

Dell Compellent Storage Center (SC8000) 2,500 Mailbox Exchange 2010 Resiliency Storage Solution

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Dell Compellent Technical Solutions



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Introduction

Simulated Environment

The solution presented in this document is designed to simulate a medium-sized number of mailboxes hosted on highly redundant hardware. Application level redundancy is augmented with redundant storage to create a highly available and fault tolerant solution.

The Mailbox Resiliency features of Exchange 2010 have greatly enhanced the availability of Exchange 2010, while also improving I/O performance. The solution presented here is a Mailbox Resiliency solution utilizing 1 Database Availability Group (DAG) and 2 copies of every database. The tested environment simulates all users in this DAG running on a single Storage Center. The number of users simulated was 2,500 across 2 servers, with 1,250 users per server. The mailbox size was 2GB per user. Each server has 2 databases, with one copy local and the second copy replicated to the second server. This provides redundancy through hardware and software.

The replication mechanism is the native Exchange 2010 DAG log shipping engine. This is a very efficient and reliable replication mechanism and is the recommended method for providing highly-available and redundant Exchange solutions.

Solution Description

The storage hardware tested was a Dell Compellent Storage Center (SC8000). This is a redundant controller pair, with redundant front-end and back-end connections. The front-end connections were fiber-channel based, over redundant fabrics, with 2 ports per server, and 4 ports per controller.

The disk connectivity is SAS 6Gbps. The spindle count is 12 disks/1 spare for database and logs, on a dedicated disk pool on each Storage Center. As this is a redundant solution, databases and logs are stored together on the same volumes. All volumes are RAID-5.

For information about compatibility please use the following link:

<http://windowservercatalog.com/item.aspx?idItem=9fb76108-7f81-d263-24dd-7c037bd9a4d1&bCatID=1282>

Dell Compellent Storage Center (SC8000) 2500 Mailbox Exchange 2010 Resiliency Storage Solution

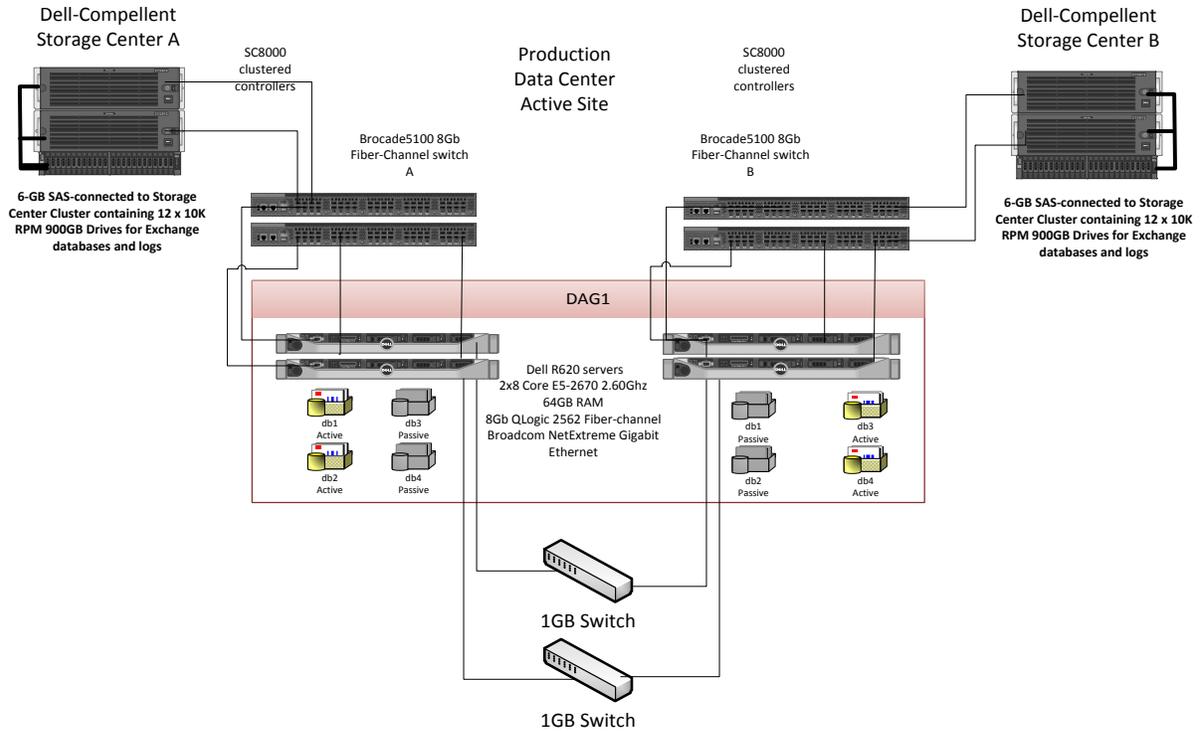


Figure 1 - Highly Available Data Center Design

The solution is designed around a highly available data center model (Figure 1). There are 2 disk arrays, for complete redundancy. The Exchange configuration is 1 DAG. The LAN ports are in a dedicated replication VLAN, for traffic isolation. There are 2 networks for redundancy.

Dell Compellent Storage Center (SC8000) 2500 Mailbox Exchange 2010 Resiliency Storage Solution

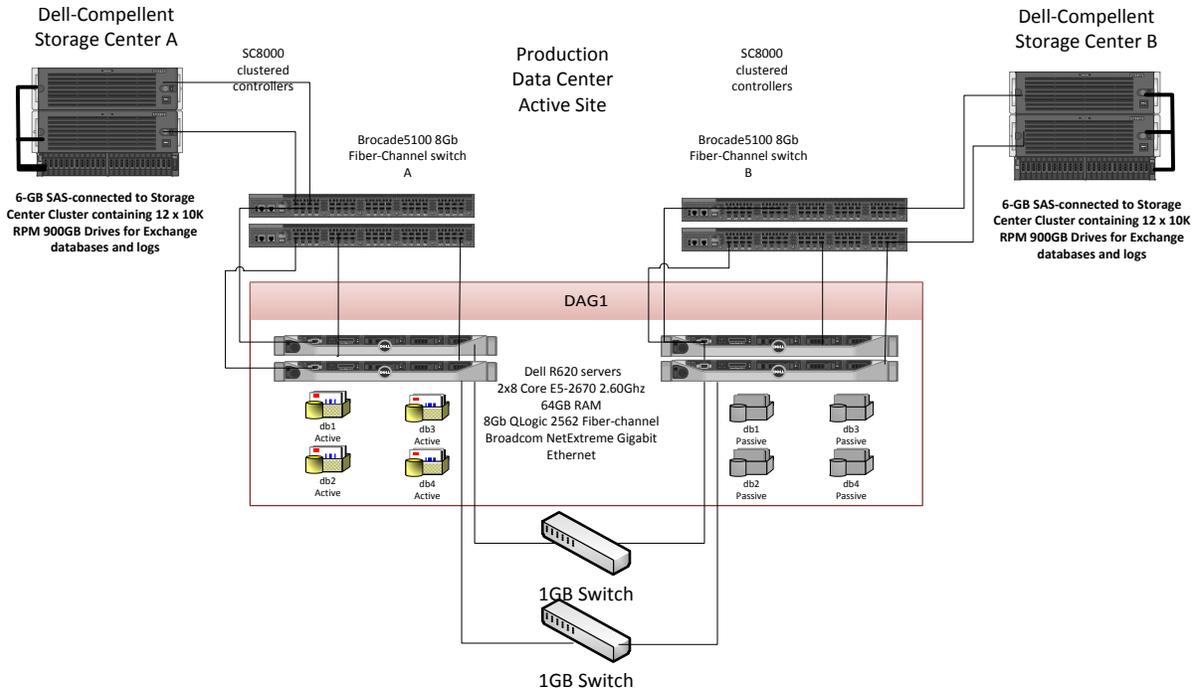


Figure 2 - Tested configuration with Storage Center A with Full user Load and Storage Center B offline

The tested configuration was a single Storage Center array (Figure 2), running with the full user load. This is to clearly show a single array can handle the user load in an array failure scenario. Under normal operating conditions the preferred activation scenario would be to run half of the mailbox databases active on each Storage Center array, while either array could handle the entire workload at any given time.

The ability to handle the entire workload on a single Storage Center array means no IO performance degradation will occur if an array or any volume(s) were to fail. All mailbox servers would have volumes mapped to both arrays, with 1 copy of each database on each array.

The Dell Compellent Storage Center (SC8000) Solution

A Modular Hardware Design

The hardware design consists of Dell 12G server-based clustered controllers providing automatic failover. Dell Compellent can seamlessly connect to any open-systems server without the need for server side agents. Organizations can mix and match Fiber Channel and iSCSI server connectivity, and disk enclosures support any external interface and disks based on Solid State, Fiber Channel, and/or Serial ATA.

Next-generation SC8000 controllers combine the benefits of proven Dell™ Fluid Data™ architecture with resilient Dell hardware design to provide efficiency, quality and durability. Compared with previous generations of Compellent controllers, the SC8000 offers increased density, exceptional processing power, greater memory, and faster PCIe Gen3 I/O bus – making the SC8000 the scalability and performance platform choice for the future.

Powerful Suite of Software

Storage Center offers a powerful suite of enterprise capabilities to manage data differently. Building on Dell Compellent's Dynamic Block Architecture, Storage Center software intelligently optimizes data movement and access at the block-level to maximize utilization, automate tiered storage, simplify replication and speed data recovery.

