



Sun StorageTek 6140 6000 Mailbox Exchange 2007 Storage Solution



Tested with: ESRP – Storage Version 2.0
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Overview

This document provides information on Sun Microsystem's storage solution for Microsoft Exchange 2007 Server, based the *Microsoft Exchange Solution Reviewed Program (ESRP) – Storage* program*. For any questions or comments regarding the contents of this document, see Contact for Additional Information.

*The *ESRP – Storage* program was developed by Microsoft Corporation to provide a common storage testing framework for vendors to provide information on its storage solutions for Microsoft Exchange Server software. For more details on the *Microsoft ESRP – Storage* program, please click <http://www.microsoft.com/technet/prodtechnol/exchange/2007/esrp.msp>

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Features

This document describes a Microsoft Exchange 2007 primary storage solution on the Sun Microsystems StorageTek 6140 array. The targeted number of users in this environment is 6000. The tested user profile was 0.5 IOPS (0.42 + 20%) per mailbox with a limit of 300MB. This solution can be scaled by adding additional arrays. The ST6140 is an excellent chose for medium to large sized businesses.

Solution Description

The tested solution consists of (1) Sun StorageTek 6140 RAID Unit with (16) 73GB 15,000 rpm FC 4Gb/s drives and (2) Expansion Units with (32) 73GB 15,000 rpm FC 4Gb/s drives for 3.5TB (raw) / 1.8TB (usable, RAID 10). This solution can expand to (6) Expansion units for a total of 84 (raw) / 74 TB (usable, RAID 5 with hot spares) SATA-II.

http://www.sun.com/storagetek/disk_systems/midrange/6140/

Sun StorageTek 6140 Array		
	6140 - 2 GB cache	6140 - 4 GB cache
Controller card	Dual Fibre Channel RAID controller cards	
Cache size (with ECC protection)	2 GB data cache	4 GB data cache
Host ports	Four (SFPs)	Eight (SFPs)
Host interfaces/link speeds	Switched FC or FC-AL/4 Gbps, 2 Gbps, 4 Gbps	
Other interfaces	<ul style="list-style-type: none"> • Two 4 Gbps or 2 Gbps FC expansion ports (switched loop) • Two 6-pin Mini-DIN to 9-pin serial ports • Four RJ45 10/100 Base-T network connectors 	
RAID Level	0, 1, 3, 5, and 1+0	
Cache Battery Backup	Up to 72 hours	
Integrated data services/ premium features (optional)	<ul style="list-style-type: none"> • Sun StorageTek Data Snapshot (supports four snapshots per volume, 512 per array) • Sun StorageTek Data Volume Copy (supports eight active copies per volume, 512 per array) • Sun StorageTek Data Replicator software (supports up to 32 replicated volumes) • Sun StorageTek Storage Domain (4, 8, 16, 64) (Sun StorageTek 6140 array's 2 GB cache supports up to 16 only) 	
Dynamic capacity expansion	Five to 64 drives 365 GB to 48 TB	Five to 112 drives 365 GB to 84 TB
Expansion tray (FC-SBOD)	Up to three expansion trays	Up to six expansion trays
Dynamic reconfiguration	Volume expansion, RAID migration, capacity expansion, segment size migration, volume/virtual disk reconfiguration, controller firmware upgrades	

Drive depopulation	Scales from five to 16 hard disk drives per tray	
Volume	Up to 1,024	Up to 1,024
Global hot spares	Up to 15	Up to 15
Maximum array capacity	48 TB	84 TB

Disk drives

Form factor	3.5 in., low-profile
Interface	Dual-ported Fibre Channel
Supported drives/system per tray capacity (raw, unformatted)	<p>Fibre Channel drives</p> <ul style="list-style-type: none"> • 73 GB 15,000-rpm 4 Gb/s • 146 GB 15,000-rpm 4 Gb/s • 146 GB 10,000-rpm 2 Gb/s • 300 GB 15,000-rpm 4 Gb/s • 300 GB 10,000-rpm 2 Gb/s <p>SATA-II drives</p> <ul style="list-style-type: none"> • 500 GB 7,200-rpm 3 Gb/s • 750 GB 7,200-rpm 3 Gb/s <p>Fibre Channel drives</p> <ul style="list-style-type: none"> • 1,168 GB per tray (3 RU) • 2,336 GB per tray (3 RU) • 2,336 GB per tray (3 RU) • 4,800 GB per tray (3 RU) • 4,800 GB per tray (3 RU) <p>SATA-II drives</p> <ul style="list-style-type: none"> • 8,000 GB per tray (3 RU) • 12,000 GB per tray (3 RU)

