



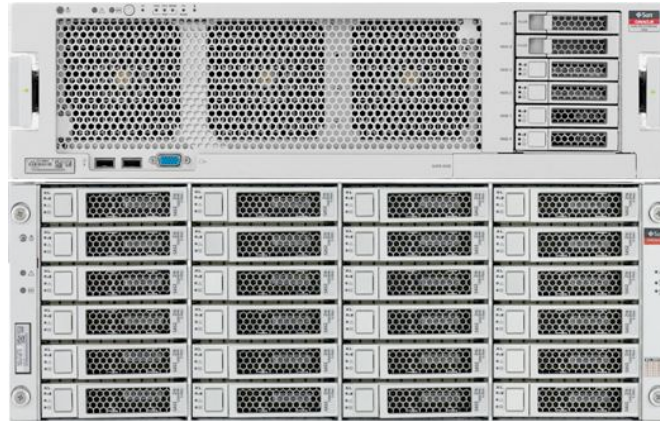
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Sun ZFS Storage 7420 Appliance 32,000 Mailbox Resiliency Exchange 2010 Storage Solution

Tested with: ESRP – Storage Version 3.0
Tested Date: 11/2010

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Overview

This document describes Oracle's storage solution for Microsoft Exchange Server, based on the Microsoft Exchange Solution Reviewed Program (ESRP) – Storage program*. The ESRP – Storage program was developed by Microsoft Corporation to provide a common storage testing framework for vendors to provide information on its storage solutions for Microsoft Exchange Server software.

Specifically, this document focuses on the mailbox server role, where the Microsoft Exchange databases and user mailboxes are stored. Note that hub transport, edge transport, client access, and unified messaging roles are not discussed here.

*For more details on the Microsoft ESRP – Storage program, please go to:

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

Introduction

Oracle's Sun ZFS Storage Appliance is an excellent platform for implementation of Microsoft Exchange deployments. The Sun ZFS Storage Appliance provides simplified storage that:

- Radically simplifies storage management for less cost
- Installs in minutes without training
- Is simple to configure and optimize
- Features easy-to-use graphical tools that provide real-time visibility
- Provides comprehensive self-healing

Benefits of the Flash Hybrid Storage Pool

A foundation of the Sun ZFS Storage Appliance's simplicity and efficiency is its flash hybrid storage pool. This technology provides some critical benefits.

Optimized storage pool

The Sun ZFS Storage 7420 uses a virtual storage pool to seamlessly optimize access to the different media types, including SSDs, improving efficiencies and increasing application performance. In fact it is the only system on the market with a hybrid storage pool that delivers over twice the performance at half the cost of traditional storage solutions, enabling you to shatter IO bottlenecks and increase productivity without breaking the bank.

Increased performance with hybrid architecture and SSDs

The Sun ZFS Storage 7420's hybrid architecture combines Read- and Write-optimized SSD-based Flash Accelerators with high-capacity disk drives to deliver higher performance and reduce power consumption and cooling requirements. This makes the Sun ZFS Storage 7420 ideal for organizations that require high throughput and lower response times for write- and read-intensive application workloads. In addition, using SSDs lowers power consumption by up to 80% compared to spinning disks.

Customers with write-intensive applications (synchronous writes) and read-intensive applications (caching frequently accessed data) can see the most benefit with the use of flash-based SSDs. For Sun ZFS Storage 7420 configurations, at least two SSD-based Read Flash Accelerators should be used for read-intensive workloads, and at least two Write Flash Accelerators should be used for write-intensive workloads.

Flexibility to meet changing needs

The Sun ZFS Storage 7420 provides you with a high-density server/storage solution. Unlike traditional storage architectures, the Sun ZFS Storage 7420 is highly adaptable to changing business needs. The system not only scales up to 192 TB of storage capacity, but also scales in multiple dimensions, including IO throughput, processor performance, cache, and total capacity.

For example, you can increase performance by adding SSDs. As your application requirements change, you can increase computational power by adding more CPUs and cache and expand total capacity by adding enterprise-class high-capacity drive expansion trays.

Environmental and energy efficiency

The Sun ZFS Storage 7420 helps you lower costs by reducing energy consumption and offering higher storage density, which reduces space requirements.

Benefits of Enhanced Analytics

Storage bottlenecks have often plagued Exchange administrators. In the past, the solution to a disk performance problem was to add additional expensive spindles, move from 10k RPM to 15k RPM, or add expensive NVRAM.

With built-in Analytics that are based on DTrace, unprecedented visibility is available to pinpoint storage bottlenecks. Breakdowns of IOPS, throughput, disk usage, disk offset, and dozens more statistics are readily available in graphical representations or through the scriptable CLI. The following screenshots illustrate various measurements during an arbitrary Jetstress run.

Figure 1 shows four Exchange servers each running with two FC ports. Analyzing this graph, isv-4150b only has a single port active, running roughly twice the throughput as the others, while the other three servers have half the throughput through two ports. It looks like isv-4150b's MPIO settings may be set to failover only, or a port may be down.



Figure 1. Fibre Channel bytes per second

Each Exchange server has three dbvol LUNs. As shown in Figure 2, you can view each LUN to see where there may be hot spots. You can place additional mailboxes in lower utilized LUNs.

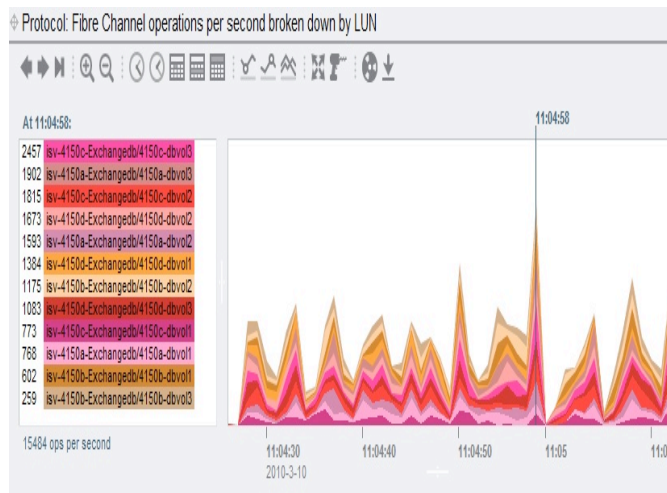


Figure 2. Fibre Channel operations per second

Sun ZFS Storage Appliance Options

The Sun ZFS Storage Appliance is available in four platforms that meet diverse requirements that include price, performance, capacity and data protection. The Sun ZFS Storage 7120, for example, is an entry-level storage system for workgroup environments that do not have medium-to-high READ performance requirements and thus are not equipped with a read-optimized flash device. On the other hand, the remaining three platforms offer up to 2TB of read cache, which substantially enables many applications to show much faster response times that are typically in the low single digit milliseconds. The write flash on all Sun ZFS Storage Appliances can improve response times for synchronous write IO intensive applications. Faster CPUs (that have up to eight threads per core) can provide up to 32 threads to process data in each Sun ZFS Storage Appliance controller. Specifically, the Sun ZFS Storage 7420 offers 72GB of primary cache and offers up to 512GB of DRAM memory. This release of the Sun ZFS Storage Appliance offers up to 2.5 TB of cache storage, which can dramatically improve READ intensive application throughput (IOPS).

Solution Description

This solution details a 32,000 mailbox, single database availability group (DAG) (2 copy) solution hosted across eight separate Sun Fire servers attached using Fibre Channel to two Sun ZFS Storage 7420 controllers. The user profile used is 0.15 IOPS per mailbox.

Mailbox Storage

Two 7420 controllers are attached to three 24-disk J4410 storage shelves. Each 7420 controller has three read-optimized cache devices and four write-optimized cache devices. The database LUNs use three read-cache and three write-cache devices. The log LUNs utilize one write-cache device.

Fibre Channel Redundancy

Each Sun ZFS Storage 7420 has two dual port 8Gb FC HBAs. The Sun Fire mailbox server utilizes one dual-port 8Gb FC HBA. Each of these has a separate port connected to two Brocade 8Gb FC switches, providing full data path redundancy to and from each mailbox server and storage device.

DAG Solution

This is a single (DAG) solution utilizing eight mailbox servers. Mailbox servers aie-4150a to aie-4150d contain primary databases 01-16 and passive databases 17-32. Mailbox servers aie-4150e to aie-4150h contain primary databases 17-32 and passive databases 01-16. In the event of a mailbox server related failure, the passive copies of the mailbox databases would be activated on the alternate mailbox server. In the event of a storage path related failure, the passive database copies would be made active on the alternate storage controller. In this solution, the primary copy storage and secondary copy storage is configured identically (from the host on down to the spindle including brand, model, firmware, drivers etc.) Table 1 illustrates each controller.