Intuitive, Unified Interface

A centralized management interface streamlines administration and speeds common storage management tasks. The interface features a point-and-click wizard-based setup and management, comprehensive Phone Home capabilities, automatic notification when user-defined capacity thresholds are reached, and advanced storage consumption and chargeback reporting.

Dell Compellent's Enterprise Manager further simplifies storage management by providing comprehensive monitoring of all local and remote Storage Center environments.

Enterprise Manager allows you to gain better insight into your Storage Center deployments and reduces planning and configuration time for remote replications.

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

Targeted Customer Profile

This solution is targeted for users large and small. Capacity can be dynamically scaled from 1TB to over a Petabyte. This provides excellent growth potential with no downtime required for upgrades.

- A Storage Center solution can be sized for any size organization
- Unlimited number of hosts can be attached, via Fiber-Channel and iSCSI
- User IO profile (.15 IOPS per user, .18 tested, giving 20% headroom).
- User mailbox size (2 GB quota)
- Backup strategy - VSS backup using SAN based snapshots, use Mailbox Resiliency as primary data protection mechanism.
- Using SAN based snapshots, and boot from SAN, a complete server can be restored in minutes.
- The tested RAID type was RAID 5 for database volumes and log volumes, while a mix of RAID10, RAID5, and RAID6 can be blended, with fully automated tiered storage providing the most efficient and best performing storage where needed.

Volume sizing

- The volume size tested was just large enough to support the database size. Volumes on Dell Compellent storage can be grown dynamically, without affecting service. As database sizes approach volume sizes, any volume can be automatically increased on demand. This simplifies sizing, as capacity can be added as needed.
- Using Dell Compellent Dynamic Capacity and hot upgrades additional disk capacity can be added as needed. If more spindles are required to accommodate growth they can simply be cabled and added to the disk pool to grow volume space. Since volumes are not tied to spindle boundaries adding spindles will increase performance and capacity as the system grows.
- The testing environment was configured for 62% storage utilization. If the storage requirement grows beyond the design specified, additional spindles will provide additional capacity for any volume to be expanded.

Tested Deployment

The following tables summarize the testing environment.

Simulated Exchange Configuration

Number of Exchange mailboxes simulated	2,500
Number of Database Availability Groups (DAGs)	1
Number of servers/DAG	2
Number of active mailboxes/server	1250
Number of databases/host	2
Number of copies/database	2
Number of mailboxes/database	625
Simulated profile: I/O's per second per mailbox (IOPS, include 20% headroom)	.15 (.18 tested)
Database/Log LUN size	1.4 TB
Total database size for performance testing	7.6 TB
% storage capacity used by Exchange database**	62.5%

Note: Database size and capacity utilized may not match on a thin-provisioned system, as only used pages will consume space. Pages that are allocated, but contain blank data, may not use disk.

Primary Storage Hardware

Storage Connectivity (Fiber Channel, SAS, SATA, iSCSI)	SAS
Storage model and OS/firmware revision	Dell Compellent Storage Center (SC8000) v6.3 http://windowservercatalog.com/item.aspx?itemId=9fb76108-7f81-d263-24dd-7c037bd9a4d1&bCatID=1282
Storage cache	16 GB
Number of storage controllers	2
Number of storage ports	8 active ports per controller
Maximum bandwidth of storage connectivity to host	64 Gb/sec (8x8Gb GB HBA)
Switch type/model/firmware revision	Brocade Model 510 36- port 8Gb Fiber Channel Switch Firmware version 7.0.0b
HBA model and firmware	QLogic QMH2564 (Driver FW 5.04.04, Flash FW 4.04.02)
Number of HBA's/host	1 Dual-port QLogic 2562 8Gb HBA
Host server type	2x8 Core E5-2670 2.60Ghz 64GB RAM
Total number of disks tested in solution	12 Active for DB and log, 1 hot spare = 13 total spindles

Maximum number of spindles can be hosted in the storage	960
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Primary Storage Software

HBA driver	QLogic StorPort FC HBA Driver 9.1.9.27
HBA Queue Depth Setting	65535
Multi-Pathing	Microsoft Windows 2008 R2 MPIO Round-Robin(In-Box DSM)
Host OS	Microsoft Windows 2008 R2
ESE.dll file version	14.02.0283.000
Replication solution name/version	Microsoft Exchange Server 2010 DAG replication

Primary Storage Disk Configuration (Mailbox Store/Log Disks)

Disk type, speed and firmware revision	SAS 10k 900GB, XRC0
Raw capacity per disk (GB)	838.36 GB
Number of physical disks in test	12
Total raw storage capacity (GB)	10.056 TB
Raid level	RAID5
Total formatted capacity	9.82TB
Storage capacity utilization	77.07 %
Database capacity utilization	62.5 %

Best Practices

Exchange Server 2010 has changed dramatically from previous versions. For a list of what has changed see the following: <http://technet.microsoft.com/en-us/library/dd298136.aspx>

The best practices have also changed, based on the changes in behavior in Exchange 2010. A big part of the change is the shift away from Single Instance Storage. This allows greater control over disk IO, as a mailbox is more self-contained within the database, changing reads and writes to or from a mailbox to be much more sequential. This greatly improves throughput.

The increase in database size is offset by inline page compression, so that database sizes in Exchange 2010 are similar to Exchange 2007 sizes. This does have an impact on processor and memory load. Because processor performance has increased dramatically, and servers support much larger memory models, sizing requirements for servers have changed to reflect this. For server sizing please refer to the Microsoft Mailbox Role Calculator.

For general sizing and requirements please visit the following link:

<http://technet.microsoft.com/en-us/library/aa996719.aspx>

One of the Microsoft best practices states that transaction logs and databases be separated from each other and dedicated to their own set of spindles. Dell Compellent virtualizes at the disk level within Storage Center, accelerating data access by spreading read/write operations across all disk drives in the SAN so multiple requests are processed in parallel. Dell Compellent virtualization allows the creation of high performance, highly efficient virtual volumes in just seconds without allocating drives to specific servers, without complicated capacity planning and without manual performance tuning. By managing disk drives as a single resource, Dell Compellent provides increased storage performance, availability and utilization.

Dell Compellent's storage virtualization is optimized to take advantage of all available spindles as part of a single disk folder, but is flexible enough to be configured allowing storage configurations where specific spindles are dedicated to a particular volume.

Another best practice in past versions of Exchange Server has been to align Exchange IO with disk page boundaries. With Windows Server 2008 this is no longer required, as Windows 2008 automatically aligns to a 1024k page boundary.

The volume on which transaction logs are stored is critical to a well performing Exchange environment. Since all transactions are first written to a transaction log before being committed to the information store database, it is important that this volume has the lowest possible write latency. Transaction logs should be placed on volumes with faster rotational speeds. For optimal transaction log performance, consider using drives with a rotational speed of 10,000 RPM or greater. Exchange 2010 no longer requires log files to be stored on a volume separate from the database volumes; The Dell Compellent Storage Center can be flexibly designed for separate disk folders or as a single disk folder configuration.

For issues related to performance and event monitoring please see the following:

<http://technet.microsoft.com/en-us/library/ee332313.aspx>

[For more information on Exchange best practices when implemented with Dell Compellent Storage Center, visit the Dell Compellent Knowledge Center at http://kc.compellent.com/.](http://kc.compellent.com/)

Using Dell Compellent Storage Center Data Progression

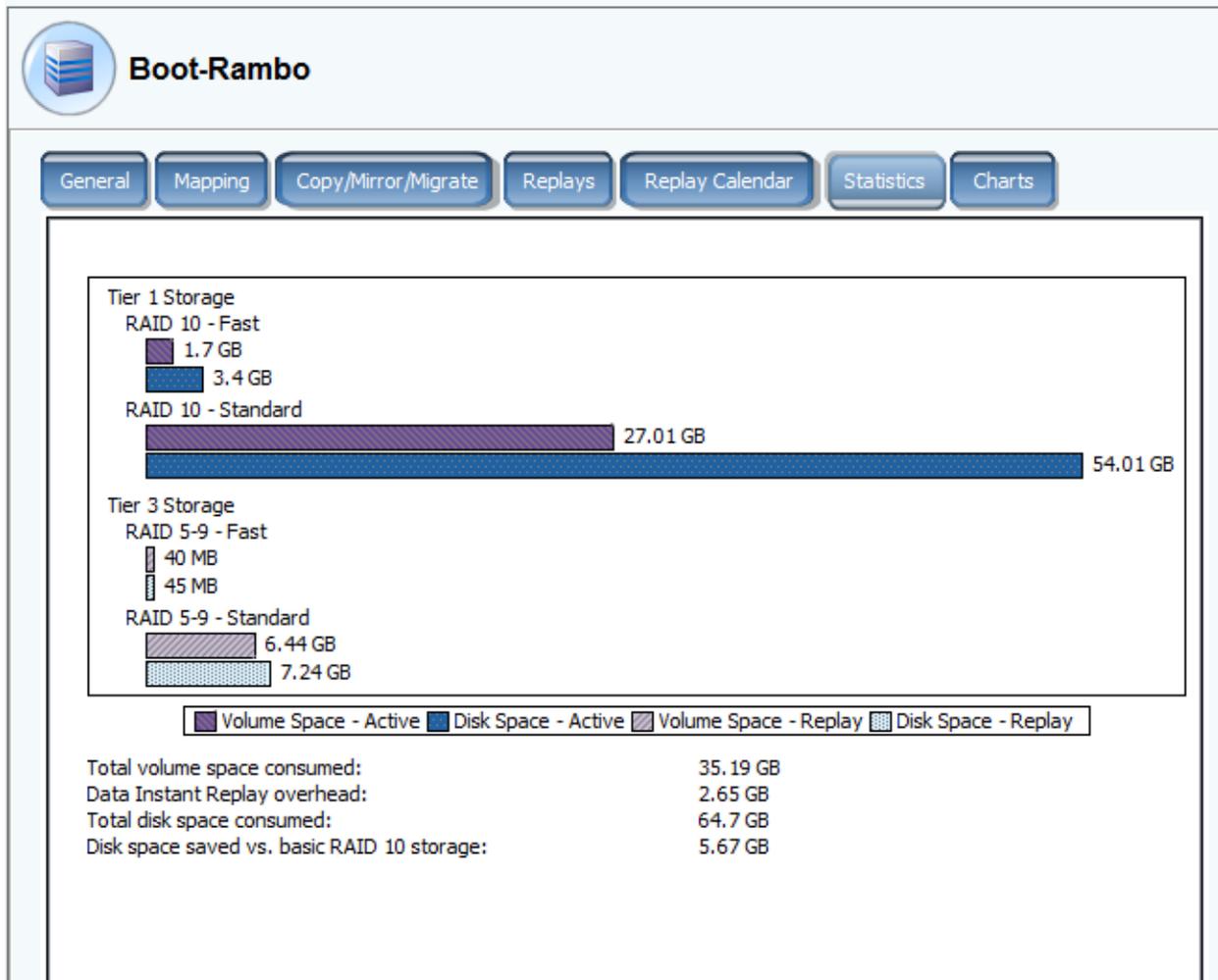
Industry studies show that as much of 80% of Exchange data is inactive. This means that a lot of fast, higher-cost storage is being unnecessarily utilized.