Software

Supported software	<ul style="list-style-type: none"> • Sun StorageTek QFS Software • Sun StorageTek Storage Archive Manager Software • Sun Cluster Software
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Management software support	<ul style="list-style-type: none"> • Sun StorageTek Enterprise Backup Software (EBS) • Solstice DiskSuite 4.2.1 (in conjunction with Solaris 8 Operating System) • Solaris Volume Manager (embedded in Solaris 9 Operating System) • Symantec NetBackup (NBU) • Symantec Volume Manager with DMP (VxVM) • Symantec File System (VxFS) • Symantec Storage Foundation • Sun StorageTek Common Array Manager (CAM) software (included)
Support	
Operating system support	<ul style="list-style-type: none"> • Solaris Operating System 8, 9, 10, and x64 • Microsoft Windows 2000 Server and Advanced Server (SP4) • Microsoft Windows 2003 Server Standard, Enterprise, and Web editions • HP-UX 11.11 and 11.23 • IBM AIX 5.2, 5.3 • Red Hat Linux AS/ES/WS Enterprise Edition 3.0/4.0 • SUSE LINUX LES 8 and 9 • Netware 6 SP5, Netware 6.5 SP3 • SGI IRIX 6.5.28 • VMWare ESX 3.0 <p>The Sun StorageTek 6140 array is fully supported with major host operating systems and multi-path drivers.</p>
Warranty	
Duration	Three years
Phone Support	8 a.m.-8 p.m., Mon-Fri
On-Site Service	Next business day, 8 a.m.-5 p.m., Mon-Fri
On-Site Response Time	Next business day, local business hours
Service upgrade	Spectrum available

Dimensions	
Height x width x depth	Controller module: 17.5cm (6.9 in.) x 48.3cm (19.0 in.) x 65.1cm (25.6 in.) Expansion module: 12.95cm (5.1 in.) x 44.70cm (17.6 in.) x 57.15cm (22.5 in.) Cabinet: 188cm (74 in.) x 59.7cm (23.5 in.) x 100cm (39.4 in.)
Weight (maximum)	40 kg (88 lbs.)
Power requirements	
AC power	Controller module: 3.96 A max. operating at 115 V AC (90–136 V AC range), 50/60 Hz 2.06 A max. operating at 240 V AC (180–264 V AC range), 50/60 Hz Expansion module: 4.11 A max. operating at 115 V AC (90–136 V AC range), 50/60 Hz 1.97 A max. operating at 240 C (180-264 V AC range), 50/60Hz
DC Power	Controller module: DC power: 17 A max. operating (-36 to -72 V DC range) Expansion module: DC power: 17 A max. operating (-36 to -72 V DC range)
Environment	
Operating temperature	5° to 40°C (41° to 104°F)
Relative humidity	5 to 85 percent noncondensing
Altitude	100 ft. (30.5m) below sea level to 9,840 ft. (3,000m)
Shock	10 G, 11 ms half-sine
Vibration	Random vibration to specified power spectral density
Heat output	Controller module: 460 watts (1,571 BTU/hr.) Expansion module: 444 watts (1,517 BTU/hr.)

Regulations	
Safety and emissions	IEC 60950, EN 60950, UL/CSA 60950, FCC Part 15 (47CFR15B), CISPR 22 (EN55022—RF radiated and conducted emissions), IEC 61000-3-2, IEC 61000-3-3
Immunity	CISPR 24 (EN55024), IEC 61000-4-2, IEC 61000-4-3, IEC 61000-4-4, IEC 61000-4-5, IEC 61000 4-6, IEC 61000-4-11
Ruggedized	NEBS Level 3 (GR-63-CORE; GR-1089-CORE), ETSi EN 300 386



The Sun StorageTek 6140 Array is listed on the Windows Server Catalog of tested products here:

<http://www.windowsservercatalog.com/item.aspx?idItem=83a649f1-77af-9726-cb1b-71d64e6eca44>

RAID Module LUNs

Sun StorageTek 6140 RAID Module LUNs can be managed through Sun StorageTek Common Array Manager (CAM). RAID levels 0, 1, (1+0), 3 and 5 are supported.

Tested Configuration

The LUN layout of this solution is as follows. Six 6+1 RAID5 LUNs were created for the databases. One 5+1 RAID5 LUN was created for sequential writes.

The I/O activity to the log is 100% small sequential writes. The I/O activity to the database is mostly random. By separating the two distinct I/O characteristics to different LUNs, performance will increase.

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 2007 solution. Other factors which 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 2007 system, please refer to Microsoft's Troubleshooting Microsoft Exchange 2007 Server Performance, available at <http://go.microsoft.com/fwlink/?LinkId=23454>.

Targeted Customer Profile

This solution is targeted towards a 6000 user Exchange 2007 deployment.