TABLE 1: DAG SOLUTION STORAGE LAYOUT

STORAGE APPLIANCE	STORAGE POOLS	RAID LEVEL	CACHE DEVICES	PROJECTS	LUNS	LUN SIZE	LOGS AND DATABASES
AIE-7420A	pool-0	10	1 write-cache	logs	logvol01	.5 TB	Log01-04
					logvol02	.5 TB	Log05-08
					logvol03	.5 TB	Log09-12
					logvol04	.5 TB	Log01-04
	pool-1	10	2 write-cache 3 read-cache	dbvols	dbvol01-04	1.5 TB	DB01-04
					dbvol05-09	1.5 TB	DB05-08
					dbvol09-12	1.5 TB	DB09-12
					dbvol13-16	1.5 TB	DB13-16
				dbcopies	cpvol01-04	1.5 TB	CP17-20
					cpvol05-08	1.5 TB	CP21-24
					cpvol09-12	1.5 TB	CP25-28
					cpvol13-16	1.5 TB	CP29-32

STORAGE APPLIANCE	STORAGE POOLS	RAID LEVEL	CACHE DEVICES	PROJECTS	LUNS	LUN SIZE	LOGS AND DATABASES
AIE-7420B	pool-0	10	1 write-cache	logs	logvol01	.5 TB	Log17-20
					logvol02	.5 TB	Log21-24
					logvol03	.5 TB	Log25-28
					logvol04	.5 TB	Log29-32
	pool-1	10	2 write-cache 3 read-cache	dbvols	dbvol01-04	1.5 TB	DB17-20
					dbvol05-09	1.5 TB	DB21-24
					dbvol09-12	1.5 TB	DB25-28
					dbvol13-16	1.5 TB	DB29-32
				dbcopies	cpvol01-04	1.5 TB	CP01-04
					cpvol05-08	1.5 TB	CP05-08
					cpvol09-12	1.5 TB	CP09-12
					cpvol13-16	1.5 TB	CP13-16

Sizing

The following items are important considerations when sizing an Exchange mailbox solution:

- Number of mailboxes
- Mailbox size
- IOPS per mailbox
- Physical drive type
- Fault tolerance

Mailbox Servers

This example solution uses high performance Sun Fire x4150 dual-core processors with 32 GB RAM. Each server has expansion room for two PCI-e IO slots as well as 64 GB RAM.

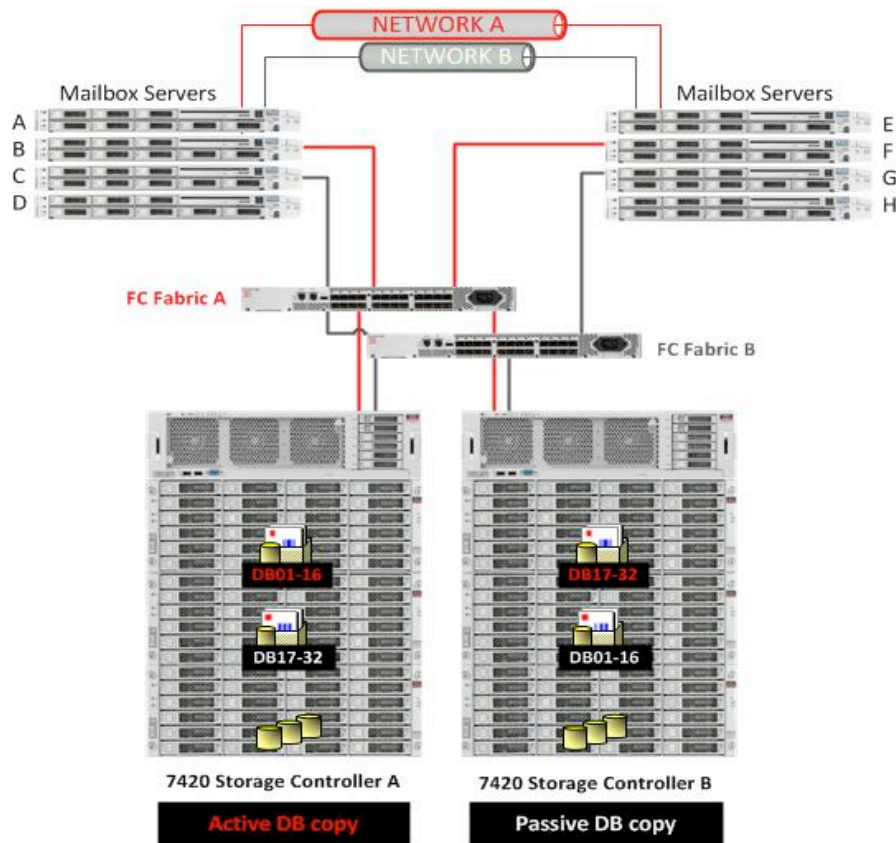


Figure 3. Sun ZFS Storage Appliance 7420 Exchange Mailbox solution

Links to the Sun ZFS Storage Appliances in the Windows Server Catalog can be found here:

<http://www.windowservercatalog.com/item.aspx?idItem=2999cdf3-6031-ea71-5734-996fe0021336&bCatID=1282>

The ESRP-Storage program focuses on storage solution testing to address performance and reliability issues with storage design. However, storage is not the only factor to take into consideration when designing a scale up Exchange solution. Other factors that affect the server scalability are: server processor utilization, server physical and virtual memory limitations, resource requirements for other applications, directory and network service latencies, network infrastructure limitations, replication and recovery requirements, and client usage profiles. All these factors are beyond the scope for ESRP-Storage. Therefore, the number of mailboxes hosted per server as part of the tested configuration may not necessarily be viable for some customer deployment.

For more information on identifying and addressing performance bottlenecks in an Exchange system, please refer to Microsoft's Troubleshooting Microsoft Exchange Server Performance, available at <http://technet.microsoft.com/en-us/library/dd335215.aspx>.

Targeted Customer Profile

The presented solution targets a mid-size to large mailbox deployment. This solution employs two concurrent servers, but allows for as many servers as the IOPS and response time requirements allow. The solution features:

- A 32,000 mailbox solution
- Eight mailbox servers
- User IO profile of 0.125 IOPs, 0.15 tested to include 20% headroom
- One GB mailboxes
- Databases configured to run maintenance during Store OLM (Online Maintenance) window
- Mailbox Resiliency as the primary data protection mechanism
- One TB database size tested
- Solaris ZFS to minimize risk of silent data corruption, Mailbox Resiliency

Tested Deployment

The following tables summarize the testing environment.

Simulated Exchange Configuration

Number of Exchange mailboxes simulated	32,000
Number of Database Availability Groups (DAGs)	1
Number of servers/DAG	8 (4 Tested)
Number of active mailboxes/server	4,000
Number of databases/host	8
Number of copies/database	2
Number of mailboxes/database	1000
Simulated profile: I/O's per second per mailbox (IOPS, include 20% headroom)	0.125 IOPs - 0.15 IOPs tested (0.125 +.025) for headroom
Database LUN size	1.5 TB
Log LUN size	.5 TB
Total database size for performance testing	64 TB (32 TB Tested)
% storage capacity used by Exchange database**	66.00%

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

Storage Hardware

Storage Connectivity	Fibre Channel
Storage model and OS/firmware revision	Sun ZFS Storage 7420, 2010.Q3.1.0 Software Release
Storage cache	1,736 GB total per controller 128 GB ARC per controller, 72 GB Write cache per controller 1,536 GB L2ARC per controller
Number of storage controllers	2 (1 Tested)
Number of storage ports	4 FC Ports per controller
Maximum bandwidth of storage connectivity to host	32 Gb total – 4 x 8 Gb per controller
Switch type/model/firmware revision	Brocade 300 8Gb FW v6.1.0h
HBA model and firmware	Emulex LightPulse 8Gb LPe12002, 1.11A5
Number of HBA's/host	1 Dual Port Fibre Channel HBA/Host
Host server type	2 Dual Core Intel E5410 ,32 GB RAM
Total number of disks tested in solution	136 (68 Tested)
Maximum number of spindles can be hosted in the storage	576

Storage Software

HBA driver	Emulex Storport Miniport 7.2.32.2
HBA QueueTarget Setting	0
HBA QueueDepth Setting	32
Multi-Pathing	Microsoft MPIO 6.0.6002.18005 RoundRobin
Host OS	Microsoft Windows Server Enterprise Edition 2008 SP2 x64
ESE.dll file version	14.00.0639.019
Replication solution name/version	NA

Storage Disk Configuration (Mailbox Store Disks)

Disk type, speed and firmware revision	SAS II - 7200 RPM FW v.0313 Write-SSD - FW v.9002 Read-SSD – FW v.AGYA0201
Raw capacity per disk (GB)	2000
Number of physical disks in test	112 (56 Tested)
Total raw storage capacity (GB)	224 TB (112 TB Tested)
Disk slice size (GB)	NA
Number of slices per LUN or number of disks per LUN	NA
RAID level	RAID 10
Total formatted capacity	96 TB (48 TB Tested)
Storage capacity utilization	43.00%
Database capacity utilization	29.00%

Storage Disk Configuration (Transactional Log Disks)

Disk type, speed and firmware revision	SAS II – 7200 RPM – 0313 Write-SSD - 9002
Raw capacity per disk (GB)	2000
Number of spindles in test	24 (12 Tested)
Total raw storage capacity (GB)	48 TB (24 TB Tested)
Disk slice size (GB)	NA
Number of slices per LUN or number of disks per LUN	NA
RAID level	RAID 10
Total formatted capacity	8 TB (4 TB Tested)

Best Practices

Consider the following best practices for configuring database and log LUNs in the Sun ZFS Storage Appliance for use with Exchange 2010 and for troubleshooting latency issues.

Database and Log LUNs

Exchange server is a disk-intensive application. Based on the testing run using the ESRP framework, Oracle recommends the following to improve storage performance:

- Use the mirrored profile when creating pools for both database LUNs and transactional log LUNs.
- Create database LUNs with a 32k volume record size.
- Create log LUNs with a 128k volume record size.
- Do not enable write cache.
- With Windows Server 2003, use diskpart.exe to align the sectors at 64k. Windows Server 2008 does this automatically.
- Format both DB and Log Volumes with an NTFS allocation unit size of 64k.
- When sizing databases, consider fewer, larger Dbs. Our testing showed a direct improvement in IOPs and response time by increasing the size and decreasing the number of Dbs.
- Do not share Exchange 2010 disks with any other applications that are IO intensive. This sharing will have a negative effect on your disk subsystem performance.