Storage Center's Data Progression is a complete hardware and software architecture that delivers fully automated tiered storage. This patented technology cuts administrative time and reduces overall storage costs by dynamically classifying and moving data at the block-level between tiers of storage based on frequency of access. This complete Automated Tiered Storage solution does not require time consuming data classification and the repetitive manual transfer of data between tiers.

Each volume is configured by default with a recommended storage profile that manages the RAID configuration and provides optimal operation and performance for Exchange on the Dell Compellent Storage Center. With this configuration all data written to each volume is written at RAID10 providing the best possible I/O performance for Exchange database and log operations.

Snapshots, known as Replays on the Dell Compellent Storage Center, are an integral part of the Data Progression solution. As data grows and usage patterns change, Data Progression can automatically move inactive blocks of data to a lower tier of storage (both disk class and RAID level) on-the-fly. With the recommended storage profile, active data is always written at RAID10, while any replays are initially stored at Tier 1 on RAID-5. This data eventually makes its way down the RAID levels and tiers.

The following chart is an example of how Data Progression moves data to the most appropriate tier:



Core Storage

1. Dell Compellent storage by its nature does not need disk sector alignment to perform properly. Dell Compellent virtualizes all disk reads and writes, and applies them across system managed data pages, so by nature isolates disk IOs from sector boundaries. The page to sector alignment for all volumes and data pages is handled automatically by the system.
2. The Dell Compellent method of IO and disk capacity aggregation provides maximum IO to all hosted applications. All the IOPS for all of the assigned drives can be applied to all applications hosted on a Storage Center. If IOPS need to be dedicated to an application, such as Exchange, a dedicated disk pool can be created for each IO type, such as database or log files. As Exchange 2010 IO is mostly sequential, using a smaller number of database files will greatly improve the performance. This is due to the fact that the more sequential streams you have, the more random it looks. Minimizing the number of file streams while meeting business requirements will provide a more

responsive solution. Isolating the log files can also provide a performance benefit in an IO constrained system. Using Dell Compellent Dynamic Storage, a small system can start with all volumes sharing spindles, and volumes can dynamically be moved to dedicated spindles and load increases.

3. Dell Compellent Storage Center is a true thin provisioned system. This means that volumes will truly only consume space when and where data is written. The volume sizes should be created to reflect the maximum size they will achieve. The volumes will only consume the space actually used by data, so the storage can be sized to host the actual storage requirement, rather than the volume sizes allocated. This allows the volumes to be sized properly to meet growth while requiring the minimum number of disks to meet the storage and IOP requirement.
4. Dell Compellent's Fluid Data architecture uses an IOP and storage aggregation model. This means that the IOPS and storage capacity of all available disks will be available to the entire disk pool. This provides a huge performance boost to all applications and all LUNs, as the combined IO performance of all spindles will apply to all configured storage. If dedicated spindles are desired, a disk pool can be created that will dedicate those spindles to the LUNs created in that pool. All disks in a disk pool will have multiple RAID types applied to them. This is done by virtualizing the RAID pools on the disks. For example, a write could come in on RAID 10, and would be mirrored at the block level, across a pair of disks. In essence each write could hit a different pair of disks, dramatically improving performance. The next write could be a RAID5 block, with the blocks striped across all the disks available to the pool. In this method a disk pool will balance the IO across all the available spindles.
5. Latency and IO load can be measured real-time, or logged historically for reporting purposes. This means if a volume is performing poorly, its IO can be reported over time, and compared to IO load on the server, for any length of time you wish to store. If you need to report on the last month of IO history, a report can be generated showing the IO graphically or as a summary chart. This provides the ability to trend and determine when IO performance changed. Volumes can also be summarized as a group, to determine if IO load is shifting, increasing, or disk performance is changing. Reporting can be done at any level, including at the disk device level. This allows reporting on the latency at the Server, LUN, or disk level to provide more accurate performance monitoring and diagnostics.
6. Because Storage Center manages block placement, defragmentation is not required. Dell Compellent Data Progression computes block placement and optimizes block placement based on access patterns. Because block placement is relative to other stored blocks Exchange On-line defragmentation is accounted for.
7. Dell Compellent Fluid Data also allows disks to be added to a pool to increase performance dynamically. This allows for accurate sizing on day one and disks to be

added as performance requirements increase. If after one year IO requirements double, additional disks could simply be added (without any downtime), and RAID stripes rebalanced.

8. The most common cause of performance issues is low spindle count. To achieve a given IO level requires a spindle count equal to or greater than the IOP target. If the IO load exceeds the capabilities of the spindles poor performance will result. Dell Compellent, along with a business partner, will work with customers to determine the correct spindle count. As IO load grows the spindle count must increase to maintain performance. Using Dell Compellent Enterprise Manager, current IO loads can be tracked, and thresholds can be set for alerting, to warn of IO usage approaching or exceeding acceptable performance levels. Because IO patterns can be very diverse, creating a baseline and using historical reporting will be a key strategy for planning for and managing growth. With an accurate growth plan, disk can be added before it is needed, and performance as well as capacity can be increased with down time.

Backup Strategy

1. The Dell Compellent Storage Center has an integrated snapshot facility that provides basic volume based snapshots. In order to provide VSS integration with a graphical management interface, Dell Compellent Replay Manager for Microsoft Servers should be implemented. This provides a full interface for scheduling database backups. Using Replay Manger Exchange Servers can be restored in less than a minute to any available restore point. It also provides detailed reporting on snapshots. Because Dell Compellent Storage Center has the ability to manage thousands of snapshots, a fine grained backup strategy can be defined to greatly reduce reliance on tape for historical data recovery. Combined with a lagged database copy, data can be recovered very quickly with minimal administrative effort.
2. Since Dell Compellent Replays take do not require page pre-allocation or disk allocation disk space requirements are much smaller for snapshots. Backup verification can also be passed to a secondary server to isolate the impact of backups on the production Exchange environment. By automating the creation and verification process using a secondary server, more frequent database backups and more frequent database scans can be implemented reducing exposure.
3. Replay restore points can also be replicated and tested in a remote environment without breaking replication. This allows Disaster Recovery testing of a production restore point without pausing replication, reducing exposure even further.

Additional Information

For more information on Dell Compellent Storage Center and other Dell Compellent solutions, visit our website at <http://www.compellent.com>.

Test Results Summary

This section provides a high level summary of the test data from ESRP. The detailed html reports which are generated by ESRP testing framework are shown in the Appendices later in this whitepaper.

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: (click on the underlined word will show the html report after the reliability tests run)

- No errors were reported in either the application or system log
- No errors were reported during the [database](#) and [log](#) checksum process
- No errors were reported during either the backup or restore 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 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 all Mailbox Databases and the average latency across all Databases on a per server basis.

Server 1 - JS6

Database I/O	
Database Disks Transfers/sec	344.135
Database Disks Reads/sec	236.535
Database Disks Writes/sec	107.60
Average Database Disk Read Latency (ms)	11.741
Average Database Disk Write Latency (ms)	2.041
Transaction Log I/O	
Log Disks Writes/sec	89.046
Average Log Disk Write Latency (ms)	0.828

Server 2 - JS7

Database I/O	
Database Disks Transfers/sec	330.123
Database Disks Reads/sec	227.605
Database Disks Writes/sec	102.518
Average Database Disk Read Latency (ms)	12.148
Average Database Disk Write Latency (ms)	2.061
Transaction Log I/O	
Log Disks Writes/sec	85.803
Average Log Disk Write Latency (ms)	0.804

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 via VSS. The following table shows the average rate for a single database file.

