	261439.526
Instance1012.5	28.002	261447.369
Instance1012.6	27.765	261463.720
Instance1012.7	27.170	261461.013
Instance1012.8	27.354	261385.468
Instance1012.9	27.282	261494.341
Instance1012.10	27.561	261504.614
Instance1012.11	27.521	261501.699

Log Replication I/O Performance

<i>MSExchange Database ==> Instances</i>	<i>I/O Log Reads/sec</i>	<i>I/O Log Reads Average Bytes</i>
Instance1012.1	0.376	149063.766
Instance1012.2	0.371	144683.284
Instance1012.3	0.373	146628.145
Instance1012.4	0.368	145130.572
Instance1012.5	0.379	148477.035
Instance1012.6	0.381	148504.262
Instance1012.7	0.373	146515.464
Instance1012.8	0.368	143266.982
Instance1012.9	0.370	144696.281
Instance1012.10	0.375	146747.477
Instance1012.11	0.365	143161.477

Total I/O Performance

<i>MSExchange Database => 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>
Instance1012.1	17.631	2.341	59.635	23.200	136924.213	35758.802	18.547	0.559	0.376	20.753	149063.766	4494.404
Instance1012.2	15.735	2.620	59.997	22.959	139014.150	35719.677	15.987	0.616	0.371	20.276	144683.284	4541.703
Instance1012.3	14.890	1.768	60.789	23.112	140201.111	35718.017	17.202	0.525	0.373	20.366	146628.145	4545.419
Instance1012.4	14.974	2.480	60.753	23.217	140532.872	35676.194	18.062	0.634	0.368	20.262	145130.572	4507.125
Instance1012.5	15.028	2.172	60.976	23.260	140047.036	35781.616	16.081	0.553	0.379	20.625	148477.035	4563.913
Instance1012.6	15.314	2.545	60.652	23.329	139594.720	35757.489	17.416	0.634	0.381	20.672	148504.262	4563.718
Instance1012.7	15.571	2.327	59.861	22.952	138560.060	35734.777	16.109	0.544	0.373	20.453	146515.464	4542.762
Instance1012.8	15.382	2.086	59.355	22.644	140483.155	35763.018	18.411	0.643	0.368	20.097	143266.982	4538.834
Instance1012.9	15.613	1.986	59.907	22.982	139304.918	35675.414	19.655	0.562	0.370	20.411	144696.281	4523.791
Instance1012.10	15.570	2.312	60.791	23.412	138678.127	35650.100	18.554	0.639	0.375	20.687	146747.477	4503.225
Instance1012.11	15.449	2.168	60.266	23.180	139350.871	35672.929	16.595	0.533	0.365	20.206	143161.477	4505.563

Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	0.612	0.000	2.658
Available MBytes	59248.502	59229.000	59450.000
Free System Page Table Entries	33555287.998	33555287.000	33555288.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	38281378.812	37576704.000	38494208.000
Pool Paged Bytes	82907641.573	82051072.000	112652288.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log 12/15/2010 12:17:04 AM -- Jetstress testing begins ...

12/15/2010 12:17:04 AM -- Prepare testing begins ...

12/15/2010 12:17:16 AM -- Attaching databases ...

12/15/2010 12:17:16 AM -- Prepare testing ends.

12/15/2010 12:17:16 AM -- Dispatching transactions begins ...

12/15/2010 12:17:16 AM -- Database cache settings: (minimum: 352.0 MB, maximum: 2.8 GB)

12/15/2010 12:17:16 AM -- Database flush thresholds: (start: 28.2 MB, stop: 56.3 MB)

12/15/2010 12:17:29 AM -- Database read latency thresholds: (average: 20 msec/read, maximum: 100 msec/read).

12/15/2010 12:17:29 AM -- Log write latency thresholds: (average: 10 msec/write, maximum: 100 msec/write).

12/15/2010 12:17:37 AM -- Operation mix: Sessions 4, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.

12/15/2010 12:17:37 AM -- Performance logging begins (interval: 15000 ms).

12/15/2010 12:17:37 AM -- Attaining prerequisites:

12/15/2010 12:23:54 AM -- \MSExchange Database(JetstressWin)\Database Cache Size, Last: 2658886000.0 (lower bound: 2657511000.0, upper bound: none)

12/15/2010 2:23:54 AM -- Performance logging ends.

12/15/2010 2:42:16 AM -- JetInterop batch transaction stats: 15463, 15612, 15637, 15567, 15791, 15744, 15532, 15382, 15349, 15698 and 15458.

12/15/2010 2:42:21 AM -- Dispatching transactions ends.

12/15/2010 2:42:21 AM -- Shutting down databases ...

12/15/2010 2:42:51 AM -- Instance1012.1 (complete), Instance1012.2 (complete), Instance1012.3 (complete), Instance1012.4 (complete), Instance1012.5 (complete), Instance1012.6 (complete), Instance1012.7 (complete), Instance1012.8 (complete), Instance1012.9 (complete), Instance1012.10 (complete) and Instance1012.11 (complete)

12/15/2010 2:42:52 AM -- Performance logging begins (interval: 30000 ms).

12/15/2010 2:42:52 AM -- Verifying database checksums ...

12/15/2010 10:53:20 AM -- C:\dbluns\db1 (100% processed), C:\dbluns\db2 (100% processed), C:\dbluns\db3 (100% processed), C:\dbluns\db4 (100% processed), C:\dbluns\db5 (100% processed), C:\dbluns\db6 (100% processed), C:\dbluns\db7 (100% processed), C:\dbluns\db8 (100% processed), C:\dbluns\db9 (100% processed), C:\dbluns\db10 (100% processed) and C:\dbluns\db11 (100% processed)

12/15/2010 10:53:20 AM -- Performance logging ends.

12/15/2010 10:53:20 AM -- C:\ESRP3.0_NL-SAS-

R10_3GB\Performance\DBChecksum_2010_12_15_2_42_51.blg has 980 samples.

12/15/2010 10:53:30 AM -- C:\ESRP3.0_NL-SAS-

R10_3GB\Performance\DBChecksum_2010_12_15_2_42_51.html is saved.