- Medium to large organization
- One Exchange 2007 Server
- .42 IOPS + 20% headroom User I/O profile (0.5 tested)
- 300MB mailbox quota

Tested Deployment

The following tables summarize the testing environment:

Simulated Exchange Configuration:

Number of Exchange mailboxes simulated	6000
Number of hosts	1
Number of mailboxes/host	6000

Number of storage groups/host	18
Number of mailbox stores/storage group	1
Number of mailboxes/mailbox store	333
Number of mailbox store LUNs/storage group	3
Simulated profile: I/O's per second per mailbox (IOPS, include 20% headroom)	.5 (very heavy workload)
Database LUN size	2442 GB (407GB x 6)
Log LUN size	340 GB
Total database size for performance testing	2166 GB
% storage capacity used by Exchange database**	66%

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

Primary Storage Hardware

Storage Connectivity	Fibre Channel
Storage model and OS/firmware revision	StorageTek 6140 06.19.25.16 http://www.windowsservercatalog.com/item.aspx?idItem=83a649f1-77af-9726-cb1b-71d64e6eca44
Storage cache	3386MB
Number of storage controllers	2
Number of storage ports	8
Maximum bandwidth of storage connectivity to host	32Gb/s (up to 8 4Gb/s host connections per controller)
Switch type/model/firmware revision	N/A
HBA model and firmware	Sun Microsystems SG-XPCIE1FC-QF4 4.00.26
Number of HBA's/host	4
Host server type	Sun Microsystems, Inc. SunFire x4600M2 4 Dual-Core AMD Opteron 8220 SE Processors 32,768MB RAM
Total number of disks tested in	48

solution	
Maximum number of spindles can be hosted in the storage	As Configured: 48 Maximum Configuration: 112

Primary Storage Software

HBA driver	9.1.4.15
HBA QueueTarget Setting	0
HBA QueueDepth Setting	128
Multi-Pathing	SMIA-WSX64-01.01.32.04 MPIO DSM
Host OS	Microsoft Windows Server 2003, Enterprise Edition x64 SP2
ESE.dll file version	08.00.0685.024
Replication solution name/version	N/A

Primary Storage Disk Configuration (Mailbox Store Disks)

Disk type, speed and firmware revision	73 GB 15,000-rpm 4 Gb/sec - 0409
Raw capacity per disk (GB)	68.366GB
Number of physical disks in test	42
total raw storage capacity (GB)	2871GB
Disk slice size (GB)	N/A
Number of disks per LUN	7
Raid level	RAID 5
Total formatted capacity	2442GB
Storage capacity utilization	85%
Database capacity utilization	75%

Primary Storage Disk Configuration (Transactional Log Disks)

Disk type, speed and firmware rev	73 GB 15,000-rpm 4Gb/sec - 0409
Raw capacity per disk (GB)	68.366GB
Number of Spindles in test	6
total raw storage capacity (GB)	410GB
Disk slice size (GB)	N/A
Number of disks per LUN	6
Raid level	RAID5
Total formatted capacity	340GB

Solution Constraints

With either priority on an otherwise idle 6140, rebuild time for a 15k-RPM 146-GB FC disk in a 6+1 RAID-5 set was 1.4 hours, and Copy Back consumed 0.8 hours. If the RAID set is not "full" of logical volumes, these operations could be faster.

In general, random reads suffered a 50% degradation during a rebuild and 15% degradation for random writes.

To mitigate this performance hit, the use of RAID10 may be considered. The performance loss of any single disk failure is much less than in a RAID5 configuration, although usable capacity is decreased as well.

Best Practices

Exchange 2007 server is a disk-intensive application. Based on the testing run using the ESRP framework, we would recommend the following to improve the storage performance.

For Exchange 2007 best practices on storage design, please visit <http://technet.microsoft.com/en-us/library/bb124518.aspx>

Core Storage

1. Use the Microsoft Diskpart utility to align the sectors of all Exchange 2007 storage volumes before formatting. The Diskpart value should be set to 64.
2. Do not share Exchange 2007 disks with any other applications that are I/O intensive. This will have a negative effect on your disk subsystem performance.
3. When possible, separate the sequential writes of logs from the random access of database volumes.
4. Primary focus should be on the speed of the disks and not size.

Contact for Additional Information

<http://www.sun.com/exchange>

Test Result Summary

This section provides a high level summary of the test data from ESRP and the link to the detailed reports which are generated by ESRP testing framework. Please click on the underlined headings below to view the 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:

- No errors were reported in the saved eventlog file
- No errors were reported during the database and log checksum process

Primary 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 data below is the sum of all of the logical disk I/O's and average of all the logical disks I/O 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 I/O's across Storage Groups and the average latency across all Storage Groups on a per server basis.