MB read/sec per database	123.75
MB read/sec total per server	254.10

Transaction Log Recovery/Replay Performance

The purpose of this 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)	1.671
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Conclusion

The testing shows the scalability and performance of the Dell Compellent Storage Center.

This document is developed by storage solution providers, and reviewed by the Microsoft Exchange Product team. The test results/data presented in this document are based on the tests introduced in the ESRP test framework. Customers 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.

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

Appendix A: Performance Testing

Server 1 - JS6

Test Summary

Overall Test Result	Pass
Machine Name	JS6
Test Description	1250 users/server 2 servers 2GB mailboxes .15 IOPS/user .18 IOPS tested 2 dbs per server 1300GB db/log combined volumes 2 copies 3 threads/db
Test Start Time	3/1/2013 12:38:13 PM
Test End Time	3/1/2013 2:41:06 PM
Collection Start Time	3/1/2013 12:40:40 PM
Collection End Time	3/1/2013 2:40:32 PM
Jetstress Version	14.01.0180.003
Ese Version	14.02.0283.000
Operating System	Windows Server 2008 R2 Standard Service Pack 1 (6.1.7601.65536)
Performance Log	C:\Program Files\Exchange Jetstress\Performance_2013_3_1_12_38_18.blg

Database Sizing and Throughput

Achieved Transactional I/O per Second	283.421
Target Transactional I/O per Second	225
Initial Database Size (bytes)	2700289900544
Final Database Size (bytes)	2701120372736
Database Files (Count)	2

Jetstress System Parameters

Thread Count	3 (per database)
Minimum Database Cache	64.0 MB
Maximum Database Cache	512.0 MB
Insert Operations	40%
Delete Operations	20%
Replace Operations	5%
Read Operations	35%
Lazy Commits	70%
Run Background Database Maintenance	True
Number of Copies per Database	2

Database Configuration

Instance1344.1	Log Path: C:\DB\DB1 Database: C:\DB\DB1\Jetstress001001.edb
Instance1344.2	Log Path: C:\DB\DB2 Database: C:\DB\DB2\Jetstress002001.edb

Transactional I/O Performance

MSExchange Database ==> Instances	I/O Database Reads Average Latency (msec)	I/O Database Writes Average Latency (msec)	I/O Database Reads/sec	I/O Database Writes/sec	I/O Database Reads Average Bytes	I/O Database Writes Average Bytes	I/O Log Reads Average Latency (msec)	I/O Log Writes Average Latency (msec)	I/O Log Reads/sec	I/O Log Writes/sec	I/O Log Reads Average Bytes	I/O Log Writes Average Bytes
Instance1344.1	11.524	2.082	87.504	53.586	33631.952	35105.632	0.000	0.817	0.000	44.555	0.000	4633.970
Instance1344.2	11.958	2.001	88.316	54.014	33559.686	35099.144	0.000	0.840	0.000	44.491	0.000	4622.975

Background Database Maintenance I/O Performance

MSExchange Database ==> Instances	Database Maintenance IO Reads/sec	Database Maintenance IO Reads Average Bytes
Instance1344.1	30.364	261861.650
Instance1344.2	30.351	261845.709

Log Replication I/O Performance

MSExchange Database ==> Instances	I/O Log Reads/sec	I/O Log Reads Average Bytes
Instance1344.1	0.836	232042.140
Instance1344.2	0.833	232035.885

Total I/O Performance

MSExchange Database ==> Instances	I/O Database Reads Average Latency (msec)	I/O Database Writes Average Latency (msec)	I/O Database Reads/sec	I/O Database Writes/sec	I/O Database Reads Average Bytes	I/O Database Writes Average Bytes	I/O Log Reads Average Latency (msec)	I/O Log Writes Average Latency (msec)	I/O Log Reads/sec	I/O Log Writes/sec	I/O Log Reads Average Bytes	I/O Log Writes Average Bytes
Instance1344.1	11.524	2.082	117.868	53.586	92426.593	35105.632	10.850	0.817	0.836	44.555	232042.140	4633.970
Instance1344.2	11.958	2.001	118.667	54.014	91948.202	35099.144	11.760	0.840	0.833	44.491	232035.885	4622.975

Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	0.430	0.000	2.606
Available MBytes	29694.232	29681.000	29723.000
Free System Page Table Entries	33555673.939	33555612.000	33555676.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	80560196.409	80535552.000	80621568.000
Pool Paged Bytes	167009397.578	166961152.000	167170048.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log

3/1/2013 12:38:13 PM -- Jetstress testing begins ...
3/1/2013 12:38:13 PM -- Prepare testing begins ...
3/1/2013 12:38:15 PM -- Attaching databases ...
3/1/2013 12:38:15 PM -- Prepare testing ends.
3/1/2013 12:38:15 PM -- Dispatching transactions begins ...
3/1/2013 12:38:15 PM -- Database cache settings: (minimum: 64.0 MB, maximum: 512.0 MB)
3/1/2013 12:38:15 PM -- Database flush thresholds: (start: 5.1 MB, stop: 10.2 MB)
3/1/2013 12:38:18 PM -- Database read latency thresholds: (average: 20 msec/read, maximum: 100 msec/read).
3/1/2013 12:38:18 PM -- Log write latency thresholds: (average: 10 msec/write, maximum: 100 msec/write).
3/1/2013 12:38:20 PM -- Operation mix: Sessions 3, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
3/1/2013 12:38:20 PM -- Performance logging begins (interval: 15000 ms).
3/1/2013 12:38:20 PM -- Attaining prerequisites:
3/1/2013 12:40:40 PM -- \MSEExchange Database(JetstressWin)\Database Cache Size, Last: 484945900.0 (lower bound: 483183800.0, upper bound: none)
3/1/2013 2:40:41 PM -- Performance logging ends.
3/1/2013 2:41:02 PM -- JetInterop batch transaction stats: 30046 and 29977.
3/1/2013 2:41:05 PM -- Dispatching transactions ends.
3/1/2013 2:41:05 PM -- Shutting down databases ...
3/1/2013 2:41:06 PM -- Instance1344.1 (complete) and Instance1344.2 (complete)
3/1/2013 2:41:06 PM -- C:\Program Files\Exchange Jetstress\Performance_2013_3_1_12_38_18.blg has 488 samples.
3/1/2013 2:41:06 PM -- Creating test report ...
3/1/2013 2:41:09 PM -- Instance1344.1 has 11.5 for I/O Database Reads Average Latency.
3/1/2013 2:41:09 PM -- Instance1344.1 has 0.8 for I/O Log Writes Average Latency.
3/1/2013 2:41:09 PM -- Instance1344.1 has 0.8 for I/O Log Reads Average Latency.
3/1/2013 2:41:09 PM -- Instance1344.2 has 12.0 for I/O Database Reads Average Latency.
3/1/2013 2:41:09 PM -- Instance1344.2 has 0.8 for I/O Log Writes Average Latency.
3/1/2013 2:41:09 PM -- Instance1344.2 has 0.8 for I/O Log Reads Average Latency.
3/1/2013 2:41:09 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.
3/1/2013 2:41:09 PM -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.
3/1/2013 2:41:09 PM -- C:\Program Files\Exchange Jetstress\Performance_2013_3_1_12_38_18.xml has 478 samples queried.

Server 2 - JS7

Test Summary

Overall Test Result	Pass
Machine Name	JS7
Test Description	1250 users/server 2 servers 2GB mailboxes .15 IOPS/user .18 IOPS tested 2 dbs per server 1300GB db/log combined volumes 2 copies 3 threads/db
Test Start Time	3/1/2013 12:38:15 PM
Test End Time	3/1/2013 2:41:01 PM
Collection Start Time	3/1/2013 12:40:49 PM
Collection End Time	3/1/2013 2:40:49 PM
Jetstress Version	14.01.0180.003
Ese Version	14.02.0283.000
Operating System	Windows Server 2008 R2 Standard Service Pack 1 (6.1.7601.65536)
Performance Log	C:\Program Files\Exchange Jetstress\Performance_2013_3_1_12_38_20.blg

Database Sizing and Throughput

Achieved Transactional I/O per Second	269.536
Target Transactional I/O per Second	225
Initial Database Size (bytes)	2700088573952
Final Database Size (bytes)	2700893880320
Database Files (Count)	2

Jetstress System Parameters

Thread Count	3 (per database)
Minimum Database Cache	64.0 MB
Maximum Database Cache	512.0 MB
Insert Operations	40%
Delete Operations	20%
Replace Operations	5%
Read Operations	35%
Lazy Commits	70%
Run Background Database Maintenance	True
Number of Copies per Database	2

Database Configuration

Instance3088.1	Log Path: C:\DB\DB1 Database: C:\DB\DB1\Jetstress001001.edb
Instance3088.2	Log Path: C:\DB\DB2 Database: C:\DB\DB2\Jetstress002001.edb

Transactional I/O Performance

MSExchange Database ==> Instances	I/O Database Reads Average Latency (msec)	I/O Database Writes Average Latency (msec)	I/O Database Reads/sec	I/O Database Writes/sec	I/O Database Reads Average Bytes	I/O Database Writes Average Bytes	I/O Log Reads Average Latency (msec)	I/O Log Writes Average Latency (msec)	I/O Log Reads/sec	I/O Log Writes/sec	I/O Log Reads Average Bytes	I/O Log Writes Average Bytes
Instance3088.1	11.207	2.105	83.520	51.406	33907.114	35174.107	0.000	0.804	0.000	43.056	0.000	4652.162
Instance3088.2	13.089	2.018	83.498	51.112	33379.795	35136.908	0.000	0.845	0.000	42.747	0.000	4595.915