12/15/2010 10:53:30 AM -- Verifying log checksums ...
12/15/2010 10:53:33 AM -- C:\logluns\log1 (12 log(s) processed), C:\logluns\log2 (12 log(s) processed), C:\logluns\log3 (12 log(s) processed), C:\logluns\log4 (12 log(s) processed), C:\logluns\log5 (12 log(s) processed), C:\logluns\log6 (10 log(s) processed), C:\logluns\log7 (11 log(s) processed), C:\logluns\log8 (12 log(s) processed), C:\logluns\log9 (11 log(s) processed), C:\logluns\log10 (12 log(s) processed) and C:\logluns\log11 (10 log(s) processed)
12/15/2010 10:53:33 AM -- C:\ESRP3.0_NL-SAS-R10_3GB\Performance\Performance_2010_12_15_0_17_29.blg has 503 samples.
12/15/2010 10:53:33 AM -- Creating test report ...
12/15/2010 10:53:37 AM -- Instance1012.1 has 17.6 for I/O Database Reads Average Latency.
12/15/2010 10:53:37 AM -- Instance1012.1 has 0.6 for I/O Log Writes Average Latency.
12/15/2010 10:53:37 AM -- Instance1012.1 has 0.6 for I/O Log Reads Average Latency.
12/15/2010 10:53:37 AM -- Instance1012.2 has 15.7 for I/O Database Reads Average Latency.
12/15/2010 10:53:37 AM -- Instance1012.2 has 0.6 for I/O Log Writes Average Latency.
12/15/2010 10:53:37 AM -- Instance1012.2 has 0.6 for I/O Log Reads Average Latency.
12/15/2010 10:53:37 AM -- Instance1012.3 has 14.9 for I/O Database Reads Average Latency.
12/15/2010 10:53:37 AM -- Instance1012.3 has 0.5 for I/O Log Writes Average Latency.
12/15/2010 10:53:37 AM -- Instance1012.3 has 0.5 for I/O Log Reads Average Latency.
12/15/2010 10:53:37 AM -- Instance1012.4 has 15.0 for I/O Database Reads Average Latency.
12/15/2010 10:53:37 AM -- Instance1012.4 has 0.6 for I/O Log Writes Average Latency.
12/15/2010 10:53:37 AM -- Instance1012.4 has 0.6 for I/O Log Reads Average Latency.
12/15/2010 10:53:37 AM -- Instance1012.5 has 15.0 for I/O Database Reads Average Latency.
12/15/2010 10:53:37 AM -- Instance1012.5 has 0.6 for I/O Log Writes Average Latency.
12/15/2010 10:53:37 AM -- Instance1012.5 has 0.6 for I/O Log Reads Average Latency.
12/15/2010 10:53:37 AM -- Instance1012.6 has 15.3 for I/O Database Reads Average Latency.
12/15/2010 10:53:37 AM -- Instance1012.6 has 0.6 for I/O Log Writes Average Latency.
12/15/2010 10:53:37 AM -- Instance1012.6 has 0.6 for I/O Log Reads Average Latency.
12/15/2010 10:53:37 AM -- Instance1012.7 has 15.6 for I/O Database Reads Average Latency.
12/15/2010 10:53:37 AM -- Instance1012.7 has 0.5 for I/O Log Writes Average Latency.
12/15/2010 10:53:37 AM -- Instance1012.7 has 0.5 for I/O Log Reads Average Latency.
12/15/2010 10:53:37 AM -- Instance1012.8 has 15.4 for I/O Database Reads Average Latency.
12/15/2010 10:53:37 AM -- Instance1012.8 has 0.6 for I/O Log Writes Average Latency.
12/15/2010 10:53:37 AM -- Instance1012.8 has 0.6 for I/O Log Reads Average Latency.
12/15/2010 10:53:37 AM -- Instance1012.9 has 15.6 for I/O Database Reads Average Latency.
12/15/2010 10:53:37 AM -- Instance1012.9 has 0.6 for I/O Log Writes Average Latency.
12/15/2010 10:53:37 AM -- Instance1012.9 has 0.6 for I/O Log Reads Average Latency.
12/15/2010 10:53:37 AM -- Instance1012.10 has 15.6 for I/O Database Reads Average Latency.
12/15/2010 10:53:37 AM -- Instance1012.10 has 0.6 for I/O Log Writes Average Latency.
12/15/2010 10:53:37 AM -- Instance1012.10 has 0.6 for I/O Log Reads Average Latency.
12/15/2010 10:53:37 AM -- Instance1012.11 has 15.4 for I/O Database Reads Average Latency.
12/15/2010 10:53:37 AM -- Instance1012.11 has 0.5 for I/O Log Writes Average Latency.
12/15/2010 10:53:37 AM -- Instance1012.11 has 0.5 for I/O Log Reads Average Latency.
12/15/2010 10:53:37 AM -- Test has 0 Maximum Database Page Fault Stalls/sec.
12/15/2010 10:53:37 AM -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.
12/15/2010 10:53:37 AM -- C:\ESRP3.0_NL-SAS-R10_3GB\Performance\Performance_2010_12_15_0_17_29.xml has 477 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	17987890	0	0	0	562121 MBytes / 28265 sec
C:\dbluns\db2\Jetstress002001.edb	17988402	0	0	0	562137 MBytes / 29118 sec
C:\dbluns\db3\Jetstress003001.edb	17988402	0	0	0	562137 MBytes / 17132 sec
C:\dbluns\db4\Jetstress004001.edb	17988146	0	0	0	562129 MBytes / 29127 sec
C:\dbluns\db5\Jetstress005001.edb	17988402	0	0	0	562137 MBytes / 26300 sec
C:\dbluns\db6\Jetstress006001.edb	17988402	0	0	0	562137 MBytes / 29427 sec
C:\dbluns\db7\Jetstress007001.edb	17988402	0	0	0	562137 MBytes / 28762 sec
C:\dbluns\db8\Jetstress008001.edb	17987890	0	0	0	562121 MBytes / 29146 sec
C:\dbluns\db9\Jetstress009001.edb	17987890	0	0	0	562121 MBytes / 26357 sec
C:\dbluns\db10\Jetstress010001.edb	17988146	0	0	0	562129 MBytes / 29205 sec
C:\dbluns\db11\Jetstress011001.edb	17987890	0	0	0	562121 MBytes / 28815 sec
(Sum)	197869862	0	0	0	6183433 MBytes / 29427 sec

Disk Subsystem Performance (of checksum)

<i>LogicalDisk</i>	<i>Avg. Disk sec/Read</i>	<i>Avg. Disk sec/Write</i>	<i>Disk Reads/sec</i>	<i>Disk Writes/sec</i>	<i>Avg. Disk Bytes/Read</i>
C:\dbluns\db1	0.092	0.000	318.039	0.000	65536.000
C:\dbluns\db2	0.091	0.000	308.720	0.000	65536.000
C:\dbluns\db3	0.056	0.000	524.984	0.000	65536.000
C:\dbluns\db4	0.090	0.000	308.567	0.000	65536.000
C:\dbluns\db5	0.081	0.000	341.967	0.000	65536.000
C:\dbluns\db6	0.091	0.000	305.309	0.000	65536.000
C:\dbluns\db7	0.090	0.000	312.206	0.000	65536.000
C:\dbluns\db8	0.091	0.000	308.580	0.000	65536.000
C:\dbluns\db9	0.081	0.000	341.216	0.000	65536.000
C:\dbluns\db10	0.090	0.000	307.967	0.000	65536.000
C:\dbluns\db11	0.091	0.000	312.120	0.000	65536.000

Memory System Performance (of checksum)

Counter	Average	Minimum	Maximum
% Processor Time	0.762	0.000	2.256
Available MBytes	62145.465	62128.000	62164.000
Free System Page Table Entries	33555288.000	33555288.000	33555288.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	43663940.963	43388928.000	43909120.000
Pool Paged Bytes	82337277.910	82259968.000	82714624.000

Test Log 12/15/2010 12:17:04 AM -- Jetstress testing begins ...

12/15/2010 12:17:04 AM -- Prepare testing begins ...

12/15/2010 12:17:16 AM -- Attaching databases ...

12/15/2010 12:17:16 AM -- Prepare testing ends.

12/15/2010 12:17:16 AM -- Dispatching transactions begins ...

12/15/2010 12:17:16 AM -- Database cache settings: (minimum: 352.0 MB, maximum: 2.8 GB)

12/15/2010 12:17:16 AM -- Database flush thresholds: (start: 28.2 MB, stop: 56.3 MB)

12/15/2010 12:17:29 AM -- Database read latency thresholds: (average: 20 msec/read, maximum: 100 msec/read).

12/15/2010 12:17:29 AM -- Log write latency thresholds: (average: 10 msec/write, maximum: 100 msec/write).

12/15/2010 12:17:37 AM -- Operation mix: Sessions 4, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.

12/15/2010 12:17:37 AM -- Performance logging begins (interval: 15000 ms).

12/15/2010 12:17:37 AM -- Attaining prerequisites:

12/15/2010 12:23:54 AM -- \MSExchange Database(JetstressWin)\Database Cache Size, Last: 2658886000.0 (lower bound: 2657511000.0, upper bound: none)

12/15/2010 2:23:54 AM -- Performance logging ends.

12/15/2010 2:42:16 AM -- JetInterop batch transaction stats: 15463, 15612, 15637, 15567, 15791, 15744, 15532, 15382, 15349, 15698 and 15458.

12/15/2010 2:42:21 AM -- Dispatching transactions ends.

12/15/2010 2:42:21 AM -- Shutting down databases ...

12/15/2010 2:42:51 AM -- Instance1012.1 (complete), Instance1012.2 (complete), Instance1012.3 (complete), Instance1012.4 (complete), Instance1012.5 (complete), Instance1012.6 (complete), Instance1012.7 (complete), Instance1012.8 (complete), Instance1012.9 (complete), Instance1012.10 (complete) and Instance1012.11 (complete)

12/15/2010 2:42:52 AM -- Performance logging begins (interval: 30000 ms).

12/15/2010 2:42:52 AM -- Verifying database checksums ...

12/15/2010 10:53:20 AM -- C:\dbluns\db1 (100% processed), C:\dbluns\db2 (100% processed), C:\dbluns\db3 (100% processed), C:\dbluns\db4 (100% processed), C:\dbluns\db5 (100% processed), C:\dbluns\db6 (100% processed), C:\dbluns\db7 (100% processed), C:\dbluns\db8 (100% processed), C:\dbluns\db9 (100% processed), C:\dbluns\db10 (100% processed) and C:\dbluns\db11 (100% processed)

12/15/2010 10:53:20 AM -- Performance logging ends.

12/15/2010 10:53:20 AM -- C:\ESRP3.0_NL-SAS-

R10_3GB\Performance\DBChecksum_2010_12_15_2_42_51.blg has 980 samples.