Database I/O	
Average Database Disk Transfers/sec	2972.726
Average Database Disk Reads/sec	1523.119
Average Database Disk Writes/sec	1449.605
Average Database Disk Read Latency (ms)	15.8
Average Database Disk Write Latency (ms)	9.5
Transaction Log I/O	
Average Log Disk Writes/sec	842.655
Average Log Disk Write Latency (ms)	2

Streaming Backup/Recovery Performance

For the Version 1.0 release, only streaming backup type is supported for testing in the framework. There are two tests in this section. First one is to measure the read IO performance metrics by running checksum on all the databases and log files. The second test is to measure the end to end performance when the databases are backed up to disks.

Database Read-only Performance

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

MB read/sec per storage group_	38.003
MB read/sec total	684.05

Log Read-only 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.

Average time to play one Log file (sec)	1.17
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Conclusion

This document is developed by storage solution providers, and reviewed by Microsoft Exchange Product team. The test results/data presented in this document is based on the tests introduced in the ESRP test framework. Customer should not quote the data directly for his/her pre-deployment verification. It is still necessary to go through the exercises to validate the storage design for a specific customer environment.

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

Appendix

Microsoft Exchange Server **Jetstress**

Performance Test Result Report

Test Summary

Overall Test **Pass**

Result**Machine Name** ISV-4600E**Test Description****Test Start Time** 2/6/2008 11:56:08 AM**Test End Time** 2/6/2008 4:44:04 PM**Jetstress** 08.01.0112.000**Version****Ese Version** 08.00.0685.024**Operating System** Microsoft Windows Server 2003 Service Pack 2 (5.2.3790.131072)**Performance Log** [C:\Program Files\Exchange2007\Performance_2008_2_6_14_33_55.blg](#)
[C:\Program Files\Exchange2007\DBChecksum_2008_2_6_16_44_4.blg](#)

Database Sizing and Throughput

Achieved I/O per Second 2972.726**Planned I/O per Second** 3000**Initial database size** 1887526748160**Final database size** 1916905750528**Database files (count)** 18

Jetstress System Parameters

Thread count 7 (per-storage group)**Log buffers** 9000**Minimum database cache** 576.0 MB**Maximum database cache** 4608.0 MB**Insert operations** 25%**Delete operations** 10%**Replace operations** 50%**Read operations** 15%**Lazy commits** 80%

Disk Subsystem Performance

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec	Avg. Disk Bytes/Write
Database (F:)	0.018	0.012	253.904	242.956	(n/a)
Database (G:)	0.014	0.007	250.613	238.841	(n/a)
Database (I:)	0.014	0.007	255.455	241.919	(n/a)
Database (J:)	0.018	0.012	254.898	243.593	(n/a)
Database	0.014	0.007	252.524	240.951	(n/a)

(K:)					
Database	0.017	0.012	255.725	241.345	(n/a)
(L:)					
Log (H:)	0.000	0.002	0.000	842.655	11889.272

Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	3.605	1.836	5.664
Available MBytes	25017.539	25009.000	25396.000
Free System Page Table Entries	16750543.000	16750543.000	16750543.000
Transition Pages RePurposed/sec	16.885	0.000	1658.196
Pool Nonpaged Bytes	144138051.875	144134144.000	144166912.000
Pool Paged Bytes	1045996674.405	1045950464.000	1046511616.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log2/6/2008 11:56:08 AM -- Jetstress testing begins ...
2/6/2008 11:56:08 AM -- Prepare testing begins ...
2/6/2008 11:56:08 AM -- Creating F:\sg1\Jetstress1.edb.
2/6/2008 11:56:08 AM -- Database cache settings: (minimum: 32.0 MB, maximum: 256.0 MB)
2/6/2008 11:56:08 AM -- Database flush thresholds: (start: 2.6 MB, stop: 5.1 MB)
2/6/2008 12:14:23 PM -- 60.0% of 97.7 GB complete (3570723 records inserted).
2/6/2008 12:30:12 PM -- 100.0% of 97.7 GB complete (5983792 records inserted).
2/6/2008 12:30:14 PM -- Duplicating 17 databases:
2/6/2008 2:33:52 PM -- 100.0% of 1.6 TB complete (1.6 TB duplicated).
2/6/2008 2:33:52 PM -- Attaching databases ...
2/6/2008 2:33:52 PM -- Prepare testing ends.
2/6/2008 2:33:52 PM -- Dispatching transactions begins ...
2/6/2008 2:33:52 PM -- Database cache settings: (minimum: 576.0 MB, maximum: 4.5 GB)
2/6/2008 2:33:52 PM -- Database flush thresholds: (start: 46.1 MB, stop: 92.2 MB)
2/6/2008 2:33:55 PM -- Database read latency thresholds: (average: 0.02 seconds/read, maximum: 0.05 seconds/read).
2/6/2008 2:33:55 PM -- Log write latency thresholds: (average: 0.01 seconds/write, maximum: 0.05 seconds/write).
2/6/2008 2:33:56 PM -- Operation mix: Sessions 7, Inserts 25%, Deletes 10%, Replaces 50%, Reads 15%, Lazy Commits 80%.
2/6/2008 2:33:56 PM -- Performance logging begins (interval: 15000 ms).
2/6/2008 2:33:56 PM -- Attaining prerequisites:
2/6/2008 2:43:27 PM -- \Database(JetstressWin)\Database Cache Size, Last: 4348699000.0 (lower bound: 4348654000.0, upper bound: none)
2/6/2008 4:43:29 PM -- Performance logging ends.
2/6/2008 4:43:29 PM -- JetInterop batch transaction stats: 38130, 38241, 38269, 37987, 38336, 37952, 38231, 37750, 38068, 38263, 38398, 38318, 38195, 38173, 38344, 38208, 38498, and 38276.
2/6/2008 4:43:29 PM -- Dispatching transactions ends.
2/6/2008 4:43:29 PM -- Shutting down databases ...
2/6/2008 4:44:04 PM -- Instance3344.1 (complete), Instance3344.2 (complete), Instance3344.3 (complete), Instance3344.4 (complete), Instance3344.5 (complete), Instance3344.6 (complete), Instance3344.7 (complete), Instance3344.8 (complete), Instance3344.9 (complete), Instance3344.10 (complete), Instance3344.11 (complete),