Background Database Maintenance I/O Performance

MSExchange Database ==> Instances	Database Maintenance IO Reads/sec	Database Maintenance IO Reads Average Bytes
Instance3088.1	30.364	261864.447
Instance3088.2	30.223	261851.698

Log Replication I/O Performance

MSExchange Database ==> Instances	I/O Log Reads/sec	I/O Log Reads Average Bytes
Instance3088.1	0.812	231054.157
Instance3088.2	0.797	229609.407

Total I/O Performance

MSExchange Database ==> Instances	I/O Database Reads Average Latency (msec)	I/O Database Writes Average Latency (msec)	I/O Database Reads/sec	I/O Database Writes/sec	I/O Database Reads Average Bytes	I/O Database Writes Average Bytes	I/O Log Reads Average Latency (msec)	I/O Log Writes Average Latency (msec)	I/O Log Reads/sec	I/O Log Writes/sec	I/O Log Reads Average Bytes	I/O Log Writes Average Bytes
Instance3088.1	11.207	2.105	113.884	51.406	94685.307	35174.107	11.062	0.804	0.812	43.056	231054.157	4652.162
Instance3088.2	13.089	2.018	113.721	51.112	94099.848	35136.908	10.238	0.845	0.797	42.747	229609.407	4595.915

Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	0.410	0.000	2.593
Available MBytes	29724.296	29575.000	29771.000
Free System Page Table Entries	33555673.904	33555612.000	33555676.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	80916096.000	80658432.000	81018880.000
Pool Paged Bytes	166828962.133	166735872.000	166985728.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log

3/1/2013 12:38:15 PM -- Jetstress testing begins ...
3/1/2013 12:38:15 PM -- Prepare testing begins ...
3/1/2013 12:38:18 PM -- Attaching databases ...
3/1/2013 12:38:18 PM -- Prepare testing ends.
3/1/2013 12:38:18 PM -- Dispatching transactions begins ...
3/1/2013 12:38:18 PM -- Database cache settings: (minimum: 64.0 MB, maximum: 512.0 MB)
3/1/2013 12:38:18 PM -- Database flush thresholds: (start: 5.1 MB, stop: 10.2 MB)
3/1/2013 12:38:20 PM -- Database read latency thresholds: (average: 20 msec/read, maximum: 100 msec/read).
3/1/2013 12:38:20 PM -- Log write latency thresholds: (average: 10 msec/write, maximum: 100 msec/write).
3/1/2013 12:38:22 PM -- Operation mix: Sessions 3, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
3/1/2013 12:38:22 PM -- Performance logging begins (interval: 15000 ms).
3/1/2013 12:38:22 PM -- Attaining prerequisites:
3/1/2013 12:40:49 PM -- \\MSEExchange Database(JetstressWin)\Database Cache Size, Last: 485953500.0 (lower bound: 483183800.0, upper bound: none)
3/1/2013 2:40:49 PM -- Performance logging ends.
3/1/2013 2:41:00 PM -- JetInterop batch transaction stats: 28871 and 28505.
3/1/2013 2:41:00 PM -- Dispatching transactions ends.
3/1/2013 2:41:00 PM -- Shutting down databases ...
3/1/2013 2:41:01 PM -- Instance3088.1 (complete) and Instance3088.2 (complete)
3/1/2013 2:41:01 PM -- C:\Program Files\Exchange Jetstress\Performance_2013_3_1_12_38_20.blg has 489 samples.
3/1/2013 2:41:01 PM -- Creating test report ...
3/1/2013 2:41:03 PM -- Instance3088.1 has 11.2 for I/O Database Reads Average Latency.
3/1/2013 2:41:03 PM -- Instance3088.1 has 0.8 for I/O Log Writes Average Latency.
3/1/2013 2:41:03 PM -- Instance3088.1 has 0.8 for I/O Log Reads Average Latency.
3/1/2013 2:41:03 PM -- Instance3088.2 has 13.1 for I/O Database Reads Average Latency.
3/1/2013 2:41:03 PM -- Instance3088.2 has 0.8 for I/O Log Writes Average Latency.
3/1/2013 2:41:03 PM -- Instance3088.2 has 0.8 for I/O Log Reads Average Latency.
3/1/2013 2:41:03 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.
3/1/2013 2:41:03 PM -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.
3/1/2013 2:41:03 PM -- C:\Program Files\Exchange Jetstress\Performance_2013_3_1_12_38_20.xml has 479 samples queried.

Appendix B: Stress Testing

Server 1 - JS6

Test Summary

Overall Test Result	Pass
Machine Name	JS6
Test Description	1250 users/server 2 servers 2GB mailboxes .15 IOPS/user .18 IOPS tested 2 dbs per server 1300GB db/log combined volumes 2 copies 3 threads/db
Test Start Time	3/6/2013 9:50:02 AM
Test End Time	3/7/2013 9:55:07 AM
Collection Start Time	3/6/2013 9:52:40 AM
Collection End Time	3/7/2013 9:52:37 AM
Jetstress Version	14.01.0180.003
Ese Version	14.02.0283.000
Operating System	Windows Server 2008 R2 Standard Service Pack 1 (6.1.7601.65536)
Performance Log	C:\Program Files\Exchange Jetstress\Stress_2013_3_6_9_50_7.blg

Database Sizing and Throughput

Achieved Transactional I/O per Second	276.448
Target Transactional I/O per Second	225
Initial Database Size (bytes)	2731822678016
Final Database Size (bytes)	2741528297472
Database Files (Count)	2

Jetstress System Parameters

Thread Count	3 (per database)
Minimum Database Cache	64.0 MB
Maximum Database Cache	512.0 MB
Insert Operations	40%
Delete Operations	20%
Replace Operations	5%
Read Operations	35%
Lazy Commits	70%
Run Background Database Maintenance	True
Number of Copies per Database	2

Database Configuration

Instance2424.1	Log Path: C:\DB\DB1 Database: C:\DB\DB1\Jetstress001001.edb
Instance2424.2	Log Path: C:\DB\DB2 Database: C:\DB\DB2\Jetstress002001.edb

Transactional I/O Performance

MSExchange Database ==> Instances	I/O Database Reads Average Latency (msec)	I/O Database Writes Average Latency (msec)	I/O Database Reads/sec	I/O Database Writes/sec	I/O Database Reads Average Bytes	I/O Database Writes Average Bytes	I/O Log Reads Average Latency (msec)	I/O Log Writes Average Latency (msec)	I/O Log Reads/sec	I/O Log Writes/sec	I/O Log Reads Average Bytes	I/O Log Writes Average Bytes
Instance2424.1	11.989	1.843	85.530	52.244	33556.159	34958.768	0.000	0.888	0.000	43.238	0.000	4601.125
Instance2424.2	11.593	1.701	86.085	52.590	33613.962	34947.037	0.000	0.888	0.000	43.367	0.000	4590.215

Background Database Maintenance I/O Performance

MSExchange Database ==> Instances	Database Maintenance IO Reads/sec	Database Maintenance IO Reads Average Bytes
Instance2424.1	30.669	261835.674
Instance2424.2	30.717	261846.997

Log Replication I/O Performance

MSExchange Database ==> Instances	I/O Log Reads/sec	I/O Log Reads Average Bytes
Instance2424.1	0.807	230669.837
Instance2424.2	0.807	231241.631

Total I/O Performance

MSExchange Database ==> Instances	I/O Database Reads Average Latency (msec)	I/O Database Writes Average Latency (msec)	I/O Database Reads/sec	I/O Database Writes/sec	I/O Database Reads Average Bytes	I/O Database Writes Average Bytes	I/O Log Reads Average Latency (msec)	I/O Log Writes Average Latency (msec)	I/O Log Reads/sec	I/O Log Writes/sec	I/O Log Reads Average Bytes	I/O Log Writes Average Bytes
Instance2424.1	11.989	1.843	116.199	52.244	93807.509	34958.768	10.635	0.888	0.807	43.238	230669.837	4601.125
Instance2424.2	11.593	1.701	116.802	52.590	93636.280	34947.037	11.835	0.888	0.807	43.367	231241.631	4590.215

Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	0.400	0.000	3.021
Available MBytes	29886.299	29850.000	30023.000
Free System Page Table Entries	33555673.710	33555610.000	33555676.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	74760459.038	73936896.000	75087872.000
Pool Paged Bytes	150435470.420	148000768.000	152875008.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log