Stress Test Result Report: HBS 107

Test Summary

<i>Overall Test Result</i>	Pass
<i>Machine Name</i>	HBS107
<i>Test Description</i>	
<i>Test Start Time</i>	12/15/2010 8:27:13 PM
<i>Test End Time</i>	12/16/2010 9:32:51 PM
<i>Collection Start Time</i>	12/15/2010 8:33:35 PM
<i>Collection End Time</i>	12/16/2010 8:33:26 PM
<i>Jetstress Version</i>	14.01.0043.000
<i>Ese Version</i>	14.00.0639.019
<i>Operating System</i>	Windows Server 2008 R2 Enterprise (6.1.7600.0)
<i>Performance Log</i>	C:\ESRP3.0_NL-SAS-R10_3GB\Stress\Stress_2010_12_15_20_27_38.blg C:\ESRP3.0_NL-SAS-R10_3GB\Stress\DBChecksum_2010_12_16_21_32_51.blg

Database Sizing and Throughput

<i>Achieved Transactional I/O per Second</i>	611.905
<i>Target Transactional I/O per Second</i>	468
<i>Initial Database Size (bytes)</i>	6483799638016
<i>Final Database Size (bytes)</i>	6508680249344
<i>Database Files (Count)</i>	11

Jetstress System Parameters

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

Database Configuration

<i>Instance1808.1</i>	Log Path: C:\logluns\log1 Database: C:\dbluns\db1\Jetstress001001.edb
<i>Instance1808.2</i>	Log Path: C:\logluns\log2 Database: C:\dbluns\db2\Jetstress002001.edb
<i>Instance1808.3</i>	Log Path: C:\logluns\log3 Database: C:\dbluns\db3\Jetstress003001.edb
<i>Instance1808.4</i>	Log Path: C:\logluns\log4 Database: C:\dbluns\db4\Jetstress004001.edb
<i>Instance1808.5</i>	Log Path: C:\logluns\log5 Database: C:\dbluns\db5\Jetstress005001.edb
<i>Instance1808.6</i>	Log Path: C:\logluns\log6 Database: C:\dbluns\db6\Jetstress006001.edb
<i>Instance1808.7</i>	Log Path: C:\logluns\log7 Database: C:\dbluns\db7\Jetstress007001.edb
<i>Instance1808.8</i>	Log Path: C:\logluns\log8 Database: C:\dbluns\db8\Jetstress008001.edb
<i>Instance1808.9</i>	Log Path: C:\logluns\log9 Database: C:\dbluns\db9\Jetstress009001.edb
<i>Instance1808.10</i>	Log Path: C:\logluns\log10 Database: C:\dbluns\db10\Jetstress010001.edb
<i>Instance1808.11</i>	Log Path: C:\logluns\log11 Database: C:\dbluns\db11\Jetstress011001.edb

Transactional I/O Performance

<i>MSExchange Database => 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>
Instance1808.1	17.803	2.737	32.513	23.091	36365.195	35507.250	0.000	0.622	0.000	20.175	0.000	4497.424
Instance1808.2	15.359	2.666	32.570	23.171	36772.626	35550.043	0.000	0.548	0.000	20.362	0.000	4513.344
Instance1808.3	15.383	1.896	32.505	23.111	36804.040	35545.200	0.000	0.610	0.000	20.227	0.000	4522.588
Instance1808.4	15.599	1.951	32.435	23.052	36706.151	35528.210	0.000	0.611	0.000	20.194	0.000	4512.752
Instance1808.5	15.511	2.592	32.537	23.120	36828.052	35530.802	0.000	0.619	0.000	20.213	0.000	4518.887
Instance1808.6	15.299	2.453	32.502	23.095	36843.697	35508.128	0.000	0.537	0.000	20.220	0.000	4518.268
Instance1808.7	15.355	2.276	32.668	23.242	36776.409	35514.246	0.000	0.632	0.000	20.310	0.000	4504.874
Instance1808.8	15.581	1.785	32.453	23.054	36651.841	35521.864	0.000	0.608	0.000	20.190	0.000	4512.092
Instance1808.9	15.346	2.063	32.487	23.081	36763.196	35503.320	0.000	0.621	0.000	20.155	0.000	4506.403
Instance1808.10	15.448	1.671	32.392	22.989	36830.363	35511.608	0.000	0.530	0.000	20.154	0.000	4507.757
Instance1808.11	15.491	1.806	32.619	23.219	36773.483	35541.708	0.000	0.608	0.000	20.349	0.000	4504.997

Background Database Maintenance I/O Performance

<i>MSExchange Database ==> Instances</i>	<i>Database Maintenance IO Reads/sec</i>	<i>Database Maintenance IO Reads Average Bytes</i>
Instance1808.1	26.409	261390.106
Instance1808.2	27.679	261381.205
Instance1808.3	27.570	261371.287
Instance1808.4	27.409	261377.539
Instance1808.5	27.477	261346.119
Instance1808.6	27.706	261373.111
Instance1808.7	27.681	261353.836
Instance1808.8	27.476	261376.360
Instance1808.9	27.723	261371.674
Instance1808.10	27.628	261383.671
Instance1808.11	27.396	261374.214

Log Replication I/O Performance

<i>MSExchange Database ==> Instances</i>	<i>I/O Log Reads/sec</i>	<i>I/O Log Reads Average Bytes</i>
Instance1808.1	0.365	143536.259
Instance1808.2	0.370	145078.725
Instance1808.3	0.368	144718.004
Instance1808.4	0.367	144729.382
Instance1808.5	0.367	143699.427
Instance1808.6	0.367	143771.008
Instance1808.7	0.369	144711.047
Instance1808.8	0.366	144285.951
Instance1808.9	0.365	143792.929
Instance1808.10	0.366	143367.174
Instance1808.11	0.369	145235.402

Total I/O Performance

<i>MSExchange Database => 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>
Instance1808.1	17.803	2.737	58.922	23.091	137221.427	35507.250	18.303	0.622	0.365	20.175	143536.259	4497.424
Instance1808.2	15.359	2.666	60.248	23.171	139960.324	35550.043	15.260	0.548	0.370	20.362	145078.725	4513.344
Instance1808.3	15.383	1.896	60.075	23.111	139864.495	35545.200	17.689	0.610	0.368	20.227	144718.004	4522.588
Instance1808.4	15.599	1.951	59.845	23.052	139607.435	35528.210	19.712	0.611	0.367	20.194	144729.382	4512.752
Instance1808.5	15.511	2.592	60.013	23.120	139622.036	35530.802	16.609	0.619	0.367	20.213	143699.427	4518.887
Instance1808.6	15.299	2.453	60.207	23.095	140165.563	35508.128	16.332	0.537	0.367	20.220	143771.008	4518.268
Instance1808.7	15.355	2.276	60.349	23.242	139786.410	35514.246	16.698	0.632	0.369	20.310	144711.047	4504.874
Instance1808.8	15.581	1.785	59.929	23.054	139682.746	35521.864	18.284	0.608	0.366	20.190	144285.951	4512.092
Instance1808.9	15.346	2.063	60.211	23.081	140181.067	35503.320	20.375	0.621	0.365	20.155	143792.929	4506.403
Instance1808.10	15.448	1.671	60.021	22.989	140195.355	35511.608	18.235	0.530	0.366	20.154	143367.174	4507.757
Instance1808.11	15.491	1.806	60.015	23.219	139300.770	35541.708	19.259	0.608	0.369	20.349	145235.402	4504.997

Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	0.674	0.000	4.348
Available MBytes	59142.016	59036.000	59472.000
Free System Page Table Entries	33555287.997	33555286.000	33555290.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	39530882.429	38064128.000	39968768.000
Pool Paged Bytes	84836113.156	83214336.000	86769664.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log 12/15/2010 8:27:13 PM -- Jetstress testing begins ...

12/15/2010 8:27:13 PM -- Prepare testing begins ...

12/15/2010 8:27:25 PM -- Attaching databases ...

12/15/2010 8:27:25 PM -- Prepare testing ends.

12/15/2010 8:27:25 PM -- Dispatching transactions begins ...

12/15/2010 8:27:25 PM -- Database cache settings: (minimum: 352.0 MB, maximum: 2.8 GB)

12/15/2010 8:27:25 PM -- Database flush thresholds: (start: 28.2 MB, stop: 56.3 MB)

12/15/2010 8:27:38 PM -- Database read latency thresholds: (average: 20 msec/read, maximum: 200 msec/read).

12/15/2010 8:27:38 PM -- Log write latency thresholds: (average: 10 msec/write, maximum: 200 msec/write).