Troubleshooting

Use the ZFS Storage Appliance Analytics to troubleshoot any latency issues.

For Exchange 2010 best practices on storage design, please visit:

<http://technet.microsoft.com/en-us/library/dd346703.aspx>

For further information, including phone and mail contact information and online references, see Appendix A: References.

Test Result Summary

This section provides a high-level summary of the test data from ESRP and the link to the detailed html reports generated by ESRP testing framework. Click the underlined headings below to view the html report for each test.

Reliability

A number of tests in the framework are to check Reliability tests runs for 24 hours. The goal is to verify the storage can handle high IO load for a long period of time. Both log and database files will be analyzed for integrity after the stress test to ensure no database/log corruption.

The following list provides an overview (clicking on the underlined word will show the html report after the reliability tests run):

- No errors reported in the saved eventlog file.
- No errors reported during the Database and soft recovery [checksum](#) process.

[Storage Performance Results](#)

The Primary Storage performance testing is designed to exercise the storage with maximum sustainable Exchange type of IO for 2 hours. The test is to show how long it takes for the storage to respond to an IO under load. The following data is the sum of the logical disk IOs and average of all the logical disks IO latency in the 2 hours test duration. Each server is listed separately and the aggregate numbers across all servers is listed as well.

Individual Server Metrics

The sum of IOs across storage groups and the average latency across all storage groups on a per-server basis.

HOST: AIE-4150A

Database I/O	
Database Disks Transfers/sec	1262
Database Disks Reads/sec	775
Database Disks Writes/sec	487
Average Database Disk Read Latency (ms)	15.75
Average Database Disk Write Latency (ms)	8.73
Transaction Log I/O	
Log Disks Writes/sec	396
Average Log Disk Write Latency (ms)	1.31

HOST: AIE-41540B

Database I/O	
--------------	--

Database Disks Transfers/sec	1264
Database Disks Reads/sec	777
Database Disks Writes/sec	487
Average Database Disk Read Latency (ms)	15.75
Average Database Disk Write Latency (ms)	8.93
Transaction Log I/O	
Log Disks Writes/sec	396
Average Log Disk Write Latency (ms)	1.25

HOST: AIE-41540C

Database I/O	
Database Disks Transfers/sec	1309
Database Disks Reads/sec	805
Database Disks Writes/sec	504
Average Database Disk Read Latency (ms)	15.35
Average Database Disk Write Latency (ms)	8.71
Transaction Log I/O	
Log Disks Writes/sec	414
Average Log Disk Write Latency (ms)	1.11

HOST: AIE-41540D

Database I/O	
Database Disks Transfers/sec	1261
Database Disks Reads/sec	775
Database Disks Writes/sec	487
Average Database Disk Read Latency (ms)	15.72
Average Database Disk Write Latency (ms)	8.79
Transaction Log I/O	
Log Disks Writes/sec	395
Average Log Disk Write Latency (ms)	1.31

Aggregate Performance Across All Servers Metrics

The sum of IOs across servers in solution and the average latency across all servers in solution.

Database I/O	
Database Disks Transfers/sec	5096
Database Disks Reads/sec	3131
Database Disks Writes/sec	1965
Average Database Disk Read Latency (ms)	15.63
Average Database Disk Write Latency (ms)	8.79
Transaction Log I/O	
Log Disks Writes/sec	1601
Average Log Disk Write Latency (ms)	1.24

Database Backup/Recovery Performance

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

Database Read-only Performance

The test is to measure the maximum rate at which databases could be backed up using VSS. The following table shows the average rate for a single database file.

HOST: AIE-4150A

MB read/sec per database	7.07
MB read/sec total per server	56.52

HOST: AIE-4150B

MB read/sec per database	7.06
MB read/sec total per server	56.45

HOST: AIE-4150C

MB read/sec per database	6.97
MB read/sec total per server	55.78

HOST: AIE-4150D

MB read/sec per database	7.06
MB read/sec total per server	56.49

Transaction Log Recovery/Replay Performance

The test is to measure the maximum rate at which the log files can be played against the databases. The following table shows the average rate for 500 log files played in a single storage group. Each log file is 1 MB in size.

HOST: AIE-4150A

Average time to play one Log file (sec)	2.13
---	------

HOST: AIE-4150B

Average time to play one Log file (sec)	1.97
---	------

HOST: AIE-4150C

Average time to play one Log file (sec)	1.98
---	------

HOST: AIE-4150D

Average time to play one Log file (sec)	2.08
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Conclusion

The Sun ZFS Storage Appliance series is a family of unified storage systems that are ideal solutions for Microsoft Exchange environments as well as numerous other applications. Their comprehensive set of data services, storage efficiency features, analytics, massive scalability, intuitive user interface and excellent performance, along with their cost effectiveness, make them an excellent candidate for the data center.

For more information, visit the following websites:

- Sun ZFS Storage Appliance Solutions
<http://www.oracle.com/us/products/servers-storage/storage/unified-storage/index.html>
- Microsoft Exchange Solution Center
<http://support.microsoft.com/ph/13965>
- Exchange 2010 Mailbox Server Role Requirements Calculator
<http://msexchangeteam.com/archive/2009/11/09/453117.aspx>

This document is developed by storage solution providers and reviewed by the Microsoft Exchange Product team. The test results and data presented in this document are conducted in the ESRP test

framework. Customers should not quote the data directly for pre-deployment verification. It is still necessary to go through the exercises to validate the storage design for your specific customer environment.

The ESRP program is not designed to be a benchmarking program; tests are not designed for getting the maximum throughput for a given solution. Rather, the program is focused on producing recommendations from vendors for the Exchange application. The data presented in this document should not be used for direct comparisons among solutions.

Appendix A: References

Use the following contacts for additional information:

By Phone

General inquiries:

+1.650.506.7000 or

+1.800.392.2999

International:

+1.650.506.7000

Sales:

+1.800.ORACLE1

By Mail

Oracle Corporation

500 Oracle Parkway

Redwood Shores, CA 94065

Web-based References from Oracle.com

- [Sun Unified Storage](#)
- [Sun ZFS Storage 7320 Appliance](#)
- [Sun ZFS Storage Appliance Software](#)
- [Oracle's Sun Flash Technology](#)
- [ZFS Storage Appliance Resource Kit](#)
- [Oracle's Sun Unified Storage Simulator](#)

Appendix B: Test Results

The results of each test from the systems were virtually identical. This appendix includes test results from one of the four servers tested, AIE-4150C.

Performance Test Result Report

Test Summary

Overall Test Result	Pass
Machine Name	AIE-4150C
Test Description	Two Hour Stress - 8000 One GB Mailboxes
Test Start Time	11/10/2010 8:36:48 AM
Test End Time	11/10/2010 10:40:34 AM
Collection Start Time	11/10/2010 8:40:14 AM
Collection End Time	11/10/2010 10:40:05 AM
Jetstress Version	14.01.0180.003
Ese Version	14.00.0639.019
Operating System	Windows Server (R) 2008 Enterprise Service Pack 2 (6.0.6002.131072)
Performance Log	C:\Exchange\7420x4\2hr\Performance_2010_11_10_8_37_5.blg

Database Sizing and Throughput

Achieved Transactional I/O per Second	1308.898
Target Transactional I/O per Second	1200
Initial Database Size (bytes)	8709707661312
Final Database Size (bytes)	8713692250112
Database Files (Count)	8

Jetstress System Parameters

Thread Count	5 (per database)
Minimum Database Cache	256.0 MB
Maximum Database Cache	2048.0 MB
Insert Operations	40%
Delete Operations	20%
Replace Operations	5%

Read Operations 35%
 Lazy Commits 70%
 Run Background Database Maintenance False
 Number of Copies per Database 2

Database Configuration

Instance2304.1 Log Path: L:\log1
 Database: M:\db1\Jetstress001001.edb
 Instance2304.2 Log Path: L:\log2
 Database: N:\db1\Jetstress002001.edb
 Instance2304.3 Log Path: L:\log3
 Database: O:\db1\Jetstress003001.edb
 Instance2304.4 Log Path: L:\log4
 Database: P:\db1\Jetstress004001.edb
 Instance2304.5 Log Path: L:\log5
 Database: Q:\db1\Jetstress005001.edb
 Instance2304.6 Log Path: L:\log6
 Database: R:\db1\Jetstress006001.edb
 Instance2304.7 Log Path: L:\log7
 Database: S:\db1\Jetstress007001.edb
 Instance2304.8 Log Path: L:\log8
 Database: T:\db1\Jetstress008001.edb