3/6/2013 9:50:02 AM -- Jetstress testing begins ...
3/6/2013 9:50:02 AM -- Prepare testing begins ...
3/6/2013 9:50:05 AM -- Attaching databases ...
3/6/2013 9:50:05 AM -- Prepare testing ends.
3/6/2013 9:50:05 AM -- Dispatching transactions begins ...
3/6/2013 9:50:05 AM -- Database cache settings: (minimum: 64.0 MB, maximum: 512.0 MB)
3/6/2013 9:50:05 AM -- Database flush thresholds: (start: 5.1 MB, stop: 10.2 MB)
3/6/2013 9:50:07 AM -- Database read latency thresholds: (average: 20 msec/read, maximum: 200 msec/read).
3/6/2013 9:50:07 AM -- Log write latency thresholds: (average: 10 msec/write, maximum: 200 msec/write).
3/6/2013 9:50:10 AM -- Operation mix: Sessions 3, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
3/6/2013 9:50:10 AM -- Performance logging begins (interval: 15000 ms).
3/6/2013 9:50:10 AM -- Attaining prerequisites:
3/6/2013 9:52:40 AM -- \\MSEExchange Database(JetstressWin)\Database Cache Size, Last: 487301100.0 (lower bound: 483183800.0, upper bound: none)
3/7/2013 9:52:40 AM -- Performance logging ends.
3/7/2013 9:55:05 AM -- JetInterop batch transaction stats: 339182 and 340326.
3/7/2013 9:55:06 AM -- Dispatching transactions ends.
3/7/2013 9:55:06 AM -- Shutting down databases ...
3/7/2013 9:55:07 AM -- Instance2424.1 (complete) and Instance2424.2 (complete)
3/7/2013 9:55:07 AM -- C:\Program Files\Exchange Jetstress\Stress_2013_3_6_9_50_7.blg has 5761 samples.
3/7/2013 9:55:07 AM -- Creating test report ...
3/7/2013 9:55:24 AM -- Instance2424.1 has 12.0 for I/O Database Reads Average Latency.
3/7/2013 9:55:24 AM -- Instance2424.1 has 0.9 for I/O Log Writes Average Latency.
3/7/2013 9:55:24 AM -- Instance2424.1 has 0.9 for I/O Log Reads Average Latency.
3/7/2013 9:55:24 AM -- Instance2424.2 has 11.6 for I/O Database Reads Average Latency.
3/7/2013 9:55:24 AM -- Instance2424.2 has 0.9 for I/O Log Writes Average Latency.
3/7/2013 9:55:24 AM -- Instance2424.2 has 0.9 for I/O Log Reads Average Latency.
3/7/2013 9:55:24 AM -- Test has 0 Maximum Database Page Fault Stalls/sec.
3/7/2013 9:55:24 AM -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.
3/7/2013 9:55:24 AM -- C:\Program Files\Exchange Jetstress\Stress_2013_3_6_9_50_7.xml has 5751 samples queried.

Server 2 - JS7

Test Summary

Overall Test Result	Pass
Machine Name	JS7
Test Description	1250 users/server 2 servers 2GB mailboxes .15 IOPS/user .18 IOPS tested 2 dbs per server 1300GB db/log combined volumes 2 copies 3 threads/db
Test Start Time	3/6/2013 9:50:05 AM
Test End Time	3/7/2013 9:55:11 AM
Collection Start Time	3/6/2013 9:52:35 AM
Collection End Time	3/7/2013 9:52:26 AM
Jetstress Version	14.01.0180.003
Ese Version	14.02.0283.000
Operating System	Windows Server 2008 R2 Standard Service Pack 1 (6.1.7601.65536)
Performance Log	C:\Program Files\Exchange Jetstress\Stress_2013_3_6_9_50_10.blg

Database Sizing and Throughput

Achieved Transactional I/O per Second	268.871
Target Transactional I/O per Second	225
Initial Database Size (bytes)	2730438557696
Final Database Size (bytes)	2739900907520
Database Files (Count)	2

Jetstress System Parameters

Thread Count	3 (per database)
Minimum Database Cache	64.0 MB
Maximum Database Cache	512.0 MB
Insert Operations	40%
Delete Operations	20%
Replace Operations	5%
Read Operations	35%
Lazy Commits	70%
Run Background Database Maintenance	True
Number of Copies per Database	2

Database Configuration

Instance2380.1	Log Path: C:\DB\DB1 Database: C:\DB\DB1\Jetstress001001.edb
Instance2380.2	Log Path: C:\DB\DB2 Database: C:\DB\DB2\Jetstress002001.edb

Transactional I/O Performance

MSExchange Database ==> Instances	I/O Database Reads Average Latency (msec)	I/O Database Writes Average Latency (msec)	I/O Database Reads/sec	I/O Database Writes/sec	I/O Database Reads Average Bytes	I/O Database Writes Average Bytes	I/O Log Reads Average Latency (msec)	I/O Log Writes Average Latency (msec)	I/O Log Reads/sec	I/O Log Writes/sec	I/O Log Reads Average Bytes	I/O Log Writes Average Bytes
Instance2380.1	11.869	1.756	83.184	50.899	33668.480	34968.610	0.000	0.879	0.000	42.109	0.000	4612.821
Instance2380.2	12.136	1.685	83.627	51.160	33583.909	34948.052	0.000	0.862	0.000	42.351	0.000	4588.943

Background Database Maintenance I/O Performance

MSExchange Database ==> Instances	Database Maintenance IO Reads/sec	Database Maintenance IO Reads Average Bytes
Instance2380.1	30.703	261824.026
Instance2380.2	30.728	261822.702

Log Replication I/O Performance

MSExchange Database ==> Instances	I/O Log Reads/sec	I/O Log Reads Average Bytes
Instance2380.1	0.787	230856.434
Instance2380.2	0.788	230550.405

Total I/O Performance

MSExchange Database ==> Instances	I/O Database Reads Average Latency (msec)	I/O Database Writes Average Latency (msec)	I/O Database Reads/sec	I/O Database Writes/sec	I/O Database Reads Average Bytes	I/O Database Writes Average Bytes	I/O Log Reads Average Latency (msec)	I/O Log Writes Average Latency (msec)	I/O Log Reads/sec	I/O Log Writes/sec	I/O Log Reads Average Bytes	I/O Log Writes Average Bytes
Instance2380.1	11.869	1.756	113.888	50.899	95177.538	34968.610	10.980	0.879	0.787	42.109	230856.434	4612.821
Instance2380.2	12.136	1.685	114.355	51.160	94913.368	34948.052	10.773	0.862	0.788	42.351	230550.405	4588.943

Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	0.396	0.000	2.298
Available MBytes	29886.412	29840.000	29955.000
Free System Page Table Entries	33555161.032	33555158.000	33555163.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	73454323.670	72757248.000	73883648.000
Pool Paged Bytes	147855667.325	145473536.000	151670784.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log

3/6/2013 9:50:05 AM -- Jetstress testing begins ...
3/6/2013 9:50:05 AM -- Prepare testing begins ...
3/6/2013 9:50:08 AM -- Attaching databases ...
3/6/2013 9:50:08 AM -- Prepare testing ends.
3/6/2013 9:50:08 AM -- Dispatching transactions begins ...
3/6/2013 9:50:08 AM -- Database cache settings: (minimum: 64.0 MB, maximum: 512.0 MB)
3/6/2013 9:50:08 AM -- Database flush thresholds: (start: 5.1 MB, stop: 10.2 MB)
3/6/2013 9:50:10 AM -- Database read latency thresholds: (average: 20 msec/read, maximum: 200 msec/read).
3/6/2013 9:50:10 AM -- Log write latency thresholds: (average: 10 msec/write, maximum: 200 msec/write).
3/6/2013 9:50:13 AM -- Operation mix: Sessions 3, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
3/6/2013 9:50:13 AM -- Performance logging begins (interval: 15000 ms).
3/6/2013 9:50:13 AM -- Attaining prerequisites:
3/6/2013 9:52:35 AM -- \\MSEExchange Database(JetstressWin)\Database Cache Size, Last: 483299300.0 (lower bound: 483183800.0, upper bound: none)
3/7/2013 9:52:36 AM -- Performance logging ends.
3/7/2013 9:55:07 AM -- JetInterop batch transaction stats: 331490 and 332235.
3/7/2013 9:55:09 AM -- Dispatching transactions ends.
3/7/2013 9:55:09 AM -- Shutting down databases ...
3/7/2013 9:55:11 AM -- Instance2380.1 (complete) and Instance2380.2 (complete)
3/7/2013 9:55:11 AM -- C:\Program Files\Exchange Jetstress\Stress_2013_3_6_9_50_10.blg has 5760 samples.
3/7/2013 9:55:11 AM -- Creating test report ...
3/7/2013 9:55:29 AM -- Instance2380.1 has 11.9 for I/O Database Reads Average Latency.
3/7/2013 9:55:29 AM -- Instance2380.1 has 0.9 for I/O Log Writes Average Latency.
3/7/2013 9:55:29 AM -- Instance2380.1 has 0.9 for I/O Log Reads Average Latency.
3/7/2013 9:55:29 AM -- Instance2380.2 has 12.1 for I/O Database Reads Average Latency.
3/7/2013 9:55:29 AM -- Instance2380.2 has 0.9 for I/O Log Writes Average Latency.
3/7/2013 9:55:29 AM -- Instance2380.2 has 0.9 for I/O Log Reads Average Latency.
3/7/2013 9:55:29 AM -- Test has 0 Maximum Database Page Fault Stalls/sec.
3/7/2013 9:55:30 AM -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.
3/7/2013 9:55:30 AM -- C:\Program Files\Exchange Jetstress\Stress_2013_3_6_9_50_10.xml has 5750 samples queried.