12/15/2010 8:27:47 PM -- Operation mix: Sessions 4, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.

12/15/2010 8:27:47 PM -- Performance logging begins (interval: 15000 ms).

12/15/2010 8:27:47 PM -- Attaining prerequisites:

12/15/2010 8:33:35 PM -- \MSEExchange Database(JetstressWin)\Database Cache Size, Last: 2663248000.0 (lower bound: 2657511000.0, upper bound: none)

12/16/2010 8:33:36 PM -- Performance logging ends.

12/16/2010 9:32:08 PM -- JetInterop batch transaction stats: 160652, 161368, 161019, 160601, 161101, 160928, 161256, 160416, 160310, 160198 and 161390.

12/16/2010 9:32:11 PM -- Dispatching transactions ends.

12/16/2010 9:32:11 PM -- Shutting down databases ...

12/16/2010 9:32:51 PM -- Instance1808.1 (complete), Instance1808.2 (complete), Instance1808.3 (complete), Instance1808.4 (complete), Instance1808.5 (complete), Instance1808.6 (complete), Instance1808.7 (complete), Instance1808.8 (complete), Instance1808.9 (complete), Instance1808.10 (complete) and Instance1808.11 (complete)

12/16/2010 9:32:52 PM -- Performance logging begins (interval: 30000 ms).

12/16/2010 9:32:52 PM -- Verifying database checksums ...

12/17/2010 7:05:12 AM -- C:\dbluns\db1 (100% processed), C:\dbluns\db2 (100% processed), C:\dbluns\db3 (100% processed), C:\dbluns\db4 (100% processed), C:\dbluns\db5 (100% processed), C:\dbluns\db6 (100% processed), C:\dbluns\db7 (100% processed), C:\dbluns\db8 (100% processed), C:\dbluns\db9 (100% processed), C:\dbluns\db10 (100% processed) and C:\dbluns\db11 (100% processed)

12/17/2010 7:05:12 AM -- Performance logging ends.

12/17/2010 7:05:12 AM -- C:\ESRP3.0_NL-SAS-

R10_3GB\Stress\DBChecksum_2010_12_16_21_32_51.blg has 1144 samples.

12/17/2010 7:05:22 AM -- C:\ESRP3.0_NL-SAS-

R10_3GB\Stress\DBChecksum_2010_12_16_21_32_51.html is saved.

12/17/2010 7:05:22 AM -- Verifying log checksums ...
12/17/2010 7:05:23 AM -- C:\logluns\log1 (12 log(s) processed), C:\logluns\log2 (12 log(s) processed), C:\logluns\log3 (8 log(s) processed), C:\logluns\log4 (11 log(s) processed), C:\logluns\log5 (12 log(s) processed), C:\logluns\log6 (11 log(s) processed), C:\logluns\log7 (12 log(s) processed), C:\logluns\log8 (10 log(s) processed), C:\logluns\log9 (12 log(s) processed), C:\logluns\log10 (12 log(s) processed) and C:\logluns\log11 (11 log(s) processed)
12/17/2010 7:05:23 AM -- C:\ESRP3.0_NL-SAS-R10_3GB\Stress\Stress_2010_12_15_20_27_38.blg has 5768 samples.
12/17/2010 7:05:23 AM -- Creating test report ...
12/17/2010 7:06:05 AM -- Instance1808.1 has 17.8 for I/O Database Reads Average Latency.
12/17/2010 7:06:05 AM -- Instance1808.1 has 0.6 for I/O Log Writes Average Latency.
12/17/2010 7:06:05 AM -- Instance1808.1 has 0.6 for I/O Log Reads Average Latency.
12/17/2010 7:06:05 AM -- Instance1808.2 has 15.4 for I/O Database Reads Average Latency.
12/17/2010 7:06:05 AM -- Instance1808.2 has 0.5 for I/O Log Writes Average Latency.
12/17/2010 7:06:05 AM -- Instance1808.2 has 0.5 for I/O Log Reads Average Latency.
12/17/2010 7:06:05 AM -- Instance1808.3 has 15.4 for I/O Database Reads Average Latency.
12/17/2010 7:06:05 AM -- Instance1808.3 has 0.6 for I/O Log Writes Average Latency.
12/17/2010 7:06:05 AM -- Instance1808.3 has 0.6 for I/O Log Reads Average Latency.
12/17/2010 7:06:05 AM -- Instance1808.4 has 15.6 for I/O Database Reads Average Latency.
12/17/2010 7:06:05 AM -- Instance1808.4 has 0.6 for I/O Log Writes Average Latency.
12/17/2010 7:06:05 AM -- Instance1808.4 has 0.6 for I/O Log Reads Average Latency.
12/17/2010 7:06:05 AM -- Instance1808.5 has 15.5 for I/O Database Reads Average Latency.
12/17/2010 7:06:05 AM -- Instance1808.5 has 0.6 for I/O Log Writes Average Latency.
12/17/2010 7:06:05 AM -- Instance1808.5 has 0.6 for I/O Log Reads Average Latency.
12/17/2010 7:06:05 AM -- Instance1808.6 has 15.3 for I/O Database Reads Average Latency.
12/17/2010 7:06:05 AM -- Instance1808.6 has 0.5 for I/O Log Writes Average Latency.
12/17/2010 7:06:05 AM -- Instance1808.6 has 0.5 for I/O Log Reads Average Latency.
12/17/2010 7:06:05 AM -- Instance1808.7 has 15.4 for I/O Database Reads Average Latency.
12/17/2010 7:06:05 AM -- Instance1808.7 has 0.6 for I/O Log Writes Average Latency.
12/17/2010 7:06:05 AM -- Instance1808.7 has 0.6 for I/O Log Reads Average Latency.
12/17/2010 7:06:05 AM -- Instance1808.8 has 15.6 for I/O Database Reads Average Latency.
12/17/2010 7:06:05 AM -- Instance1808.8 has 0.6 for I/O Log Writes Average Latency.
12/17/2010 7:06:05 AM -- Instance1808.8 has 0.6 for I/O Log Reads Average Latency.
12/17/2010 7:06:05 AM -- Instance1808.9 has 15.3 for I/O Database Reads Average Latency.
12/17/2010 7:06:05 AM -- Instance1808.9 has 0.6 for I/O Log Writes Average Latency.
12/17/2010 7:06:05 AM -- Instance1808.9 has 0.6 for I/O Log Reads Average Latency.
12/17/2010 7:06:05 AM -- Instance1808.10 has 15.4 for I/O Database Reads Average Latency.
12/17/2010 7:06:05 AM -- Instance1808.10 has 0.5 for I/O Log Writes Average Latency.
12/17/2010 7:06:05 AM -- Instance1808.10 has 0.5 for I/O Log Reads Average Latency.
12/17/2010 7:06:05 AM -- Instance1808.11 has 15.5 for I/O Database Reads Average Latency.
12/17/2010 7:06:05 AM -- Instance1808.11 has 0.6 for I/O Log Writes Average Latency.
12/17/2010 7:06:05 AM -- Instance1808.11 has 0.6 for I/O Log Reads Average Latency.
12/17/2010 7:06:05 AM -- Test has 0 Maximum Database Page Fault Stalls/sec.
12/17/2010 7:06:05 AM -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.
12/17/2010 7:06:05 AM -- C:\ESRP3.0_NL-SAS-R10_3GB\Stress\Stress_2010_12_15_20_27_38.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	18056498	0	0	0	564265 MBytes / 34339 sec
C:\dbluns\db2\Jetstress002001.edb	18057778	0	0	0	564305 MBytes / 34035 sec
C:\dbluns\db3\Jetstress003001.edb	18057778	0	0	0	564305 MBytes / 18479 sec
C:\dbluns\db4\Jetstress004001.edb	18057266	0	0	0	564289 MBytes / 26560 sec
C:\dbluns\db5\Jetstress005001.edb	18057522	0	0	0	564297 MBytes / 33370 sec
C:\dbluns\db6\Jetstress006001.edb	18057522	0	0	0	564297 MBytes / 33663 sec
C:\dbluns\db7\Jetstress007001.edb	18057522	0	0	0	564297 MBytes / 34164 sec
C:\dbluns\db8\Jetstress008001.edb	18056498	0	0	0	564265 MBytes / 25990 sec
C:\dbluns\db9\Jetstress009001.edb	18056498	0	0	0	564265 MBytes / 33223 sec
C:\dbluns\db10\Jetstress010001.edb	18056754	0	0	0	564273 MBytes / 14020 sec
C:\dbluns\db11\Jetstress011001.edb	18057522	0	0	0	564297 MBytes / 18810 sec
(Sum)	198629158	0	0	0	6207161 MBytes / 34339 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	0.148	0.000	262.828	0.000	65536.000
C:\dbluns\db2	0.130	0.000	264.427	0.000	65536.000
C:\dbluns\db3	0.065	0.000	488.186	0.000	65536.000
C:\dbluns\db4	0.083	0.000	338.866	0.000	65536.000
C:\dbluns\db5	0.132	0.000	269.578	0.000	65536.000
C:\dbluns\db6	0.133	0.000	267.630	0.000	65536.000
C:\dbluns\db7	0.130	0.000	264.161	0.000	65536.000
C:\dbluns\db8	0.079	0.000	347.110	0.000	65536.000
C:\dbluns\db9	0.132	0.000	270.309	0.000	65536.000
C:\dbluns\db10	0.047	0.000	644.085	0.000	65536.000
C:\dbluns\db11	0.066	0.000	479.271	0.000	65536.000