Instance3344.12 (complete), Instance3344.13 (complete), Instance3344.14 (complete), Instance3344.15 (complete), Instance3344.16 (complete), Instance3344.17 (complete), and Instance3344.18 (complete)
 2/6/2008 4:44:04 PM -- Performance logging begins (interval: 30000 ms).
 2/6/2008 4:44:04 PM -- Verifying database checksums ...
 2/6/2008 5:39:57 PM -- F: (100% processed), G: (100% processed), I: (100% processed), J: (100% processed), K: (100% processed), and L: (100% processed)
 2/6/2008 5:39:58 PM -- Performance logging ends.
 2/6/2008 5:39:58 PM -- [C:\Program Files\Exchange2007\DBChecksum_2008_2_6_16_44_4.blg](#) has 111 samples.
 2/6/2008 5:40:01 PM -- [C:\Program Files\Exchange2007\DBChecksum_2008_2_6_16_44_4.html](#) is saved.
 2/6/2008 5:40:01 PM -- Verifying log checksums ...
 2/6/2008 5:40:52 PM -- H:\sg1 (22 logs passed), H:\sg2 (22 logs passed), H:\sg3 (22 logs passed), H:\sg4 (22 logs passed), H:\sg5 (22 logs passed), H:\sg6 (22 logs passed), H:\sg7 (22 logs passed), H:\sg8 (23 logs passed), H:\sg9 (22 logs passed), H:\sg10 (22 logs passed), H:\sg11 (21 logs passed), H:\sg12 (22 logs passed), H:\sg13 (22 logs passed), H:\sg14 (22 logs passed), H:\sg15 (23 logs passed), H:\sg16 (21 logs passed), H:\sg17 (21 logs passed), and H:\sg18 (22 logs passed)
 2/6/2008 5:40:52 PM -- [C:\Program Files\Exchange2007\Performance_2008_2_6_14_33_55.blg](#) has 517 samples.
 2/6/2008 5:40:52 PM -- Creating test report ...
 2/6/2008 5:41:05 PM -- Volume F: has 0.0182 for Avg. Disk sec/Read.
 2/6/2008 5:41:05 PM -- Volume G: has 0.0144 for Avg. Disk sec/Read.
 2/6/2008 5:41:05 PM -- Volume I: has 0.0145 for Avg. Disk sec/Read.
 2/6/2008 5:41:05 PM -- Volume J: has 0.0178 for Avg. Disk sec/Read.
 2/6/2008 5:41:05 PM -- Volume K: has 0.0142 for Avg. Disk sec/Read.
 2/6/2008 5:41:05 PM -- Volume L: has 0.0170 for Avg. Disk sec/Read.
 2/6/2008 5:41:05 PM -- Volume H: has 0.0025 for Avg. Disk sec/Write.
 2/6/2008 5:41:05 PM -- Volume H: has 0.0000 for Avg. Disk sec/Read.
 2/6/2008 5:41:05 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.
 2/6/2008 5:41:05 PM -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.
 2/6/2008 5:41:05 PM -- [C:\Program Files\Exchange2007\Performance_2008_2_6_14_33_55.xml](#) has 478 samples queried.