Appendix C: Backup testing

Server 1 - JS6

Database Backup Statistics - All

Database Instance	Database Size (MBytes)	Elapsed Backup Time	MBytes Transferred/sec
Instance1344.1	1297930.59	02:43:36	132.22
Instance1344.2	1297882.59	02:48:21	128.48

Jetstress System Parameters

Thread Count	3 (per database)
Minimum Database Cache	64.0 MB
Maximum Database Cache	512.0 MB
Insert Operations	40%
Delete Operations	20%
Replace Operations	5%
Read Operations	35%
Lazy Commits	70%

Database Configuration

Instance1344.1	Log Path: C:\DB\DB1 Database: C:\DB\DB1\Jetstress001001.edb
Instance1344.2	Log Path: C:\DB\DB2 Database: C:\DB\DB2\Jetstress002001.edb

Transactional I/O Performance

MSExchange Database ==> Instances	I/O Database Reads Average Latency (msec)	I/O Database Writes Average Latency (msec)	I/O Database Reads/sec	I/O Database Writes/sec	I/O Database Reads Average Bytes	I/O Database Writes Average Bytes	I/O Log Reads Average Latency (msec)	I/O Log Writes Average Latency (msec)	I/O Log Reads/sec	I/O Log Writes/sec	I/O Log Reads Average Bytes	I/O Log Writes Average Bytes
Instance1344.1	2.865	0.000	528.862	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance1344.2	2.865	0.000	514.219	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	0.451	0.000	1.601
Available MBytes	30176.854	30153.000	30180.000
Free System Page Table Entries	33555674.131	33555674.000	33555676.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	80619958.857	80609280.000	80670720.000
Pool Paged Bytes	170086144.000	170070016.000	170254336.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log

3/1/2013 12:38:13 PM -- Jetstress testing begins ...
3/1/2013 12:38:13 PM -- Prepare testing begins ...
3/1/2013 12:38:15 PM -- Attaching databases ...
3/1/2013 12:38:15 PM -- Prepare testing ends.
3/1/2013 12:38:15 PM -- Dispatching transactions begins ...
3/1/2013 12:38:15 PM -- Database cache settings: (minimum: 64.0 MB, maximum: 512.0 MB)
3/1/2013 12:38:15 PM -- Database flush thresholds: (start: 5.1 MB, stop: 10.2 MB)
3/1/2013 12:38:18 PM -- Database read latency thresholds: (average: 20 msec/read, maximum: 100 msec/read).
3/1/2013 12:38:18 PM -- Log write latency thresholds: (average: 10 msec/write, maximum: 100 msec/write).
3/1/2013 12:38:20 PM -- Operation mix: Sessions 3, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
3/1/2013 12:38:20 PM -- Performance logging begins (interval: 15000 ms).
3/1/2013 12:38:20 PM -- Attaining prerequisites:
3/1/2013 12:40:40 PM -- \MSEExchange Database(JetstressWin)\Database Cache Size, Last: 484945900.0 (lower bound: 483183800.0, upper bound: none)
3/1/2013 2:40:41 PM -- Performance logging ends.
3/1/2013 2:41:02 PM -- JetInterop batch transaction stats: 30046 and 29977.
3/1/2013 2:41:05 PM -- Dispatching transactions ends.
3/1/2013 2:41:05 PM -- Shutting down databases ...
3/1/2013 2:41:06 PM -- Instance1344.1 (complete) and Instance1344.2 (complete)
3/1/2013 2:41:06 PM -- C:\Program Files\Exchange Jetstress\Performance_2013_3_1_12_38_18.blg has 488 samples.
3/1/2013 2:41:06 PM -- Creating test report ...
3/1/2013 2:41:09 PM -- Instance1344.1 has 11.5 for I/O Database Reads Average Latency.
3/1/2013 2:41:09 PM -- Instance1344.1 has 0.8 for I/O Log Writes Average Latency.
3/1/2013 2:41:09 PM -- Instance1344.1 has 0.8 for I/O Log Reads Average Latency.
3/1/2013 2:41:09 PM -- Instance1344.2 has 12.0 for I/O Database Reads Average Latency.
3/1/2013 2:41:09 PM -- Instance1344.2 has 0.8 for I/O Log Writes Average Latency.
3/1/2013 2:41:09 PM -- Instance1344.2 has 0.8 for I/O Log Reads Average Latency.
3/1/2013 2:41:09 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.
3/1/2013 2:41:09 PM -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.
3/1/2013 2:41:09 PM -- C:\Program Files\Exchange Jetstress\Performance_2013_3_1_12_38_18.xml has 478 samples queried.
3/1/2013 2:41:09 PM -- C:\Program Files\Exchange Jetstress\Performance_2013_3_1_12_38_18.html is saved.
3/1/2013 2:41:10 PM -- Performance logging begins (interval: 30000 ms).
3/1/2013 2:41:10 PM -- Verifying database checksums ...
3/1/2013 4:31:16 PM -- C:\DB\DB1 (100% processed) and C:\DB\DB2 (100% processed)
3/1/2013 4:31:16 PM -- Performance logging ends.
3/1/2013 4:31:16 PM -- C:\Program Files\Exchange Jetstress\DBCchecksum_2013_3_1_14_41_9.blg has 220 samples.
3/1/2013 4:31:18 PM -- C:\Program Files\Exchange Jetstress\DBCchecksum_2013_3_1_14_41_9.html is saved.
3/1/2013 4:31:18 PM -- Verifying log checksums ...

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3/1/2013 4:31:19 PM -- C:\DB\DB1 (6 log(s) processed) and C:\DB\DB2 (7 log(s) processed)
3/1/2013 4:31:19 PM -- [C:\Program Files\Exchange Jetstress\Application_2013_3_1_16_31_19.evt](#) is saved.
3/1/2013 4:31:19 PM -- [C:\Program Files\Exchange Jetstress\System_2013_3_1_16_31_19.evt](#) is saved.
3/1/2013 4:31:19 PM -- [C:\Program Files\Exchange Jetstress\XmlConfig_2013_3_1_16_31_19.xml](#) is saved.
3/1/2013 4:31:19 PM -- Jetstress testing ends.
3/1/2013 4:38:41 PM -- Jetstress testing begins ...
3/1/2013 4:38:41 PM -- Prepare testing begins ...
3/1/2013 4:38:44 PM -- Attaching databases ...
3/1/2013 4:38:44 PM -- Prepare testing ends.
3/1/2013 4:38:44 PM -- Dispatching transactions begins ...
3/1/2013 4:38:44 PM -- Database cache settings: (minimum: 64.0 MB, maximum: 512.0 MB)
3/1/2013 4:38:44 PM -- Database flush thresholds: (start: 5.1 MB, stop: 10.2 MB)
3/1/2013 4:38:46 PM -- Database read latency thresholds: (average: 20 msec/read, maximum: 200 msec/read).
3/1/2013 4:38:46 PM -- Log write latency thresholds: (average: 10 msec/write, maximum: 200 msec/write).
3/1/2013 4:38:49 PM -- Operation mix: Sessions 3, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
3/1/2013 4:38:49 PM -- Performance logging begins (interval: 15000 ms).
3/1/2013 4:38:49 PM -- Attaining prerequisites:
3/1/2013 4:41:07 PM -- \MSEExchange Database(JetstressWin)\Database Cache Size, Last: 485433300.0 (lower bound: 483183800.0, upper bound: none)
3/2/2013 4:41:08 PM -- Performance logging ends.
3/3/2013 9:25:43 PM -- JetInterop batch transaction stats: 736598 and 735331.
3/3/2013 9:25:43 PM -- Dispatching transactions ends.
3/3/2013 9:25:43 PM -- Shutting down databases ...
3/3/2013 9:25:44 PM -- Instance1344.1 (complete) and Instance1344.2 (complete)
3/3/2013 9:25:44 PM -- [C:\Program Files\Exchange Jetstress\Stress_2013_3_1_16_38_46.blg](#) has 5760 samples.
3/3/2013 9:25:44 PM -- Creating test report ...
3/3/2013 9:25:59 PM -- Instance1344.1 has 12.5 for I/O Database Reads Average Latency.
3/3/2013 9:25:59 PM -- Instance1344.1 has 0.8 for I/O Log Writes Average Latency.
3/3/2013 9:25:59 PM -- Instance1344.1 has 0.8 for I/O Log Reads Average Latency.
3/3/2013 9:25:59 PM -- Instance1344.2 has 12.2 for I/O Database Reads Average Latency.
3/3/2013 9:25:59 PM -- Instance1344.2 has 0.8 for I/O Log Writes Average Latency.
3/3/2013 9:25:59 PM -- Instance1344.2 has 0.8 for I/O Log Reads Average Latency.
3/3/2013 9:25:59 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.
3/3/2013 9:25:59 PM -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.
3/3/2013 9:25:59 PM -- [C:\Program Files\Exchange Jetstress\Stress_2013_3_1_16_38_46.xml](#) has 5750 samples queried.
3/3/2013 9:26:00 PM -- [C:\Program Files\Exchange Jetstress\Stress_2013_3_1_16_38_46.html](#) is saved.
3/3/2013 9:26:01 PM -- Performance logging begins (interval: 30000 ms).
3/3/2013 9:26:01 PM -- Verifying database checksums ...
3/3/2013 11:33:37 PM -- C:\DB\DB1 (100% processed) and C:\DB\DB2 (100% processed)
3/3/2013 11:33:37 PM -- Performance logging ends.