Memory System Performance (of checksum)

Counter	Average	Minimum	Maximum
% Processor Time	0.669	0.000	2.761
Available MBytes	61946.970	61926.000	61964.000
Free System Page Table Entries	33555287.998	33555287.000	33555288.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	44330012.643	44032000.000	44568576.000
Pool Paged Bytes	86099960.839	86085632.000	86335488.000

Test Log 12/15/2010 8:27:13 PM -- Jetstress testing begins ...
 12/15/2010 8:27:13 PM -- Prepare testing begins ...
 12/15/2010 8:27:25 PM -- Attaching databases ...
 12/15/2010 8:27:25 PM -- Prepare testing ends.
 12/15/2010 8:27:25 PM -- Dispatching transactions begins ...
 12/15/2010 8:27:25 PM -- Database cache settings: (minimum: 352.0 MB, maximum: 2.8 GB)
 12/15/2010 8:27:25 PM -- Database flush thresholds: (start: 28.2 MB, stop: 56.3 MB)
 12/15/2010 8:27:38 PM -- Database read latency thresholds: (average: 20 msec/read, maximum: 200 msec/read).
 12/15/2010 8:27:38 PM -- Log write latency thresholds: (average: 10 msec/write, maximum: 200 msec/write).
 12/15/2010 8:27:47 PM -- Operation mix: Sessions 4, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
 12/15/2010 8:27:47 PM -- Performance logging begins (interval: 15000 ms).
 12/15/2010 8:27:47 PM -- Attaining prerequisites:
 12/15/2010 8:33:35 PM -- \MSEExchange Database(JetstressWin)\Database Cache Size, Last: 2663248000.0 (lower bound: 2657511000.0, upper bound: none)
 12/16/2010 8:33:36 PM -- Performance logging ends.
 12/16/2010 9:32:08 PM -- JetInterop batch transaction stats: 160652, 161368, 161019, 160601, 161101, 160928, 161256, 160416, 160310, 160198 and 161390.
 12/16/2010 9:32:11 PM -- Dispatching transactions ends.
 12/16/2010 9:32:11 PM -- Shutting down databases ...
 12/16/2010 9:32:51 PM -- Instance1808.1 (complete), Instance1808.2 (complete), Instance1808.3 (complete), Instance1808.4 (complete), Instance1808.5 (complete), Instance1808.6 (complete), Instance1808.7 (complete), Instance1808.8 (complete), Instance1808.9 (complete), Instance1808.10 (complete) and Instance1808.11 (complete)
 12/16/2010 9:32:52 PM -- Performance logging begins (interval: 30000 ms).
 12/16/2010 9:32:52 PM -- Verifying database checksums ...
 12/17/2010 7:05:12 AM -- C:\dbluns\db1 (100% processed), C:\dbluns\db2 (100% processed), C:\dbluns\db3 (100% processed), C:\dbluns\db4 (100% processed), C:\dbluns\db5 (100% processed), C:\dbluns\db6 (100% processed), C:\dbluns\db7 (100% processed), C:\dbluns\db8 (100% processed), C:\dbluns\db9 (100% processed), C:\dbluns\db10 (100% processed) and C:\dbluns\db11 (100% processed)
 12/17/2010 7:05:12 AM -- Performance logging ends.
 12/17/2010 7:05:12 AM -- C:\ESRP3.0_NL-SAS-R10_3GB\Stress\DBChecksum_2010_12_16_21_32_51.blg has 1144 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>
Instance808.1	564257.59	07:35:30	20.65
Instance808.2	564297.59	07:11:20	21.80
Instance808.3	564297.59	05:52:12	26.70
Instance808.4	564281.59	06:48:09	23.04
Instance808.5	564289.59	06:54:03	22.71
Instance808.6	564289.59	06:16:16	24.99
Instance808.7	564289.59	06:02:31	25.94
Instance808.8	564257.59	06:10:48	25.36
Instance808.9	564257.59	06:14:13	25.13
Instance808.10	564265.59	07:15:27	21.60
Instance808.11	564289.59	07:14:37	21.64

Jetstress System Parameters

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

Database Configuration

<i>Instance808.1</i>	Log Path: C:\logluns\log1 Database: C:\dbluns\db1\Jetstress001001.edb
<i>Instance808.2</i>	Log Path: C:\logluns\log2 Database: C:\dbluns\db2\Jetstress002001.edb
<i>Instance808.3</i>	Log Path: C:\logluns\log3 Database: C:\dbluns\db3\Jetstress003001.edb
<i>Instance808.4</i>	Log Path: C:\logluns\log4 Database: C:\dbluns\db4\Jetstress004001.edb
<i>Instance808.5</i>	Log Path: C:\logluns\log5 Database: C:\dbluns\db5\Jetstress005001.edb
<i>Instance808.6</i>	Log Path: C:\logluns\log6 Database: C:\dbluns\db6\Jetstress006001.edb
<i>Instance808.7</i>	Log Path: C:\logluns\log7 Database: C:\dbluns\db7\Jetstress007001.edb
<i>Instance808.8</i>	Log Path: C:\logluns\log8 Database: C:\dbluns\db8\Jetstress008001.edb
<i>Instance808.9</i>	Log Path: C:\logluns\log9 Database: C:\dbluns\db9\Jetstress009001.edb
<i>Instance808.10</i>	Log Path: C:\logluns\log10 Database: C:\dbluns\db10\Jetstress010001.edb
<i>Instance808.11</i>	Log Path: C:\logluns\log11 Database: C:\dbluns\db11\Jetstress011001.edb

Transactional I/O Performance

<i>MSExchange Database => 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>
Instance808.1	207.026	0.000	82.543	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance808.2	174.476	0.000	86.884	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance808.3	154.962	0.000	106.533	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance808.4	168.322	0.000	91.956	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance808.5	157.104	0.000	90.765	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance808.6	159.588	0.000	99.369	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance808.7	204.020	0.000	103.439	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance808.8	164.200	0.000	100.710	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance808.9	141.983	0.000	100.147	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance808.10	163.521	0.000	86.324	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance808.11	170.372	0.000	86.518	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	0.540	0.000	2.171
Available MBytes	62186.255	62150.000	62199.000
Free System Page Table Entries	33555288.016	33555287.000	33555290.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	36562003.270	36483072.000	36761600.000
Pool Paged Bytes	86352772.220	81731584.000	109912064.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log 12/17/2010 10:31:08 PM -- Jetstress testing begins ...

12/17/2010 10:31:08 PM -- Prepare testing begins ...

12/17/2010 10:31:19 PM -- Attaching databases ...

12/17/2010 10:31:19 PM -- Prepare testing ends.

12/17/2010 10:31:35 PM -- Performance logging begins (interval: 30000 ms).

12/17/2010 10:31:35 PM -- Backing up databases ...

12/18/2010 6:07:06 AM -- Performance logging ends.

12/18/2010 6:07:06 AM -- Instance808.1 (100% processed), Instance808.2 (100% processed), Instance808.3 (100% processed), Instance808.4 (100% processed), Instance808.5 (100% processed), Instance808.6 (100% processed), Instance808.7 (100% processed), Instance808.8 (100% processed), Instance808.9 (100% processed), Instance808.10 (100% processed) and Instance808.11 (100% processed)

12/18/2010 6:07:06 AM -- C:\ESRP3.0_NL-SAS-

R10_3GB\BackupTest\DatabaseBackup_2010_12_17_22_31_19.blg has 910 samples.

12/18/2010 6:07:06 AM -- Creating test report ...