Transactional I/O Performance

MSEXCHANGE DB ==> INSTANCES	I/O DB READS AVE LATENCY (MSEC)	I/O DB WRITES AVE LATENCY (MSEC)	I/O DB READS/SEC	I/O DB WRITES/ SEC	I/O DB READS AVE BYTES	I/O DB WRITES AVE BYTES	I/O LOG READS AVE LATENCY (MSEC)	I/O LOG WRITES AVE LATENCY (MSEC)	I/O LOG READS /SEC	I/O LOG WRITES/ SEC	I/O LOG READS AVE BYTES	I/O LOG WRITES AVE BYTES
	Instance2304.1	16.241	13.261	100.159	62.636	32768.404	35013.028	0.000	1.109	0.000	51.568	0.000
Instance2304.2	15.270	11.973	99.934	62.490	32768.000	35055.699	0.000	1.117	0.000	51.494	0.000	4717.578
Instance2304.3	15.360	10.153	99.833	62.561	32768.307	34992.173	0.000	1.105	0.000	51.198	0.000	4696.488
Instance2304.4	15.362	8.607	101.144	63.425	32768.000	35044.284	0.000	1.111	0.000	52.133	0.000	4692.444
Instance2304.5	15.017	7.244	101.261	63.515	32768.000	35006.143	0.000	1.112	0.000	52.001	0.000	4664.375
Instance2304.6	15.279	6.473	100.606	63.051	32768.270	35003.258	0.000	1.084	0.000	51.785	0.000	4669.696
Instance2304.7	14.956	6.073	100.458	63.079	32768.000	35046.851	0.000	1.108	0.000	51.649	0.000	4721.131
Instance2304.8	15.322	5.890	101.178	63.567	32768.000	35014.384	0.000	1.104	0.000	52.168	0.000	4675.332

Background Database Maintenance I/O Performance

MSExchange Database ==> Instances	Database Maintenance IO Reads/sec	Database Maintenance IO Reads Average Bytes
Instance2304.1	0.000	0.000
Instance2304.2	0.000	0.000
Instance2304.3	0.000	0.000
Instance2304.4	0.000	0.000
Instance2304.5	0.000	0.000
Instance2304.6	0.000	0.000
Instance2304.7	0.000	0.000
Instance2304.8	0.000	0.000

Log Replication I/O Performance

MSExchange Database ==> Instances	I/O Log Reads/sec	I/O Log Reads Average Bytes
Instance2304.1	0.971	232076.592
Instance2304.2	0.984	232563.091
Instance2304.3	0.975	232075.247
Instance2304.4	0.993	232604.453
Instance2304.5	0.983	232563.973
Instance2304.6	0.981	232078.520
Instance2304.7	0.988	232075.247
Instance2304.8	0.989	232546.691

Total I/O Performance

MSEXCHANGE DB ==> INSTANCES	I/O DB		I/O DB				I/O LOG		I/O LOG			
	READS	WRITES	I/O DB	I/O DB	I/O DB	I/O DB	READS	WRITES	I/O LOG	I/O LOG	I/O LOG	I/O LOG
	AVE	AVE	READS/SEC	WRITES/SEC	AVE	WRITES	AVE	AVE	READS/	WRITES/	AVE	WRITES
	LATENCY	LATENCY			AVE	AVE	LATENCY	LATENCY	SEC	SEC	AVE	AVE
	(MSEC)	(MSEC)			BYTES	BYTES	(MSEC)	(MSEC)			BYTES	BYTES
Instance2304.1	16.241	13.261	100.159	62.636	32768.404	35013.028	2.398	1.109	0.971	51.568	232076.592	4650.529
Instance2304.2	15.270	11.973	99.934	62.490	32768.000	35055.699	2.192	1.117	0.984	51.494	232563.091	4717.578
Instance2304.3	15.360	10.153	99.833	62.561	32768.307	34992.173	2.223	1.105	0.975	51.198	232075.247	4696.488
Instance2304.4	15.362	8.607	101.144	63.425	32768.000	35044.284	2.198	1.111	0.993	52.133	232604.453	4692.444
Instance2304.5	15.017	7.244	101.261	63.515	32768.000	35006.143	2.120	1.112	0.983	52.001	232563.973	4664.375
Instance2304.6	15.279	6.473	100.606	63.051	32768.270	35003.258	2.016	1.084	0.981	51.785	232078.520	4669.696

Instance2304.7	14.956	6.073	100.458	63.079	32768.000	35046.851	1.909	1.108	0.988	51.649	232075.247	4721.131
Instance2304.8	15.322	5.890	101.178	63.567	32768.000	35014.384	2.159	1.104	0.989	52.168	232546.691	4675.332

Host System Performance

Counter	Average	Minimum	Maximum
Percent Processor Time	4.228	2.544	5.607
Available Mbytes	28481.332	28478.000	28579.000
Free System Page Table Entries	33557888.704	33557725.000	33557932.000
Transition Pages Repurposed/sec	0.000	0.000	0.000
Pool Non-paged Bytes	66557092.610	66547712.000	66568192.000
Pool Paged Bytes	127908810.555	127885312.000	128061440.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log

```

11/10/2010 8:36:48 AM -- Jetstress testing begins ...
11/10/2010 8:36:48 AM -- Prepare testing begins ...
11/10/2010 8:36:56 AM -- Attaching databases ...
11/10/2010 8:36:56 AM -- Prepare testing ends.
11/10/2010 8:36:56 AM -- Dispatching transactions begins ...
11/10/2010 8:36:56 AM -- Database cache settings: (minimum: 256.0 MB, maximum: 2.0 GB)
11/10/2010 8:36:56 AM -- Database flush thresholds: (start: 20.5 MB, stop: 40.9 MB)
11/10/2010 8:37:05 AM -- Database read latency thresholds: (average: 20 msec/read,
maximum: 100 msec/read).
11/10/2010 8:37:05 AM -- Log write latency thresholds: (average: 10 msec/write,
maximum: 100 msec/write).
11/10/2010 8:37:09 AM -- Operation mix: Sessions 5, Inserts 40%, Deletes 20%, Replaces
5%, Reads 35%, Lazy Commits 70%.
11/10/2010 8:37:09 AM -- Performance logging begins (interval: 15000 ms).
11/10/2010 8:37:09 AM -- Attaining prerequisites:
11/10/2010 8:40:14 AM -- \MSEExchange Database(JetstressWin)\Database Cache Size, Last:
1935819000.0 (lower bound: 1932735000.0, upper bound: none)
11/10/2010 10:40:15 AM -- Performance logging ends.
11/10/2010 10:40:15 AM -- JetInterop batch transaction stats: 34691, 34930, 34728,
35254, 35236, 34899, 34856 and 35212.
11/10/2010 10:40:17 AM -- Dispatching transactions ends.
11/10/2010 10:40:17 AM -- Shutting down databases ...
11/10/2010 10:40:34 AM -- Instance2304.1 (complete), Instance2304.2 (complete),
Instance2304.3 (complete), Instance2304.4 (complete), Instance2304.5 (complete),
Instance2304.6 (complete), Instance2304.7 (complete) and Instance2304.8 (complete)
11/10/2010 10:40:34 AM -- C:\Exchange\7420x4\2hr\Performance_2010_11_10_8_37_5.blg has
491 samples.
11/10/2010 10:40:34 AM -- Creating test report ...
11/10/2010 10:40:37 AM -- Instance2304.1 has 16.2 for I/O Database Reads Average
Latency.
11/10/2010 10:40:37 AM -- Instance2304.1 has 1.1 for I/O Log Writes Average Latency.
11/10/2010 10:40:37 AM -- Instance2304.1 has 1.1 for I/O Log Reads Average Latency.
11/10/2010 10:40:37 AM -- Instance2304.2 has 15.3 for I/O Database Reads Average
Latency.
11/10/2010 10:40:37 AM -- Instance2304.2 has 1.1 for I/O Log Writes Average Latency.
11/10/2010 10:40:37 AM -- Instance2304.2 has 1.1 for I/O Log Reads Average Latency.
11/10/2010 10:40:37 AM -- Instance2304.3 has 15.4 for I/O Database Reads Average

```

Latency.
11/10/2010 10:40:37 AM -- Instance2304.3 has 1.1 for I/O Log Writes Average Latency.
11/10/2010 10:40:37 AM -- Instance2304.3 has 1.1 for I/O Log Reads Average Latency.
11/10/2010 10:40:37 AM -- Instance2304.4 has 15.4 for I/O Database Reads Average Latency.
11/10/2010 10:40:37 AM -- Instance2304.4 has 1.1 for I/O Log Writes Average Latency.
11/10/2010 10:40:37 AM -- Instance2304.4 has 1.1 for I/O Log Reads Average Latency.
11/10/2010 10:40:37 AM -- Instance2304.5 has 15.0 for I/O Database Reads Average Latency.
11/10/2010 10:40:37 AM -- Instance2304.5 has 1.1 for I/O Log Writes Average Latency.
11/10/2010 10:40:37 AM -- Instance2304.5 has 1.1 for I/O Log Reads Average Latency.
11/10/2010 10:40:37 AM -- Instance2304.6 has 15.3 for I/O Database Reads Average Latency.
11/10/2010 10:40:38 AM -- Instance2304.6 has 1.1 for I/O Log Writes Average Latency.
11/10/2010 10:40:38 AM -- Instance2304.6 has 1.1 for I/O Log Reads Average Latency.
11/10/2010 10:40:38 AM -- Instance2304.7 has 15.0 for I/O Database Reads Average Latency.
11/10/2010 10:40:38 AM -- Instance2304.7 has 1.1 for I/O Log Writes Average Latency.
11/10/2010 10:40:38 AM -- Instance2304.7 has 1.1 for I/O Log Reads Average Latency.
11/10/2010 10:40:38 AM -- Instance2304.8 has 15.3 for I/O Database Reads Average Latency.
11/10/2010 10:40:38 AM -- Instance2304.8 has 1.1 for I/O Log Writes Average Latency.
11/10/2010 10:40:38 AM -- Instance2304.8 has 1.1 for I/O Log Reads Average Latency.
11/10/2010 10:40:38 AM -- Test has 0 Maximum Database Page Fault Stalls/sec.
11/10/2010 10:40:38 AM -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.
11/10/2010 10:40:38 AM -- C:\Exchange\7420x4\2hr\Performance_2010_11_10_8_37_5.xml has 478 samples queried.