Microsoft Exchange Server **Jetstress**

Streaming backup Test Result Report

Streaming Backup Statistics - All

Database Instance	Database Size (MBytes)	Elapsed Backup Time	MBytes Transferred/sec
Instance3344.1	101580.77	00:44:51	37.74
Instance3344.2	101582.77	00:44:54	37.71
Instance3344.3	101572.77	00:44:53	37.71
Instance3344.4	101530.77	00:44:21	38.15
Instance3344.5	101524.77	00:44:52	37.71
Instance3344.6	101550.77	00:44:20	38.17
Instance3344.7	101558.77	00:44:23	38.14
Instance3344.8	101514.77	00:44:53	37.69
Instance3344.9	101558.77	00:44:20	38.18

Instance3344.10	101598.77	00:44:15	38.25
Instance3344.11	101574.77	00:44:47	37.80
Instance3344.12	101588.77	00:44:12	38.30
Instance3344.13	101542.77	00:44:22	38.14
Instance3344.14	101560.77	00:44:49	37.77
Instance3344.15	101596.77	00:44:20	38.18
Instance3344.16	101516.77	00:44:14	38.24
Instance3344.17	101542.77	00:44:41	37.87
Instance3344.18	101570.77	00:44:12	38.30

Jetstress System Parameters

Thread count	7 (per-storage group)
Log buffers	9000
Minimum database cache	576.0 MB
Maximum database cache	4608.0 MB
Insert operations	25%
Delete operations	10%
Replace operations	50%
Read operations	15%
Lazy commits	80%

Disk Subsystem Performance

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec	Avg. Disk Bytes/Write
Database (F:)	0.001	1.97443181818182E-05	906.377	0.003	(n/a)
Database (G:)	0.001	4.64700193423598E-05	909.717	0.021	(n/a)
Database (I:)	0.001	6.76455241187384E-05	909.912	0.022	(n/a)
Database (J:)	0.001	6.31353305785124E-05	910.918	0.024	(n/a)
Database (K:)	0.001	8.30650252525252E-05	910.039	0.022	(n/a)
Database (L:)	0.001	5.27777777777778E-05	910.883	0.025	(n/a)
Log (H:)	0.000	2.81363636363636E-05	0.000	0.133	376.436

Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	14.247	11.960	14.805
Available MBytes	29807.416	29763.000	29811.000
Free System Page Table Entries	16750478.000	16750478.000	16750478.000

Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	149313512.989	149286912.000	149422080.000
Pool Paged Bytes	1047420007.551	1047154688.000	1048748032.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log 2/6/2008 6:44:03 PM -- Jetstress testing begins ...
 2/6/2008 6:44:03 PM -- Prepare testing begins ...
 2/6/2008 6:44:04 PM -- Attaching databases ...
 2/6/2008 6:44:04 PM -- Prepare testing ends.
 2/6/2008 6:44:10 PM -- Performance logging begins (interval: 30000 ms).
 2/6/2008 6:44:10 PM -- Streaming backup databases ...
 2/6/2008 7:29:05 PM -- Performance logging ends.
 2/6/2008 7:29:05 PM -- Instance3344.1 (100% processed), Instance3344.2 (100% processed), Instance3344.3 (100% processed), Instance3344.4 (100% processed), Instance3344.5 (100% processed), Instance3344.6 (100% processed), Instance3344.7 (100% processed), Instance3344.8 (100% processed), Instance3344.9 (100% processed), Instance3344.10 (100% processed), Instance3344.11 (100% processed), Instance3344.12 (100% processed), Instance3344.13 (100% processed), Instance3344.14 (100% processed), Instance3344.15 (100% processed), Instance3344.16 (100% processed), Instance3344.17 (100% processed), and Instance3344.18 (100% processed)
 2/6/2008 7:29:05 PM -- [C:\Program Files\Exchange2007\StreamingBackup_2008_2_6_18_44_4.blg](#) has 89 samples.
 2/6/2008 7:29:05 PM -- Creating test report ...

Microsoft Exchange Server **Jetstress**

SoftRecovery Test Result Report

Soft-Recovery Statistics - All

Database Instance	Log files replayed	Elapsed seconds
Instance3344.1	500	600.265625
Instance3344.2	529	606.515625
Instance3344.3	520	605.265625
Instance3344.4	521	608.015625
Instance3344.5	524	608.515625
Instance3344.6	507	605.765625
Instance3344.7	519	607.765625
Instance3344.8	523	607.515625
Instance3344.9	515	606.765625
Instance3344.10	522	605.265625
Instance3344.11	514	598.515625
Instance3344.12	518	602.015625
Instance3344.13	517	606.765625
Instance3344.14	520	606.515625
Instance3344.15	523	608.015625

Instance3344.16 506	598.515625
Instance3344.17 511	600.515625
Instance3344.18 503	597.015625

Disk Subsystem Performance

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec	Avg. Disk Bytes/Write
Database (F:)	0.059	0.013	685.325	10.405	(n/a)
Database (G:)	0.111	0.020	650.716	10.373	(n/a)
Database (I:)	0.108	0.021	644.847	10.431	(n/a)
Database (J:)	0.058	0.012	687.309	10.448	(n/a)
Database (K:)	0.111	0.020	650.914	10.461	(n/a)
Database (L:)	0.058	0.012	667.089	10.176	(n/a)
Log (H:)	0.009	0.017	505.410	24.662	5063.532

Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	5.423	3.320	29.492
Available MBytes	25761.855	25018.000	29582.000
Free System Page Table Entries	16750199.842	16750198.000	16750268.000
Transition Pages RePurposed/sec	17.202	0.000	1769.012
Pool Nonpaged Bytes	145586768.842	143822848.000	159092736.000
Pool Paged Bytes	1048098762.105	1047724032.000	1048944640.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log2/6/2008 6:44:03 PM -- Jetstress testing begins ...