Soft Recovery Test Result Report: HBS 107

Soft-Recovery Statistics - All

Database Instance	Log files replayed	Elapsed seconds
Instance2200.1	506	2023.7447545
Instance2200.2	505	1786.3903376
Instance2200.3	506	1788.7771418
Instance2200.4	508	1894.5921277
Instance2200.5	509	1983.4342837
Instance2200.6	506	1859.3204657
Instance2200.7	500	1978.9258758
Instance2200.8	512	1997.7551088
Instance2200.9	504	1975.7434702
Instance2200.10	503	1813.7059856
Instance2200.11	500	1853.220855

Database Configuration

<i>Instance2200.1</i>	Log Path: C:\logluns\log1 Database: C:\dbluns\db1\Jetstress001001.edb
<i>Instance2200.2</i>	Log Path: C:\logluns\log2 Database: C:\dbluns\db2\Jetstress002001.edb
<i>Instance2200.3</i>	Log Path: C:\logluns\log3 Database: C:\dbluns\db3\Jetstress003001.edb
<i>Instance2200.4</i>	Log Path: C:\logluns\log4 Database: C:\dbluns\db4\Jetstress004001.edb
<i>Instance2200.5</i>	Log Path: C:\logluns\log5 Database: C:\dbluns\db5\Jetstress005001.edb
<i>Instance2200.6</i>	Log Path: C:\logluns\log6 Database: C:\dbluns\db6\Jetstress006001.edb
<i>Instance2200.7</i>	Log Path: C:\logluns\log7 Database: C:\dbluns\db7\Jetstress007001.edb
<i>Instance2200.8</i>	Log Path: C:\logluns\log8 Database: C:\dbluns\db8\Jetstress008001.edb
<i>Instance2200.9</i>	Log Path: C:\logluns\log9 Database: C:\dbluns\db9\Jetstress009001.edb
<i>Instance2200.10</i>	Log Path: C:\logluns\log10 Database: C:\dbluns\db10\Jetstress010001.edb
<i>Instance2200.11</i>	Log Path: C:\logluns\log11 Database: C:\dbluns\db11\Jetstress011001.edb

Transactional I/O Performance

<i>MSExchange Database => 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>
Instance2200.1	213.371	16.777	163.219	1.481	83033.575	15174.004	3.838	0.000	2.224	0.000	94654.575	0.000
Instance2200.2	155.872	25.029	184.856	1.690	75450.042	16606.407	4.146	0.000	2.535	0.000	105256.433	0.000
Instance2200.3	241.387	31.609	185.295	1.689	71336.483	16568.921	3.571	0.000	2.534	0.000	104994.909	0.000
Instance2200.4	198.015	41.466	174.408	1.612	74322.596	15720.256	2.885	0.001	2.417	0.002	96237.910	1.092
Instance2200.5	167.737	15.807	165.772	1.512	77784.930	14882.411	3.650	0.000	2.268	0.000	91509.584	0.000
Instance2200.6	133.782	17.366	178.478	1.635	76124.197	15779.818	3.383	0.002	2.454	0.006	100856.281	1.111
Instance2200.7	199.588	12.300	169.875	1.509	75946.326	15247.151	3.457	0.000	2.264	0.000	95380.494	0.000
Instance2200.8	165.204	38.673	169.399	1.530	74099.622	15424.129	2.702	0.000	2.295	0.000	96847.179	0.000
Instance2200.9	186.545	18.257	171.745	1.533	77832.030	15278.331	4.034	0.001	2.300	0.002	97084.148	1.047
Instance2200.10	183.104	24.465	183.398	1.655	77363.201	15836.650	3.414	0.000	2.482	0.000	99106.125	0.000
Instance2200.11	227.234	35.442	178.419	1.615	73516.007	16776.645	3.660	0.000	2.422	0.000	102640.384	0.000

Background Database Maintenance I/O Performance

<i>MSExchange Database ==> Instances</i>	<i>Database Maintenance IO Reads/sec</i>	<i>Database Maintenance IO Reads Average Bytes</i>
Instance2200.1	22.239	261695.804
Instance2200.2	23.811	260938.863
Instance2200.3	22.795	259270.997
Instance2200.4	21.191	259291.195
Instance2200.5	22.612	260515.390
Instance2200.6	22.242	261496.128
Instance2200.7	22.155	260986.854
Instance2200.8	22.605	258785.384
Instance2200.9	24.798	260343.583
Instance2200.10	23.175	259157.545
Instance2200.11	22.761	259629.232

Total I/O Performance

<i>MSExchange Database => 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>
Instance2200.1	213.371	16.777	185.459	1.481	104457.751	15174.004	3.838	0.000	2.224	0.000	94654.575	0.000
Instance2200.2	155.872	25.029	208.666	1.690	96615.880	16606.407	4.146	0.000	2.535	0.000	105256.433	0.000
Instance2200.3	241.387	31.609	208.090	1.689	91923.551	16568.921	3.571	0.000	2.534	0.000	104994.909	0.000
Instance2200.4	198.015	41.466	195.598	1.612	94361.611	15720.256	2.885	0.001	2.417	0.002	96237.910	1.092
Instance2200.5	167.737	15.807	188.384	1.512	99718.756	14882.411	3.650	0.000	2.268	0.000	91509.584	0.000
Instance2200.6	133.782	17.366	200.720	1.635	96665.269	15779.818	3.383	0.002	2.454	0.006	100856.281	1.111
Instance2200.7	199.588	12.300	192.030	1.509	97295.045	15247.151	3.457	0.000	2.264	0.000	95380.494	0.000
Instance2200.8	165.204	38.673	192.003	1.530	95842.667	15424.129	2.702	0.000	2.295	0.000	96847.179	0.000
Instance2200.9	186.545	18.257	196.543	1.533	100859.543	15278.331	4.034	0.001	2.300	0.002	97084.148	1.047
Instance2200.10	183.104	24.465	206.573	1.655	97758.719	15836.650	3.414	0.000	2.482	0.000	99106.125	0.000
Instance2200.11	227.234	35.442	201.180	1.615	94572.797	16776.645	3.660	0.000	2.422	0.000	102640.384	0.000

Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	1.431	0.000	9.480
Available MBytes	59300.769	59231.000	61764.000
Free System Page Table Entries	33555288.016	33555288.000	33555290.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	59357534.853	43806720.000	60465152.000
Pool Paged Bytes	86000382.980	85958656.000	86126592.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log 12/19/2010 8:05:01 PM -- Jetstress testing begins ...

12/19/2010 8:05:02 PM -- Prepare testing begins ...

12/19/2010 8:05:13 PM -- Attaching databases ...

12/19/2010 8:05:13 PM -- Prepare testing ends.

12/19/2010 8:05:13 PM -- Dispatching transactions begins ...

12/19/2010 8:05:13 PM -- Database cache settings: (minimum: 352.0 MB, maximum: 2.8 GB)

12/19/2010 8:05:13 PM -- Database flush thresholds: (start: 28.2 MB, stop: 56.3 MB)

12/19/2010 8:05:25 PM -- Database read latency thresholds: (average: 20 msec/read, maximum: 100 msec/read).

12/19/2010 8:05:25 PM -- Log write latency thresholds: (average: 10 msec/write, maximum: 100 msec/write).

12/19/2010 8:05:31 PM -- Operation mix: Sessions 4, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.

12/19/2010 8:05:31 PM -- Performance logging begins (interval: 15000 ms).

12/19/2010 8:05:31 PM -- Generating log files ...

12/19/2010 11:14:01 PM -- C:\logluns\log1 (101.4% generated), C:\logluns\log2 (101.2% generated), C:\logluns\log3 (101.4% generated), C:\logluns\log4 (101.8% generated), C:\logluns\log5 (102.0% generated), C:\logluns\log6 (101.4% generated), C:\logluns\log7 (100.2% generated), C:\logluns\log8 (102.6% generated), C:\logluns\log9 (101.0% generated), C:\logluns\log10 (100.8% generated) and C:\logluns\log11 (100.2% generated)

12/19/2010 11:14:01 PM -- Performance logging ends.

12/19/2010 11:14:01 PM -- JetInterop batch transaction stats: 22115, 21932, 22245, 21867, 22110, 22202, 22173, 22244, 21901, 21975 and 22028.

12/19/2010 11:14:01 PM -- Dispatching transactions ends.

12/19/2010 11:14:01 PM -- Shutting down databases ...