Stress Test Result Report

Test Summary

Overall Test Result	Pass
Machine Name	AIE-4150C
Test Description	Twenty Four Hour Stress - 8000 One GB Mailboxes
Test Start Time	11/8/2010 8:41:21 AM
Test End Time	11/9/2010 8:44:19 AM
Collection Start Time	11/8/2010 8:44:14 AM
Collection End Time	11/9/2010 8:44:09 AM
Jetstress Version	14.01.0180.003
Ese Version	14.00.0639.019
Operating System	Windows Server (R) 2008 Enterprise Service Pack 2 (6.0.6002.131072)
Performance Log	C:\Exchange\7420x4\24hr\Stress_2010_11_8_8_41_38.blg

Database Sizing and Throughput

Achieved Transactional I/O per Second	1392.145
Target Transactional I/O per Second	1200
Initial Database Size (bytes)	8659828998144
Final Database Size (bytes)	8709707661312
Database Files (Count)	8

Jetstress System Parameters

Thread Count	5 (per database)
Minimum Database Cache	256.0 MB
Maximum Database Cache	2048.0 MB
Insert Operations	40%
Delete Operations	20%
Replace Operations	5%
Read Operations	35%
Lazy Commits	70%
Run Background Database Maintenance	False
Number of Copies per Database	2

Database Configuration

Instance2304.1	Log Path: L:\log1 Database: M:\db1\Jetstress001001.edb
Instance2304.2	Log Path: L:\log2 Database: N:\db1\Jetstress002001.edb
Instance2304.3	Log Path: L:\log3 Database: O:\db1\Jetstress003001.edb
Instance2304.4	Log Path: L:\log4 Database: P:\db1\Jetstress004001.edb
Instance2304.5	Log Path: L:\log5 Database: Q:\db1\Jetstress005001.edb
Instance2304.6	Log Path: L:\log6 Database: R:\db1\Jetstress006001.edb
Instance2304.7	Log Path: L:\log7 Database: S:\db1\Jetstress007001.edb
Instance2304.8	Log Path: L:\log8 Database: T:\db1\Jetstress008001.edb

Transactional I/O Performance

MSEXCHANGE DB ==> INSTANCES	I/O DB		I/O DB				I/O LOG		I/O LOG			
	READS	WRITES	I/O DB	I/O DB	I/O DB	I/O DB	READS	WRITES	I/O LOG	I/O LOG	I/O LOG	I/O LOG
	AVE	AVE	READS/SEC	WRITES/SEC	READS	WRITES	AVE	AVE	READS/SEC	WRITES/SEC	READS	WRITES
	LATENCY (MSEC)	LATENCY (MSEC)	AVE BYTES	AVE BYTES	AVE BYTES	AVE BYTES	LATENCY (MSEC)	LATENCY (MSEC)	SEC	SEC	BYTES	BYTES
Instance2304.1	15.536	14.038	106.783	66.871	32768.119	35052.884	0.000	1.254	0.000	54.963	0.000	4689.399
Instance2304.2	14.405	12.708	106.884	66.926	32768.118	35046.208	0.000	1.246	0.000	54.862	0.000	4706.467
Instance2304.3	14.396	10.991	106.998	66.962	32768.039	35052.415	0.000	1.260	0.000	54.782	0.000	4698.965
Instance2304.4	14.406	9.292	107.104	67.078	32768.054	35049.633	0.000	1.251	0.000	54.901	0.000	4703.317
Instance2304.5	14.400	7.973	106.875	66.884	32768.038	35053.039	0.000	1.256	0.000	54.746	0.000	4707.187
Instance2304.6	14.410	7.123	107.165	67.110	32768.066	35050.153	0.000	1.237	0.000	55.025	0.000	4707.248
Instance2304.7	14.434	6.682	107.060	67.057	32768.117	35053.369	0.000	1.246	0.000	55.003	0.000	4705.670
Instance2304.8	14.422	6.549	107.223	67.163	32768.028	35053.489	0.000	1.238	0.000	55.005	0.000	4704.621

Background Database Maintenance I/O Performance

MSEXCHANGE DATABASE ==> INSTANCES	DATABASE MAINTENANCE IO READS/SEC	DATABASE MAINTENANCE IO READS AVERAGE BYTES
Instance2304.1	0.000	0.000
Instance2304.2	0.000	0.000

Instance2304.3	0.000	0.000
Instance2304.4	0.000	0.000
Instance2304.5	0.000	0.000
Instance2304.6	0.000	0.000
Instance2304.7	0.000	0.000
Instance2304.8	0.000	0.000

Log Replication I/O Performance

MSEXCHANGE DATABASE ==> INSTANCES	I/O LOG READS/SEC	I/O LOG READS AVERAGE BYTES
Instance2304.1	1.046	232320.160
Instance2304.2	1.048	232237.205
Instance2304.3	1.044	231996.423
Instance2304.4	1.048	232154.078
Instance2304.5	1.046	232156.406
Instance2304.6	1.051	232149.344
Instance2304.7	1.050	232154.722
Instance2304.8	1.050	232117.237

Total I/O Performance

MSEXCHANGE DB ==> INSTANCES	I/O DB	I/O DB	I/O DB	I/O DB	I/O DB	I/O DB	I/O LOG	I/O LOG	I/O LOG	I/O LOG	I/O LOG	I/O LOG
	READS AVE	WRITES AVE										
Instance2304.1	15.536	14.038	106.783	66.871	32768.119	35052.884	1.592	1.254	1.046	54.963	232320.160	4689.399
Instance2304.2	14.405	12.708	106.884	66.926	32768.118	35046.208	1.625	1.246	1.048	54.862	232237.205	4706.467
Instance2304.3	14.396	10.991	106.998	66.962	32768.039	35052.415	1.546	1.260	1.044	54.782	231996.423	4698.965
Instance2304.4	14.406	9.292	107.104	67.078	32768.054	35049.633	1.577	1.251	1.048	54.901	232154.078	4703.317
Instance2304.5	14.400	7.973	106.875	66.884	32768.038	35053.039	1.559	1.256	1.046	54.746	232156.406	4707.187
Instance2304.6	14.410	7.123	107.165	67.110	32768.066	35050.153	1.576	1.237	1.051	55.025	232149.344	4707.248
Instance2304.7	14.434	6.682	107.060	67.057	32768.117	35053.369	1.627	1.246	1.050	55.003	232154.722	4705.670
Instance2304.8	14.422	6.549	107.223	67.163	32768.028	35053.489	1.593	1.238	1.050	55.005	232117.237	4704.621

Host System Performance

COUNTER	AVERAGE	MINIMUM	MAXIMUM
% Processor Time	4.522	0.208	12.046
Available Mbytes	28529.734	28391.000	28559.000
Free System Page Table Entries	33558181.458	33557747.000	33558249.000
Transition Pages Repurposed/sec	0.000	0.000	0.000
Pool Non-paged Bytes	66485784.839	66469888.000	66519040.000
Pool Paged Bytes	123145949.413	123056128.000	163004416.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log

```

11/8/2010 8:41:21 AM -- Jetstress testing begins ...
11/8/2010 8:41:21 AM -- Prepare testing begins ...
11/8/2010 8:41:29 AM -- Attaching databases ...
11/8/2010 8:41:29 AM -- Prepare testing ends.
11/8/2010 8:41:29 AM -- Dispatching transactions begins ...
11/8/2010 8:41:29 AM -- Database cache settings: (minimum: 256.0 MB, maximum: 2.0 GB)
11/8/2010 8:41:29 AM -- Database flush thresholds: (start: 20.5 MB, stop: 40.9 MB)
11/8/2010 8:41:38 AM -- Database read latency thresholds: (average: 20 msec/read,
maximum: 200 msec/read).
11/8/2010 8:41:38 AM -- Log write latency thresholds: (average: 10 msec/write, maximum:
200 msec/write).
11/8/2010 8:41:42 AM -- Operation mix: Sessions 5, Inserts 40%, Deletes 20%, Replaces
5%, Reads 35%, Lazy Commits 70%.
11/8/2010 8:41:42 AM -- Performance logging begins (interval: 15000 ms).
11/8/2010 8:41:42 AM -- Attaining prerequisites:
11/8/2010 8:44:14 AM -- \MSEExchange Database(JetstressWin)\Database Cache Size, Last:
1946202000.0 (lower bound: 1932735000.0, upper bound: none)
11/9/2010 8:44:14 AM -- Performance logging ends.
11/9/2010 8:44:14 AM -- JetInterop batch transaction stats: 438808, 437927, 438476,
439043, 438027, 439456, 439293 and 439723.
11/9/2010 8:44:15 AM -- Dispatching transactions ends.
11/9/2010 8:44:15 AM -- Shutting down databases ...
11/9/2010 8:44:19 AM -- Instance2304.1 (complete), Instance2304.2 (complete),
Instance2304.3 (complete), Instance2304.4 (complete), Instance2304.5 (complete),
Instance2304.6 (complete), Instance2304.7 (complete) and Instance2304.8 (complete)
11/9/2010 8:44:19 AM -- C:\Exchange\7420x4\24hr\Stress_2010_11_8_8_41_38.blg has 5761
samples.
11/9/2010 8:44:19 AM -- Creating test report ...
11/9/2010 8:45:08 AM -- Instance2304.1 has 15.5 for I/O Database Reads Average Latency.
11/9/2010 8:45:08 AM -- Instance2304.1 has 1.3 for I/O Log Writes Average Latency.
11/9/2010 8:45:08 AM -- Instance2304.1 has 1.3 for I/O Log Reads Average Latency.
11/9/2010 8:45:08 AM -- Instance2304.2 has 14.4 for I/O Database Reads Average Latency.
11/9/2010 8:45:08 AM -- Instance2304.2 has 1.2 for I/O Log Writes Average Latency.
11/9/2010 8:45:08 AM -- Instance2304.2 has 1.2 for I/O Log Reads Average Latency.
11/9/2010 8:45:08 AM -- Instance2304.3 has 14.4 for I/O Database Reads Average Latency.
11/9/2010 8:45:08 AM -- Instance2304.3 has 1.3 for I/O Log Writes Average Latency.
11/9/2010 8:45:08 AM -- Instance2304.3 has 1.3 for I/O Log Reads Average Latency.
11/9/2010 8:45:08 AM -- Instance2304.4 has 14.4 for I/O Database Reads Average Latency.
11/9/2010 8:45:08 AM -- Instance2304.4 has 1.3 for I/O Log Writes Average Latency.
11/9/2010 8:45:08 AM -- Instance2304.4 has 1.3 for I/O Log Reads Average Latency.
11/9/2010 8:45:08 AM -- Instance2304.5 has 14.4 for I/O Database Reads Average Latency.
11/9/2010 8:45:08 AM -- Instance2304.5 has 1.3 for I/O Log Writes Average Latency.
11/9/2010 8:45:08 AM -- Instance2304.5 has 1.3 for I/O Log Reads Average Latency.
11/9/2010 8:45:08 AM -- Instance2304.6 has 14.4 for I/O Database Reads Average Latency.