2/6/2008 6:44:03 PM -- Prepare testing begins ...

2/6/2008 6:44:04 PM -- Attaching databases ...

2/6/2008 6:44:04 PM -- Prepare testing ends.

2/6/2008 6:44:10 PM -- Performance logging begins (interval: 30000 ms).

2/6/2008 6:44:10 PM -- Streaming backup databases ...

2/6/2008 7:29:05 PM -- Performance logging ends.

2/6/2008 7:29:05 PM -- Instance3344.1 (100% processed), Instance3344.2 (100% processed), Instance3344.3 (100% processed), Instance3344.4 (100% processed), Instance3344.5 (100% processed), Instance3344.6 (100% processed), Instance3344.7 (100% processed), Instance3344.8 (100% processed), Instance3344.9 (100% processed), Instance3344.10 (100% processed), Instance3344.11 (100% processed), Instance3344.12 (100% processed), Instance3344.13 (100% processed), Instance3344.14 (100% processed), Instance3344.15 (100% processed), Instance3344.16 (100% processed), Instance3344.17 (100% processed), and Instance3344.18 (100% processed)

2/6/2008 7:29:05 PM -- [C:\Program Files\Exchange2007\StreamingBackup_2008_2_6_18_44_4.blg](#) has 89 samples.
2/6/2008 7:29:05 PM -- Creating test report ...
2/6/2008 7:29:07 PM -- [C:\Program Files\Exchange2007\StreamingBackup_2008_2_6_18_44_4.html](#) is saved.
2/6/2008 7:29:07 PM -- Jetstress testing ends.
2/6/2008 7:34:38 PM -- Jetstress testing begins ...
2/6/2008 7:34:38 PM -- Prepare testing begins ...
2/6/2008 7:34:39 PM -- Attaching databases ...
2/6/2008 7:34:39 PM -- Prepare testing ends.
2/6/2008 7:34:39 PM -- Dispatching transactions begins ...
2/6/2008 7:34:39 PM -- Database cache settings: (minimum: 576.0 MB, maximum: 4.5 GB)
2/6/2008 7:34:39 PM -- Database flush thresholds: (start: 46.1 MB, stop: 92.2 MB)
2/6/2008 7:34:40 PM -- Database read latency thresholds: (average: 0.02 seconds/read, maximum: 0.05 seconds/read).
2/6/2008 7:34:40 PM -- Log write latency thresholds: (average: 0.01 seconds/write, maximum: 0.05 seconds/write).
2/6/2008 7:34:41 PM -- Operation mix: Sessions 7, Inserts 25%, Deletes 10%, Replaces 50%, Reads 15%, Lazy Commits 80%.
2/6/2008 7:34:41 PM -- Performance logging begins (interval: 15000 ms).
2/6/2008 7:34:41 PM -- Generating log files ...
2/6/2008 8:11:14 PM -- H:\sg1 (100.2% generated), H:\sg2 (106.0% generated), H:\sg3 (104.0% generated), H:\sg4 (104.4% generated), H:\sg5 (104.8% generated), H:\sg6 (101.4% generated), H:\sg7 (103.8% generated), H:\sg8 (104.6% generated), H:\sg9 (103.0% generated), H:\sg10 (104.6% generated), H:\sg11 (103.0% generated), H:\sg12 (103.6% generated), H:\sg13 (103.4% generated), H:\sg14 (104.0% generated), H:\sg15 (104.8% generated), H:\sg16 (101.2% generated), H:\sg17 (102.2% generated), and H:\sg18 (100.8% generated)
2/6/2008 8:11:15 PM -- Performance logging ends.
2/6/2008 8:11:15 PM -- JetInterop batch transaction stats: 10106, 9972, 10205, 10199, 10204, 10147, 10114, 10088, 10063, 10084, 10140, 10164, 10113, 10192, 10152, 10151, 9955, and 9995.
2/6/2008 8:11:16 PM -- Dispatching transactions ends.
2/6/2008 8:11:16 PM -- Shutting down databases ...
2/6/2008 8:11:38 PM -- Instance3344.1 (complete), Instance3344.2 (complete), Instance3344.3 (complete), Instance3344.4 (complete), Instance3344.5 (complete), Instance3344.6 (complete), Instance3344.7 (complete), Instance3344.8 (complete), Instance3344.9 (complete), Instance3344.10 (complete), Instance3344.11 (complete), Instance3344.12 (complete), Instance3344.13 (complete), Instance3344.14 (complete), Instance3344.15 (complete), Instance3344.16 (complete), Instance3344.17 (complete), and Instance3344.18 (complete)
2/6/2008 8:11:38 PM -- Performance logging begins (interval: 30000 ms).
2/6/2008 8:11:38 PM -- Verifying database checksums ...
2/6/2008 9:07:03 PM -- F: (100% processed), G: (100% processed), I: (100% processed), J: (100% processed), K: (100% processed), and L: (100% processed)
2/6/2008 9:07:04 PM -- Performance logging ends.
2/6/2008 9:07:04 PM -- [C:\Program Files\Exchange2007\DBChecksum_2008_2_6_20_11_38.blg](#) has 110 samples.
2/6/2008 9:07:08 PM -- [C:\Program Files\Exchange2007\DBChecksum_2008_2_6_20_11_38.html](#) is saved.
2/6/2008 9:07:08 PM -- Verifying log checksums ...
2/6/2008 9:10:58 PM -- H:\sg1 (100 logs passed), H:\sg2 (100 logs passed), H:\sg3 (100 logs passed), H:\sg4 (100 logs passed), H:\sg5 (100 logs passed), H:\sg6 (100 logs passed), H:\sg7 (100 logs passed), H:\sg8 (100 logs passed), H:\sg9 (100 logs passed), H:\sg10 (100 logs passed), H:\sg11 (100 logs passed), H:\sg12 (100 logs passed), H:\sg13 (100 logs passed), H:\sg14 (100 logs passed), H:\sg15 (100 logs passed), H:\sg16 (100 logs passed), H:\sg17 (100 logs passed), and H:\sg18 (100 logs passed)
2/6/2008 9:10:58 PM -- [C:\Program Files\Exchange2007\Performance_2008_2_6_19_34_40.blg](#) has 146 samples.