12/19/2010 11:14:08 PM -- Instance2200.1 (complete), Instance2200.2 (complete), Instance2200.3 (complete), Instance2200.4 (complete), Instance2200.5 (complete), Instance2200.6 (complete), Instance2200.7 (complete), Instance2200.8 (complete), Instance2200.9 (complete), Instance2200.10 (complete) and Instance2200.11 (complete)

12/19/2010 11:14:08 PM -- C:\ESRP3.0_NL-SAS-R10_3GB\SoftRecovery\Performance_2010_12_19_20_5_25.blg has 752 samples.

12/19/2010 11:14:08 PM -- Creating test report ...

12/19/2010 11:14:13 PM -- Instance2200.1 has 22.3 for I/O Database Reads Average Latency.

12/19/2010 11:14:13 PM -- Instance2200.1 has 0.4 for I/O Log Writes Average Latency.

12/19/2010 11:14:13 PM -- Instance2200.1 has 0.4 for I/O Log Reads Average Latency.

12/19/2010 11:14:13 PM -- Instance2200.2 has 20.2 for I/O Database Reads Average Latency.

12/19/2010 11:14:13 PM -- Instance2200.2 has 0.4 for I/O Log Writes Average Latency.

12/19/2010 11:14:13 PM -- Instance2200.2 has 0.4 for I/O Log Reads Average Latency.

12/19/2010 11:14:13 PM -- Instance2200.3 has 19.9 for I/O Database Reads Average Latency.
12/19/2010 11:14:13 PM -- Instance2200.3 has 0.4 for I/O Log Writes Average Latency.
12/19/2010 11:14:13 PM -- Instance2200.3 has 0.4 for I/O Log Reads Average Latency.
12/19/2010 11:14:13 PM -- Instance2200.4 has 19.9 for I/O Database Reads Average Latency.
12/19/2010 11:14:13 PM -- Instance2200.4 has 0.4 for I/O Log Writes Average Latency.
12/19/2010 11:14:13 PM -- Instance2200.4 has 0.4 for I/O Log Reads Average Latency.
12/19/2010 11:14:13 PM -- Instance2200.5 has 19.9 for I/O Database Reads Average Latency.
12/19/2010 11:14:13 PM -- Instance2200.5 has 0.4 for I/O Log Writes Average Latency.
12/19/2010 11:14:13 PM -- Instance2200.5 has 0.4 for I/O Log Reads Average Latency.
12/19/2010 11:14:13 PM -- Instance2200.6 has 19.9 for I/O Database Reads Average Latency.
12/19/2010 11:14:13 PM -- Instance2200.6 has 0.4 for I/O Log Writes Average Latency.
12/19/2010 11:14:13 PM -- Instance2200.6 has 0.4 for I/O Log Reads Average Latency.
12/19/2010 11:14:13 PM -- Instance2200.7 has 20.0 for I/O Database Reads Average Latency.
12/19/2010 11:14:13 PM -- Instance2200.7 has 0.4 for I/O Log Writes Average Latency.
12/19/2010 11:14:13 PM -- Instance2200.7 has 0.4 for I/O Log Reads Average Latency.
12/19/2010 11:14:13 PM -- Instance2200.8 has 19.9 for I/O Database Reads Average Latency.
12/19/2010 11:14:13 PM -- Instance2200.8 has 0.4 for I/O Log Writes Average Latency.
12/19/2010 11:14:13 PM -- Instance2200.8 has 0.4 for I/O Log Reads Average Latency.
12/19/2010 11:14:13 PM -- Instance2200.9 has 19.9 for I/O Database Reads Average Latency.
12/19/2010 11:14:13 PM -- Instance2200.9 has 0.4 for I/O Log Writes Average Latency.
12/19/2010 11:14:13 PM -- Instance2200.9 has 0.4 for I/O Log Reads Average Latency.
12/19/2010 11:14:13 PM -- Instance2200.10 has 20.1 for I/O Database Reads Average Latency.
12/19/2010 11:14:13 PM -- Instance2200.10 has 0.4 for I/O Log Writes Average Latency.
12/19/2010 11:14:13 PM -- Instance2200.10 has 0.4 for I/O Log Reads Average Latency.
12/19/2010 11:14:13 PM -- Instance2200.11 has 20.1 for I/O Database Reads Average Latency.
12/19/2010 11:14:13 PM -- Instance2200.11 has 0.4 for I/O Log Writes Average Latency.
12/19/2010 11:14:13 PM -- Instance2200.11 has 0.4 for I/O Log Reads Average Latency.
12/19/2010 11:14:13 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.
12/19/2010 11:14:13 PM -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.
12/19/2010 11:14:13 PM -- C:\ESRP3.0_NL-SAS-R10_3GB\SoftRecovery\Performance_2010_12_19_20_5_25.xml has 751 samples queried.
12/19/2010 11:14:14 PM -- C:\ESRP3.0_NL-SAS-R10_3GB\SoftRecovery\Performance_2010_12_19_20_5_25.html is saved.
12/19/2010 11:50:14 PM -- Performance logging begins (interval: 4000 ms).
12/19/2010 11:50:14 PM -- Recovering databases ...
12/20/2010 12:23:58 AM -- Performance logging ends.
12/20/2010 12:23:58 AM -- Instance2200.1 (2023.7447545), Instance2200.2 (1786.3903376), Instance2200.3 (1788.7771418), Instance2200.4 (1894.5921277), Instance2200.5 (1983.4342837), Instance2200.6 (1859.3204657), Instance2200.7 (1978.9258758), Instance2200.8 (1997.7551088), Instance2200.9 (1975.7434702), Instance2200.10 (1813.7059856) and Instance2200.11 (1853.220855)
12/20/2010 12:23:58 AM -- C:\ESRP3.0_NL-SAS-R10_3GB\SoftRecovery\SoftRecovery_2010_12_19_23_50_10.blg has 502 samples.
12/20/2010 12:23:58 AM -- Creating test report ...

Soft Recovery Test Performance Result: HBS 107

Test Summary

Overall Test Result	Fail
Machine Name	HBS107
Test Description	
Test Start Time	12/19/2010 8:05:02 PM
Test End Time	12/19/2010 11:14:08 PM
Collection Start Time	12/19/2010 8:05:46 PM
Collection End Time	12/19/2010 11:13:48 PM
Jetstress Version	14.01.0043.000
Ese Version	14.00.0639.019
Operating System	Windows Server 2008 R2 Enterprise (6.1.7600.0)
Performance Log	C:\ESRP3.0_NL-SAS-R10_3GB\SoftRecovery\Performance_2010_12_19_20_5_25.blg

Test Issues

Fail	Process has average database read latencies higher than 20.000 msec.
-------------	--

Database Sizing and Throughput

Achieved Transactional I/O per Second	669.199
Capacity Percentage	100%
Throughput Percentage	100%
Initial Database Size (bytes)	6508680249344
Final Database Size (bytes)	6512111190016
Database Files (Count)	11

Jetstress System Parameters

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

Database Configuration

<i>Instance2200.1</i>	Log Path: C:\logluns\log1 Database: C:\dbluns\db1\Jetstress001001.edb
<i>Instance2200.2</i>	Log Path: C:\logluns\log2 Database: C:\dbluns\db2\Jetstress002001.edb
<i>Instance2200.3</i>	Log Path: C:\logluns\log3 Database: C:\dbluns\db3\Jetstress003001.edb
<i>Instance2200.4</i>	Log Path: C:\logluns\log4 Database: C:\dbluns\db4\Jetstress004001.edb
<i>Instance2200.5</i>	Log Path: C:\logluns\log5 Database: C:\dbluns\db5\Jetstress005001.edb
<i>Instance2200.6</i>	Log Path: C:\logluns\log6 Database: C:\dbluns\db6\Jetstress006001.edb
<i>Instance2200.7</i>	Log Path: C:\logluns\log7 Database: C:\dbluns\db7\Jetstress007001.edb
<i>Instance2200.8</i>	Log Path: C:\logluns\log8 Database: C:\dbluns\db8\Jetstress008001.edb
<i>Instance2200.9</i>	Log Path: C:\logluns\log9 Database: C:\dbluns\db9\Jetstress009001.edb
<i>Instance2200.10</i>	Log Path: C:\logluns\log10 Database: C:\dbluns\db10\Jetstress010001.edb
<i>Instance2200.11</i>	Log Path: C:\logluns\log11 Database: C:\dbluns\db11\Jetstress011001.edb