```

```

11/9/2010 8:45:08 AM -- Instance2304.6 has 1.2 for I/O Log Writes Average Latency.
11/9/2010 8:45:08 AM -- Instance2304.6 has 1.2 for I/O Log Reads Average Latency.
11/9/2010 8:45:08 AM -- Instance2304.7 has 14.4 for I/O Database Reads Average Latency.
11/9/2010 8:45:08 AM -- Instance2304.7 has 1.2 for I/O Log Writes Average Latency.
11/9/2010 8:45:08 AM -- Instance2304.7 has 1.2 for I/O Log Reads Average Latency.
11/9/2010 8:45:08 AM -- Instance2304.8 has 14.4 for I/O Database Reads Average Latency.
11/9/2010 8:45:08 AM -- Instance2304.8 has 1.2 for I/O Log Writes Average Latency.
11/9/2010 8:45:08 AM -- Instance2304.8 has 1.2 for I/O Log Reads Average Latency.
11/9/2010 8:45:08 AM -- Test has 0 Maximum Database Page Fault Stalls/sec.
11/9/2010 8:45:08 AM -- Test has 0 Database Page Fault Stalls/sec samples higher than
0.
11/9/2010 8:45:08 AM -- C:\Exchange\7420x4\24hr\Stress_2010_11_8_8_41_38.xml has 5750
samples queried.

```

Database Checksum Result Report

Checksum Statistics - All

DATABASE	SEEN PAGES	BAD PAGES	CORRECTABLE PAGES	WRONG PAGE-NUMBER PAGES	FILE LENGTH / SECONDS TAKEN
M:\db1\Jetstress001001.edb	33224514	0	0	0	1038266 Mbytes / 72763 sec
N:\db1\Jetstress002001.edb	33224258	0	0	0	1038258 Mbytes / 70995 sec
O:\db1\Jetstress003001.edb	33224258	0	0	0	1038258 Mbytes / 70999 sec
P:\db1\Jetstress004001.edb	33225282	0	0	0	1038290 Mbytes / 70976 sec
Q:\db1\Jetstress005001.edb	33224770	0	0	0	1038274 Mbytes / 70971 sec
R:\db1\Jetstress006001.edb	33225538	0	0	0	1038298 Mbytes / 70974 sec
S:\db1\Jetstress007001.edb	33225538	0	0	0	1038298 Mbytes / 70969 sec
T:\db1\Jetstress008001.edb	33225026	0	0	0	1038282 Mbytes / 70967 sec
(Sum)	265799184	0	0	0	8306224 Mbytes / 72763 sec

Disk Subsystem Performance (of checksum)

LOGICALDISK	AVG. DISK SEC/READ	AVG. DISK SEC/WRITE	DISK READS/SEC	DISK WRITES/SEC	AVG. DISK BYTES/READ
M:	0.155	0.000	228.135	0.000	65536.000
N:	0.142	0.000	233.798	0.000	65536.000
O:	0.142	0.000	233.753	0.000	65536.000
P:	0.143	0.000	233.831	0.000	65536.000
Q:	0.143	0.000	233.890	0.000	65536.000
R:	0.143	0.000	233.845	0.000	65536.000
S:	0.143	0.000	233.901	0.000	65536.000
T:	0.142	0.000	233.923	0.000	65536.000

Memory System Performance (of checksum)

COUNTER	AVERAGE	MINIMUM	MAXIMUM
% Processor Time	2.904	1.130	10.577
Available Mbytes	30619.651	30465.000	30636.000
Free System Page Table Entries	33557793.665	33557299.000	33558363.000
Transition Pages Repurposed/sec	0.000	0.000	0.000
Pool Non-paged Bytes	66536985.347	66478080.000	66555904
Pool Paged Bytes	126173118.099	125669376.000	142606336.000

Test Log

```

11/8/2010 8:41:21 AM -- Jetstress testing begins ...
11/8/2010 8:41:21 AM -- Prepare testing begins ...
11/8/2010 8:41:29 AM -- Attaching databases ...
11/8/2010 8:41:29 AM -- Prepare testing ends.
11/8/2010 8:41:29 AM -- Dispatching transactions begins ...
11/8/2010 8:41:29 AM -- Database cache settings: (minimum: 256.0 MB, maximum: 2.0 GB)
11/8/2010 8:41:29 AM -- Database flush thresholds: (start: 20.5 MB, stop: 40.9 MB)
11/8/2010 8:41:38 AM -- Database read latency thresholds: (average: 20 msec/read,
maximum: 200 msec/read).
11/8/2010 8:41:38 AM -- Log write latency thresholds: (average: 10 msec/write, maximum:
200 msec/write).
11/8/2010 8:41:42 AM -- Operation mix: Sessions 5, Inserts 40%, Deletes 20%, Replaces
5%, Reads 35%, Lazy Commits 70%.
11/8/2010 8:41:42 AM -- Performance logging begins (interval: 15000 ms).
11/8/2010 8:41:42 AM -- Attaining prerequisites:
11/8/2010 8:44:14 AM -- \MSExchange Database (JetstressWin)\Database Cache Size, Last:
1946202000.0 (lower bound: 1932735000.0, upper bound: none)
11/9/2010 8:44:14 AM -- Performance logging ends.
11/9/2010 8:44:14 AM -- JetInterop batch transaction stats: 438808, 437927, 438476,
439043, 438027, 439456, 439293 and 439723.
11/9/2010 8:44:15 AM -- Dispatching transactions ends.
11/9/2010 8:44:15 AM -- Shutting down databases ...
11/9/2010 8:44:19 AM -- Instance2304.1 (complete), Instance2304.2 (complete),
Instance2304.3 (complete), Instance2304.4 (complete), Instance2304.5 (complete),
Instance2304.6 (complete), Instance2304.7 (complete) and Instance2304.8 (complete)
11/9/2010 8:44:19 AM -- C:\Exchange\7420x4\24hr\Stress_2010_11_8_8_41_38.blg has 5761
samples.
11/9/2010 8:44:19 AM -- Creating test report ...
11/9/2010 8:45:08 AM -- Instance2304.1 has 15.5 for I/O Database Reads Average Latency.
11/9/2010 8:45:08 AM -- Instance2304.1 has 1.3 for I/O Log Writes Average Latency.
11/9/2010 8:45:08 AM -- Instance2304.1 has 1.3 for I/O Log Reads Average Latency.
11/9/2010 8:45:08 AM -- Instance2304.2 has 14.4 for I/O Database Reads Average Latency.
11/9/2010 8:45:08 AM -- Instance2304.2 has 1.2 for I/O Log Writes Average Latency.
11/9/2010 8:45:08 AM -- Instance2304.2 has 1.2 for I/O Log Reads Average Latency.
11/9/2010 8:45:08 AM -- Instance2304.3 has 14.4 for I/O Database Reads Average Latency.
11/9/2010 8:45:08 AM -- Instance2304.3 has 1.3 for I/O Log Writes Average Latency.
11/9/2010 8:45:08 AM -- Instance2304.3 has 1.3 for I/O Log Reads Average Latency.
11/9/2010 8:45:08 AM -- Instance2304.4 has 14.4 for I/O Database Reads Average Latency.
11/9/2010 8:45:08 AM -- Instance2304.4 has 1.3 for I/O Log Writes Average Latency.
11/9/2010 8:45:08 AM -- Instance2304.4 has 1.3 for I/O Log Reads Average Latency.
11/9/2010 8:45:08 AM -- Instance2304.5 has 14.4 for I/O Database Reads Average Latency.
11/9/2010 8:45:08 AM -- Instance2304.5 has 1.3 for I/O Log Writes Average Latency.
11/9/2010 8:45:08 AM -- Instance2304.5 has 1.3 for I/O Log Reads Average Latency.
11/9/2010 8:45:08 AM -- Instance2304.6 has 14.4 for I/O Database Reads Average Latency.
11/9/2010 8:45:08 AM -- Instance2304.6 has 1.2 for I/O Log Writes Average Latency.
11/9/2010 8:45:08 AM -- Instance2304.6 has 1.2 for I/O Log Reads Average Latency.
11/9/2010 8:45:08 AM -- Instance2304.7 has 14.4 for I/O Database Reads Average Latency.