2/6/2008 9:10:58 PM -- Creating test report ...
2/6/2008 9:11:01 PM -- Volume F: has 0.0183 for Avg. Disk sec/Read.
2/6/2008 9:11:01 PM -- Volume G: has 0.0148 for Avg. Disk sec/Read.
2/6/2008 9:11:01 PM -- Volume I: has 0.0143 for Avg. Disk sec/Read.
2/6/2008 9:11:01 PM -- Volume J: has 0.0183 for Avg. Disk sec/Read.
2/6/2008 9:11:01 PM -- Volume K: has 0.0145 for Avg. Disk sec/Read.
2/6/2008 9:11:01 PM -- Volume L: has 0.0174 for Avg. Disk sec/Read.
2/6/2008 9:11:01 PM -- Volume H: has 0.0025 for Avg. Disk sec/Write.
2/6/2008 9:11:01 PM -- Volume H: has 0.0016 for Avg. Disk sec/Read.
2/6/2008 9:11:01 PM -- Test has 1.66668554783294 Maximum Database Page Fault Stalls/sec.
2/6/2008 9:11:01 PM -- Test has 10 Database Page Fault Stalls/sec samples higher than 0.
2/6/2008 9:11:01 PM -- [C:\Program Files\Exchange2007\Performance_2008_2_6_19_34_40.xml](#) has 145 samples queried.
2/6/2008 9:11:01 PM -- [C:\Program Files\Exchange2007\Performance_2008_2_6_19_34_40.html](#) is saved.
2/6/2008 9:11:07 PM -- Performance logging begins (interval: 4000 ms).
2/6/2008 9:11:07 PM -- Recovering databases ...
2/6/2008 9:21:17 PM -- Performance logging ends.
2/6/2008 9:21:17 PM -- Instance3344.1 (600.265625), Instance3344.2 (606.515625), Instance3344.3 (605.265625), Instance3344.4 (608.015625), Instance3344.5 (608.515625), Instance3344.6 (605.765625), Instance3344.7 (607.765625), Instance3344.8 (607.515625), Instance3344.9 (606.765625), Instance3344.10 (605.265625), Instance3344.11 (598.515625), Instance3344.12 (602.015625), Instance3344.13 (606.765625), Instance3344.14 (606.515625), Instance3344.15 (608.015625), Instance3344.16 (598.515625), Instance3344.17 (600.515625), and Instance3344.18 (597.015625)
2/6/2008 9:21:17 PM -- [C:\Program Files\Exchange2007\SoftRecovery_2008_2_6_21_11_1.blg](#) has 152 samples.
2/6/2008 9:21:17 PM -- Creating test report ...