Transactional I/O Performance

<i>MSExchange Database => 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>
Instance2200.1	22.304	3.120	35.714	25.080	32768.000	35413.468	0.000	0.444	0.000	22.350	0.000	4469.105
Instance2200.2	20.191	2.869	35.796	25.042	32768.000	35459.250	0.000	0.387	0.000	22.182	0.000	4500.521
Instance2200.3	19.887	2.634	35.792	25.156	32768.000	35414.154	0.000	0.372	0.000	22.319	0.000	4494.008
Instance2200.4	19.923	5.616	35.637	25.071	32768.000	35435.332	0.000	0.446	0.000	22.225	0.000	4497.529
Instance2200.5	19.932	5.205	35.575	25.008	32768.000	35417.555	0.000	0.390	0.000	22.289	0.000	4517.079
Instance2200.6	19.914	4.568	36.123	25.372	32768.000	35414.034	0.000	0.408	0.000	22.344	0.000	4470.182
Instance2200.7	20.012	3.962	35.838	25.109	32768.000	35360.275	0.000	0.386	0.000	22.136	0.000	4441.256
Instance2200.8	19.912	3.563	35.832	25.135	32768.000	35423.737	0.000	0.433	0.000	22.371	0.000	4507.433
Instance2200.9	19.887	3.559	35.479	24.821	32768.000	35433.542	0.000	0.449	0.000	22.058	0.000	4513.005
Instance2200.10	20.083	3.943	35.839	25.183	32768.000	35400.088	0.000	0.397	0.000	22.211	0.000	4480.587
Instance2200.11	20.080	4.110	35.630	24.967	32768.000	35409.885	0.000	0.406	0.000	22.127	0.000	4465.858

Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	0.633	0.000	2.046
Available MBytes	59311.258	59252.000	61766.000
Free System Page Table Entries	33555287.993	33555285.000	33555288.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	40660692.426	36524032.000	41127936.000
Pool Paged Bytes	85382220.255	85184512.000	85737472.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log 12/19/2010 8:05:01 PM -- Jetstress testing begins ...

12/19/2010 8:05:02 PM -- Prepare testing begins ...

12/19/2010 8:05:13 PM -- Attaching databases ...

12/19/2010 8:05:13 PM -- Prepare testing ends.

12/19/2010 8:05:13 PM -- Dispatching transactions begins ...

12/19/2010 8:05:13 PM -- Database cache settings: (minimum: 352.0 MB, maximum: 2.8 GB)

12/19/2010 8:05:13 PM -- Database flush thresholds: (start: 28.2 MB, stop: 56.3 MB)

12/19/2010 8:05:25 PM -- Database read latency thresholds: (average: 20 msec/read, maximum: 100 msec/read).

12/19/2010 8:05:25 PM -- Log write latency thresholds: (average: 10 msec/write, maximum: 100 msec/write).

12/19/2010 8:05:31 PM -- Operation mix: Sessions 4, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.

12/19/2010 8:05:31 PM -- Performance logging begins (interval: 15000 ms).

12/19/2010 8:05:31 PM -- Generating log files ...

12/19/2010 11:14:01 PM -- C:\logluns\log1 (101.4% generated), C:\logluns\log2 (101.2% generated), C:\logluns\log3 (101.4% generated), C:\logluns\log4 (101.8% generated), C:\logluns\log5 (102.0% generated), C:\logluns\log6 (101.4% generated), C:\logluns\log7 (100.2% generated), C:\logluns\log8 (102.6% generated), C:\logluns\log9 (101.0% generated), C:\logluns\log10 (100.8% generated) and C:\logluns\log11 (100.2% generated)

12/19/2010 11:14:01 PM -- Performance logging ends.

12/19/2010 11:14:01 PM -- JetInterop batch transaction stats: 22115, 21932, 22245, 21867, 22110, 22202, 22173, 22244, 21901, 21975 and 22028.

12/19/2010 11:14:01 PM -- Dispatching transactions ends.

12/19/2010 11:14:01 PM -- Shutting down databases ...

12/19/2010 11:14:08 PM -- Instance2200.1 (complete), Instance2200.2 (complete), Instance2200.3 (complete), Instance2200.4 (complete), Instance2200.5 (complete), Instance2200.6 (complete), Instance2200.7 (complete), Instance2200.8 (complete), Instance2200.9 (complete), Instance2200.10 (complete) and Instance2200.11 (complete)

12/19/2010 11:14:08 PM -- C:\ESRP3.0_NL-SAS-R10_3GB\SoftRecovery\Performance_2010_12_19_20_5_25.blg has 752 samples.

12/19/2010 11:14:08 PM -- Creating test report ...

12/19/2010 11:14:13 PM -- Instance2200.1 has 22.3 for I/O Database Reads Average Latency.

12/19/2010 11:14:13 PM -- Instance2200.1 has 0.4 for I/O Log Writes Average Latency.

12/19/2010 11:14:13 PM -- Instance2200.1 has 0.4 for I/O Log Reads Average Latency.

12/19/2010 11:14:13 PM -- Instance2200.2 has 20.2 for I/O Database Reads Average Latency.

12/19/2010 11:14:13 PM -- Instance2200.2 has 0.4 for I/O Log Writes Average Latency.

12/19/2010 11:14:13 PM -- Instance2200.2 has 0.4 for I/O Log Reads Average Latency.

12/19/2010 11:14:13 PM -- Instance2200.3 has 19.9 for I/O Database Reads Average Latency.
12/19/2010 11:14:13 PM -- Instance2200.3 has 0.4 for I/O Log Writes Average Latency.
12/19/2010 11:14:13 PM -- Instance2200.3 has 0.4 for I/O Log Reads Average Latency.
12/19/2010 11:14:13 PM -- Instance2200.4 has 19.9 for I/O Database Reads Average Latency.
12/19/2010 11:14:13 PM -- Instance2200.4 has 0.4 for I/O Log Writes Average Latency.
12/19/2010 11:14:13 PM -- Instance2200.4 has 0.4 for I/O Log Reads Average Latency.
12/19/2010 11:14:13 PM -- Instance2200.5 has 19.9 for I/O Database Reads Average Latency.
12/19/2010 11:14:13 PM -- Instance2200.5 has 0.4 for I/O Log Writes Average Latency.
12/19/2010 11:14:13 PM -- Instance2200.5 has 0.4 for I/O Log Reads Average Latency.
12/19/2010 11:14:13 PM -- Instance2200.6 has 19.9 for I/O Database Reads Average Latency.
12/19/2010 11:14:13 PM -- Instance2200.6 has 0.4 for I/O Log Writes Average Latency.
12/19/2010 11:14:13 PM -- Instance2200.6 has 0.4 for I/O Log Reads Average Latency.
12/19/2010 11:14:13 PM -- Instance2200.7 has 20.0 for I/O Database Reads Average Latency.
12/19/2010 11:14:13 PM -- Instance2200.7 has 0.4 for I/O Log Writes Average Latency.
12/19/2010 11:14:13 PM -- Instance2200.7 has 0.4 for I/O Log Reads Average Latency.
12/19/2010 11:14:13 PM -- Instance2200.8 has 19.9 for I/O Database Reads Average Latency.
12/19/2010 11:14:13 PM -- Instance2200.8 has 0.4 for I/O Log Writes Average Latency.
12/19/2010 11:14:13 PM -- Instance2200.8 has 0.4 for I/O Log Reads Average Latency.
12/19/2010 11:14:13 PM -- Instance2200.9 has 19.9 for I/O Database Reads Average Latency.
12/19/2010 11:14:13 PM -- Instance2200.9 has 0.4 for I/O Log Writes Average Latency.
12/19/2010 11:14:13 PM -- Instance2200.9 has 0.4 for I/O Log Reads Average Latency.
12/19/2010 11:14:13 PM -- Instance2200.10 has 20.1 for I/O Database Reads Average Latency.
12/19/2010 11:14:13 PM -- Instance2200.10 has 0.4 for I/O Log Writes Average Latency.
12/19/2010 11:14:13 PM -- Instance2200.10 has 0.4 for I/O Log Reads Average Latency.
12/19/2010 11:14:13 PM -- Instance2200.11 has 20.1 for I/O Database Reads Average Latency.
12/19/2010 11:14:13 PM -- Instance2200.11 has 0.4 for I/O Log Writes Average Latency.
12/19/2010 11:14:13 PM -- Instance2200.11 has 0.4 for I/O Log Reads Average Latency.
12/19/2010 11:14:13 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.
12/19/2010 11:14:13 PM -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.
12/19/2010 11:14:13 PM -- C:\ESRP3.0_NL-SAS-R10_3GB\SoftRecovery\Performance_2010_12_19_20_5_25.xml has 751 samples queried.

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