```

```

11/9/2010 8:45:08 AM -- Instance2304.7 has 1.2 for I/O Log Writes Average Latency.
11/9/2010 8:45:08 AM -- Instance2304.7 has 1.2 for I/O Log Reads Average Latency.
11/9/2010 8:45:08 AM -- Instance2304.8 has 14.4 for I/O Database Reads Average Latency.
11/9/2010 8:45:08 AM -- Instance2304.8 has 1.2 for I/O Log Writes Average Latency.
11/9/2010 8:45:08 AM -- Instance2304.8 has 1.2 for I/O Log Reads Average Latency.
11/9/2010 8:45:08 AM -- Test has 0 Maximum Database Page Fault Stalls/sec.
11/9/2010 8:45:08 AM -- Test has 0 Database Page Fault Stalls/sec samples higher than
0.
11/9/2010 8:45:08 AM -- C:\Exchange\7420x4\24hr\Stress_2010_11_8_8_41_38.xml has 5750
samples queried.
11/9/2010 8:45:08 AM -- C:\Exchange\7420x4\24hr\Stress_2010_11_8_8_41_38.html is saved.
11/9/2010 8:45:09 AM -- Performance logging begins (interval: 30000 ms).
11/9/2010 8:45:09 AM -- Verifying database checksums ...
11/10/2010 4:57:53 AM -- M: (100% processed), N: (100% processed), O: (100% processed),
P: (100% processed), Q: (100% processed), R: (100% processed), S: (100% processed) and
T: (100% processed)
11/10/2010 4:57:53 AM -- Performance logging ends.
11/10/2010 4:57:53 AM -- C:\Exchange\7420x4\24hr\DBChecksum_2010_11_9_8_45_8.blg has
2424 samples.
    
```

Soft Recovery Test Result Report

Transaction Log Recovery/Replay Performance

Soft Recovery Statistics - All

DATABASE INSTANCE	LOG FILES REPLAYED	ELAPSED SECONDS
Instance2576.1	516	987.0963275
Instance2576.2	505	1037.2194488
Instance2576.3	506	1003.2736312
Instance2576.4	508	1016.7989179
Instance2576.5	512	924.773928
Instance2576.6	504	1040.4018692
Instance2576.7	505	993.4611683
Instance2576.8	500	1018.1249264

Database Configuration

Instance2576.1	Log Path: L:\log1 Database: M:\db1\Jetstress001001.edb
Instance2576.2	Log Path: L:\log2 Database: N:\db1\Jetstress002001.edb
Instance2576.3	Log Path: L:\log3 Database: O:\db1\Jetstress003001.edb
Instance2576.4	Log Path: L:\log4 Database: P:\db1\Jetstress004001.edb

Instance2576.5 Log Path: L:\log5
Database: Q:\db1\Jetstress005001.edb

Instance2576.6 Log Path: L:\log6
Database: R:\db1\Jetstress006001.edb

Instance2576.7 Log Path: L:\log7
Database: S:\db1\Jetstress007001.edb

Instance2576.8 Log Path: L:\log8
Database: T:\db1\Jetstress008001.edb

Transactional I/O Performance

MSEXCHANGE DB ==> INSTANCES	I/O DB	I/O DB					I/O LOG	I/O LOG				
	READS	WRITES	I/O DB	I/O DB	I/O DB	I/O DB	READS	WRITES	I/O LOG	I/O LOG	I/O LOG	I/O LOG
	AVE	AVE	READS/SEC	WRITES/SEC	READS AVE	WRITES	AVE	AVE	READS/SEC	WRITES/SEC	READS AVE	WRITES
	LATENCY (MSEC)	LATENCY (MSEC)			BYTES	AVE BYTES	LATENCY (MSEC)	LATENCY (MSEC)			BYTES	AVE BYTES
Instance2576.1	19.937	11.934	595.917	3.152	35350.680	30082.098	12.140	0.045	4.728	0.003	212605.629	2.098
Instance2576.2	19.507	12.051	577.783	2.920	35302.305	29962.957	11.329	0.000	4.378	0.000	210475.703	0.000
Instance2576.3	20.162	12.168	586.195	3.035	35301.314	29729.032	13.075	0.000	4.553	0.000	208268.314	0.000
Instance2576.4	19.738	12.384	592.552	2.999	35308.726	30557.460	11.450	0.000	4.499	0.000	214988.721	0.000
Instance2576.5	20.661	12.091	613.329	3.326	35377.460	30764.716	14.027	0.000	4.988	0.000	216813.804	0.000
Instance2576.6	19.661	12.011	571.140	2.912	35290.508	29338.791	11.612	0.001	4.368	0.003	208017.853	1.984
Instance2576.7	19.566	11.779	593.694	3.048	35307.511	28638.699	11.576	0.000	4.572	0.000	203254.725	0.000
Instance2576.8	19.424	11.946	581.646	2.946	35372.436	29777.270	11.638	0.000	4.418	0.000	211501.145	0.000

Background Database Maintenance I/O Performance

MSEXCHANGE DATABASE ==> INSTANCES	DATABASE MAINTENANCE IO READS/SEC	DATABASE MAINTENANCE IO READS AVERAGE BYTES
Instance2576.1	0.000	0.000
Instance2576.2	0.000	0.000
Instance2576.3	0.000	0.000
Instance2576.4	0.000	0.000
Instance2576.5	0.000	0.000
Instance2576.6	0.000	0.000
Instance2576.7	0.000	0.000
Instance2576.8	0.000	0.000

Total I/O Performance

MSEXCHANGE DB => INSTANCES	I/O DB		I/O DB				I/O LOG		I/O LOG			
	READS	WRITES	I/O DB	I/O DB	I/O DB READS	I/O DB	READS	WRITES	I/O LOG	I/O LOG	I/O LOG READS	WRITES
	AVE	AVE	READS/SEC	WRITES/SEC	AVE BYTES	WRITES BYTES	AVE	AVE	READS/SEC	WRITES/SEC	AVE BYTES	AVE
	LATENCY (MSEC)	LATENCY (MSEC)					LATENCY (MSEC)	LATENCY (MSEC)				BYTES
Instance2576.1	19.937	11.934	595.917	3.152	35350.680	30082.098	12.140	0.045	4.728	0.003	212605.629	2.098
Instance2576.2	19.507	12.051	577.783	2.920	35302.305	29962.957	11.329	0.000	4.378	0.000	210475.703	0.000
Instance2576.3	20.162	12.168	586.195	3.035	35301.314	29729.032	13.075	0.000	4.553	0.000	208268.314	0.000
Instance2576.4	19.738	12.384	592.552	2.999	35308.726	30557.460	11.450	0.000	4.499	0.000	214988.721	0.000
Instance2576.5	20.661	12.091	613.329	3.326	35377.460	30764.716	14.027	0.000	4.988	0.000	216813.804	0.000
Instance2576.6	19.661	12.011	571.140	2.912	35290.508	29338.791	11.612	0.001	4.368	0.003	208017.853	1.984
Instance2576.7	19.566	11.779	593.694	3.048	35307.511	28638.699	11.576	0.000	4.572	0.000	203254.725	0.000
Instance2576.8	19.424	11.946	581.646	2.946	35372.436	29777.270	11.638	0.000	4.418	0.000	211501.145	0.000

Host System Performance

COUNTER	AVERAGE	MINIMUM	MAXIMUM
% Processor Time	8.311	2.043	18.217
Available Mbytes	28710.228	28675.000	30728.000
Free System Page Table Entries	33558169.344	33557570.000	33558321.000
Transition Pages Repurposed/sec	0.000	0.000	0.000
Pool Non-paged Bytes	65936158.641	57991168.000	66301952.000
Pool Paged Bytes	114521281.730	113319936.000	114675712.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log

```

11/11/2010 9:44:09 PM -- Jetstress testing begins ...
11/11/2010 9:44:09 PM -- Prepare testing begins ...
11/11/2010 9:44:17 PM -- Attaching databases ...
11/11/2010 9:44:17 PM -- Prepare testing ends.
11/11/2010 9:44:17 PM -- Dispatching transactions begins ...
11/11/2010 9:44:17 PM -- Database cache settings: (minimum: 256.0 MB, maximum: 2.0 GB)
11/11/2010 9:44:17 PM -- Database flush thresholds: (start: 20.5 MB, stop: 40.9 MB)
11/11/2010 9:44:27 PM -- Database read latency thresholds: (average: 20 msec/read,
maximum: 100 msec/read).
11/11/2010 9:44:27 PM -- Log write latency thresholds: (average: 10 msec/write,
maximum: 100 msec/write).
11/11/2010 9:44:29 PM -- Operation mix: Sessions 5, Inserts 40%, Deletes 20%, Replaces
5%, Reads 35%, Lazy Commits 70%.
11/11/2010 9:44:29 PM -- Performance logging begins (interval: 15000 ms).
11/11/2010 9:44:29 PM -- Generating log files ...
11/11/2010 11:03:32 PM -- L:\log1 (103.4% generated), L:\log2 (101.2% generated),
L:\log3 (101.4% generated), L:\log4 (101.8% generated), L:\log5 (102.6% generated),
L:\log6 (101.0% generated), L:\log7 (101.2% generated) and L:\log8 (100.2% generated)
11/11/2010 11:03:32 PM -- Performance logging ends.

```

```

11/11/2010 11:03:32 PM -- JetInterop batch transaction stats: 22286, 22096, 21943,
22143, 22139, 22070, 22087 and 21864.
11/11/2010 11:03:32 PM -- Dispatching transactions ends.
11/11/2010 11:03:32 PM -- Shutting down databases ...
11/11/2010 11:03:37 PM -- Instance2576.1 (complete), Instance2576.2 (complete),
Instance2576.3 (complete), Instance2576.4 (complete), Instance2576.5 (complete),
Instance2576.6 (complete), Instance2576.7 (complete) and Instance2576.8 (complete)
11/11/2010 11:03:37 PM --
C:\Exchange\7420x4\soft_recovery\Performance_2010_11_11_21_44_27.blg has 315 samples.
11/11/2010 11:03:37 PM -- Creating test report ...
11/11/2010 11:03:39 PM -- Instance2576.1 has 17.7 for I/O Database Reads Average
Latency.
11/11/2010 11:03:39 PM -- Instance2576.1 has 2.0 for I/O Log Writes Average Latency.
11/11/2010 11:03:39 PM -- Instance2576.1 has 2.0 for I/O Log Reads Average Latency.
11/11/2010 11:03:39 PM -- Instance2576.2 has 16.7 for I/O Database Reads Average
Latency.
11/11/2010 11:03:39 PM -- Instance2576.2 has 1.9 for I/O Log Writes Average Latency.
11/11/2010 11:03:39 PM -- Instance2576.2 has 1.9 for I/O Log Reads Average Latency.
11/11/2010 11:03:39 PM -- Instance2576.3 has 15.9 for I/O Database Reads Average
Latency.
11/11/2010 11:03:39 PM -- Instance2576.3 has 1.9 for I/O Log Writes Average Latency.
11/11/2010 11:03:39 PM -- Instance2576.3 has 1.9 for I/O Log Reads Average Latency.
11/11/2010 11:03:39 PM -- Instance2576.4 has 16.7 for I/O Database Reads Average
Latency.
11/11/2010 11:03:39 PM -- Instance2576.4 has 2.3 for I/O Log Writes Average Latency.
11/11/2010 11:03:39 PM -- Instance2576.4 has 2.3 for I/O Log Reads Average Latency.
11/11/2010 11:03:39 PM -- Instance2576.5 has 16.5 for I/O Database Reads Average
Latency.
11/11/2010 11:03:39 PM -- Instance2576.5 has 2.0 for I/O Log Writes Average Latency.
11/11/2010 11:03:39 PM -- Instance2576.5 has 2.0 for I/O Log Reads Average Latency.
11/11/2010 11:03:39 PM -- Instance2576.6 has 16.4 for I/O Database Reads Average
Latency.
11/11/2010 11:03:39 PM -- Instance2576.6 has 2.2 for I/O Log Writes Average Latency.
11/11/2010 11:03:39 PM -- Instance2576.6 has 2.2 for I/O Log Reads Average Latency.
11/11/2010 11:03:39 PM -- Instance2576.7 has 16.7 for I/O Database Reads Average
Latency.
11/11/2010 11:03:39 PM -- Instance2576.7 has 2.0 for I/O Log Writes Average Latency.
11/11/2010 11:03:39 PM -- Instance2576.7 has 2.0 for I/O Log Reads Average Latency.
11/11/2010 11:03:39 PM -- Instance2576.8 has 17.0 for I/O Database Reads Average
Latency.
11/11/2010 11:03:39 PM -- Instance2576.8 has 2.6 for I/O Log Writes Average Latency.
11/11/2010 11:03:39 PM -- Instance2576.8 has 2.6 for I/O Log Reads Average Latency.
11/11/2010 11:03:39 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.
11/11/2010 11:03:39 PM -- Test has 0 Database Page Fault Stalls/sec samples higher than
0.
11/11/2010 11:03:39 PM --
C:\Exchange\7420x4\soft_recovery\Performance_2010_11_11_21_44_27.xml has 314 samples
queried.
11/11/2010 11:03:40 PM --
C:\Exchange\7420x4\soft_recovery\Performance_2010_11_11_21_44_27.html is saved.
11/11/2010 11:03:42 PM -- Performance logging begins (interval: 4000 ms).
11/11/2010 11:03:42 PM -- Recovering databases ...
11/11/2010 11:21:02 PM -- Performance logging ends.
11/11/2010 11:21:02 PM -- Instance2576.1 (987.0963275), Instance2576.2 (1037.2194488),
Instance2576.3 (1003.2736312), Instance2576.4 (1016.7989179), Instance2576.5
(924.773928), Instance2576.6 (1040.4018692), Instance2576.7 (993.4611683) and
Instance2576.8 (1018.1249264)
11/11/2010 11:21:03 PM --
C:\Exchange\7420x4\soft_recovery\SoftRecovery_2010_11_11_23_3_40.blg has 259 samples.
11/11/2010 11:21:03 PM -- Creating test report ...

```

Database Backup Test Result Report

[Database Read-only Performance](#)

Database Backup Statistics - All

DATABASE INSTANCE	DATABASE SIZE (MBYTES)	ELAPSED BACKUP TIME	MBYTES TRANSFERRED/SEC
Instance2576.1	1039338.09	21:05:29	6.40
Instance2576.2	1039322.09	16:54:01	7.06
Instance2576.3	1039314.09	16:55:30	7.05
Instance2576.4	1039370.09	16:56:01	7.05
Instance2576.5	1039346.09	16:55:33	7.05
Instance2576.6	1039362.09	16:55:43	7.05
Instance2576.7	1039378.09	16:54:50	7.06
Instance2576.8	1039354.09	16:53:37	7.06

Jetstress System Parameters

Thread Count	5 (per database)
Minimum Database Cache	256.0 MB
Maximum Database Cache	2048.0 MB
Insert Operations	40%
Delete Operations	20%
Replace Operations	5%
Read Operations	35%
Lazy Commits	70%

Database Configuration

Instance2576.1	Log Path: L:\log1 Database: M:\db1\Jetstress001001.edb
Instance2576.2	Log Path: L:\log2 Database: N:\db1\Jetstress002001.edb
Instance2576.3	Log Path: L:\log3 Database: O:\db1\Jetstress003001.edb
Instance2576.4	Log Path: L:\log4 Database: P:\db1\Jetstress004001.edb
Instance2576.5	Log Path: L:\log5

Instance2576.6 Database: Q:\db1\Jetstress005001.edb
 Log Path: L:\log6
 Database: R:\db1\Jetstress006001.edb

Instance2576.7 Database: S:\db1\Jetstress007001.edb
 Log Path: L:\log7

Instance2576.8 Database: T:\db1\Jetstress008001.edb
 Log Path: L:\log8

Transactional I/O Performance

MSEXCHANGE DB => INSTANCES	I/O DB		I/O DB				I/O LOG		I/O LOG		I/O LOG	
	READS AVE LATENCY (MSEC)	WRITES AVE LATENCY (MSEC)	I/O DB READS/SEC	I/O DB WRITES/SEC	I/O DB READS AVE BYTES	I/O DB WRITES AVE BYTES	READS AVE LATENCY (MSEC)	WRITES AVE LATENCY (MSEC)	I/O LOG READS/SEC	I/O LOG WRITES/SEC	I/O LOG READS AVE BYTES	I/O LOG WRITES AVE BYTES
Instance2576.1	65.127	0.000	25.604	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance2576.2	56.213	0.000	28.235	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance2576.3	56.278	0.000	28.218	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance2576.4	56.275	0.000	28.213	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance2576.5	56.261	0.000	28.217	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance2576.6	56.265	0.000	28.214	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance2576.7	56.259	0.000	28.225	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance2576.8	56.224	0.000	28.240	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	0.823	0.052	7.675
Available Mbytes	30764.443	30609.000	30783.000
Free System Page Table Entries	33558232.955	33557787.000	33558322.000
Transition Pages Repurposed/sec	0.000	0.000	0.000
Pool Non-paged Bytes	65782706.921	65740800.000	65908736.000
Pool Paged Bytes	117489243.567	114593792.000	118722560.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log

```
11/12/2010 8:47:35 AM -- Jetstress testing begins ...
11/12/2010 8:47:35 AM -- Prepare testing begins ...
11/12/2010 8:47:44 AM -- Attaching databases ...
11/12/2010 8:47:44 AM -- Prepare testing ends.
11/12/2010 8:47:54 AM -- Performance logging begins (interval: 30000 ms).
```

```
11/12/2010 8:47:54 AM -- Backing up databases ...
11/14/2010 5:53:24 AM -- Performance logging ends.
11/14/2010 5:53:24 AM -- Instance2576.1 (100% processed), Instance2576.2 (100%
processed), Instance2576.3 (100% processed), Instance2576.4 (100% processed),
Instance2576.5 (100% processed), Instance2576.6 (100% processed), Instance2576.7 (100%
processed) and Instance2576.8 (100% processed)
11/14/2010 5:53:24 AM --
C:\Exchange\7420x4\database_backup\DatabaseBackup_2010_11_12_8_47_44.blg has 5407
samples.
11/14/2010 5:53:24 AM -- Creating test repo
```



Sun ZFS Storage 7420 Appliance
32,000 Mailbox Resiliency Exchange 2010
Storage Solution

June 2012

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