Dell Compellent Storage Center (SC8000) 2500 Mailbox Exchange 2010 Resiliency Storage Solution

3/3/2013 11:33:37 PM -- [C:\Program Files\Exchange Jetstress\DBChecksum_2013_3_3_21_26_0.blg](#) has 255 samples.
3/3/2013 11:33:38 PM -- [C:\Program Files\Exchange Jetstress\DBChecksum_2013_3_3_21_26_0.html](#) is saved.
3/3/2013 11:33:38 PM -- Verifying log checksums ...
3/3/2013 11:33:40 PM -- C:\DB\DB1 (8 log(s) processed) and C:\DB\DB2 (8 log(s) processed)
3/3/2013 11:33:40 PM -- [C:\Program Files\Exchange Jetstress\Application_2013_3_3_23_33_40.evt](#) is saved.
3/3/2013 11:33:40 PM -- [C:\Program Files\Exchange Jetstress\System_2013_3_3_23_33_40.evt](#) is saved.
3/3/2013 11:33:40 PM -- [C:\Program Files\Exchange Jetstress\XmlConfig_2013_3_3_23_33_40.xml](#) is saved.
3/3/2013 11:33:40 PM -- Jetstress testing ends.
3/4/2013 8:30:54 AM -- Jetstress testing begins ...
3/4/2013 8:30:54 AM -- Prepare testing begins ...
3/4/2013 8:30:56 AM -- Attaching databases ...
3/4/2013 8:30:56 AM -- Prepare testing ends.
3/4/2013 8:31:01 AM -- Performance logging begins (interval: 30000 ms).
3/4/2013 8:31:01 AM -- Backing up databases ...
3/4/2013 11:19:23 AM -- Performance logging ends.
3/4/2013 11:19:23 AM -- Instance1344.1 (100% processed) and Instance1344.2 (100% processed)
3/4/2013 11:19:23 AM -- [C:\Program Files\Exchange Jetstress\DatabaseBackup_2013_3_4_8_30_56.blg](#) has 336 samples.
3/4/2013 11:19:23 AM -- Creating test report ...

Server 2 - JS7

Database Backup Statistics - All

Database Instance	Database Size (MBytes)	Elapsed Backup Time	MBytes Transferred/sec
Instance3088.1	1297418.59	02:53:09	124.88
Instance3088.2	1297394.59	02:56:21	122.62

Jetstress System Parameters

Thread Count	3 (per database)
Minimum Database Cache	64.0 MB
Maximum Database Cache	512.0 MB
Insert Operations	40%
Delete Operations	20%
Replace Operations	5%
Read Operations	35%
Lazy Commits	70%

Database Configuration

Instance3088.1	Log Path: C:\DB\DB1 Database: C:\DB\DB1\Jetstress001001.edb
Instance3088.2	Log Path: C:\DB\DB2 Database: C:\DB\DB2\Jetstress002001.edb

Transactional I/O Performance

MSExchange Database ==> Instances	I/O Database Reads Average Latency (msec)	I/O Database Writes Average Latency (msec)	I/O Database Reads/sec	I/O Database Writes/sec	I/O Database Reads Average Bytes	I/O Database Writes Average Bytes	I/O Log Reads Average Latency (msec)	I/O Log Writes Average Latency (msec)	I/O Log Reads/sec	I/O Log Writes/sec	I/O Log Reads Average Bytes	I/O Log Writes Average Bytes
Instance3088.1	2.915	0.000	499.254	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance3088.2	3.187	0.000	489.173	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	0.445	0.000	1.806
Available MBytes	30186.648	30161.000	30236.000
Free System Page Table Entries	33555674.063	33555672.000	33555676.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	83657157.818	81027072.000	84553728.000
Pool Paged Bytes	175797818.182	167813120.000	179859456.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log

3/1/2013 12:38:15 PM -- Jetstress testing begins ...
3/1/2013 12:38:15 PM -- Prepare testing begins ...
3/1/2013 12:38:18 PM -- Attaching databases ...
3/1/2013 12:38:18 PM -- Prepare testing ends.
3/1/2013 12:38:18 PM -- Dispatching transactions begins ...
3/1/2013 12:38:18 PM -- Database cache settings: (minimum: 64.0 MB, maximum: 512.0 MB)
3/1/2013 12:38:18 PM -- Database flush thresholds: (start: 5.1 MB, stop: 10.2 MB)
3/1/2013 12:38:20 PM -- Database read latency thresholds: (average: 20 msec/read, maximum: 100 msec/read).
3/1/2013 12:38:20 PM -- Log write latency thresholds: (average: 10 msec/write, maximum: 100 msec/write).
3/1/2013 12:38:22 PM -- Operation mix: Sessions 3, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
3/1/2013 12:38:22 PM -- Performance logging begins (interval: 15000 ms).
3/1/2013 12:38:22 PM -- Attaining prerequisites:
3/1/2013 12:40:49 PM -- \\MSEExchange Database(JetstressWin)\Database Cache Size, Last: 485953500.0 (lower bound: 483183800.0, upper bound: none)
3/1/2013 2:40:49 PM -- Performance logging ends.
3/1/2013 2:41:00 PM -- JetInterop batch transaction stats: 28871 and 28505.
3/1/2013 2:41:00 PM -- Dispatching transactions ends.
3/1/2013 2:41:00 PM -- Shutting down databases ...
3/1/2013 2:41:01 PM -- Instance3088.1 (complete) and Instance3088.2 (complete)
3/1/2013 2:41:01 PM -- C:\Program Files\Exchange Jetstress\Performance_2013_3_1_12_38_20.blg has 489 samples.
3/1/2013 2:41:01 PM -- Creating test report ...
3/1/2013 2:41:03 PM -- Instance3088.1 has 11.2 for I/O Database Reads Average Latency.
3/1/2013 2:41:03 PM -- Instance3088.1 has 0.8 for I/O Log Writes Average Latency.
3/1/2013 2:41:03 PM -- Instance3088.1 has 0.8 for I/O Log Reads Average Latency.
3/1/2013 2:41:03 PM -- Instance3088.2 has 13.1 for I/O Database Reads Average Latency.
3/1/2013 2:41:03 PM -- Instance3088.2 has 0.8 for I/O Log Writes Average Latency.
3/1/2013 2:41:03 PM -- Instance3088.2 has 0.8 for I/O Log Reads Average Latency.
3/1/2013 2:41:03 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.
3/1/2013 2:41:03 PM -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.
3/1/2013 2:41:03 PM -- C:\Program Files\Exchange Jetstress\Performance_2013_3_1_12_38_20.xml has 479 samples queried.
3/1/2013 2:41:03 PM -- C:\Program Files\Exchange Jetstress\Performance_2013_3_1_12_38_20.html is saved.
3/1/2013 2:41:04 PM -- Performance logging begins (interval: 30000 ms).
3/1/2013 2:41:04 PM -- Verifying database checksums ...
3/1/2013 4:37:55 PM -- C:\DB\DB1 (100% processed) and C:\DB\DB2 (100% processed)
3/1/2013 4:37:55 PM -- Performance logging ends.
3/1/2013 4:37:55 PM -- C:\Program Files\Exchange Jetstress\DBCchecksum_2013_3_1_14_41_3.blg has 233 samples.
3/1/2013 4:37:56 PM -- C:\Program Files\Exchange Jetstress\DBCchecksum_2013_3_1_14_41_3.html is saved.
3/1/2013 4:37:56 PM -- Verifying log checksums ...

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3/1/2013 4:37:57 PM -- C:\DB\DB1 (7 log(s) processed) and C:\DB\DB2 (7 log(s) processed)
3/1/2013 4:37:57 PM -- C:\Program Files\Exchange Jetstress\Application_2013_3_1_16_37_57.evt is saved.
3/1/2013 4:37:57 PM -- C:\Program Files\Exchange Jetstress\System_2013_3_1_16_37_57.evt is saved.
3/1/2013 4:37:57 PM -- C:\Program Files\Exchange Jetstress\XmlConfig_2013_3_1_16_37_57.xml is saved.
3/1/2013 4:37:57 PM -- Jetstress testing ends.
3/1/2013 4:38:38 PM -- Jetstress testing begins ...
3/1/2013 4:38:38 PM -- Prepare testing begins ...
3/1/2013 4:38:40 PM -- Attaching databases ...
3/1/2013 4:38:40 PM -- Prepare testing ends.
3/1/2013 4:38:40 PM -- Dispatching transactions begins ...
3/1/2013 4:38:40 PM -- Database cache settings: (minimum: 64.0 MB, maximum: 512.0 MB)
3/1/2013 4:38:40 PM -- Database flush thresholds: (start: 5.1 MB, stop: 10.2 MB)
3/1/2013 4:38:43 PM -- Database read latency thresholds: (average: 20 msec/read, maximum: 100 msec/read).
3/1/2013 4:38:43 PM -- Log write latency thresholds: (average: 10 msec/write, maximum: 100 msec/write).
3/1/2013 4:38:46 PM -- Operation mix: Sessions 3, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
3/1/2013 4:38:46 PM -- Performance logging begins (interval: 15000 ms).
3/1/2013 4:38:46 PM -- Attaining prerequisites:
3/1/2013 4:41:10 PM -- \MSEExchange Database(JetstressWin)\Database Cache Size, Last: 485314600.0 (lower bound: 483183800.0, upper bound: none)
3/2/2013 4:41:11 PM -- Performance logging ends.
3/3/2013 9:25:34 PM -- JetInterop batch transaction stats: 706180 and 707008.
3/3/2013 9:25:34 PM -- Dispatching transactions ends.
3/3/2013 9:25:34 PM -- Shutting down databases ...
3/3/2013 9:25:35 PM -- Instance3088.1 (complete) and Instance3088.2 (complete)
3/3/2013 9:25:35 PM -- C:\Program Files\Exchange Jetstress\Performance_2013_3_1_16_38_43.blg has 5760 samples.
3/3/2013 9:25:35 PM -- Creating test report ...
3/3/2013 9:25:51 PM -- Instance3088.1 has 12.4 for I/O Database Reads Average Latency.
3/3/2013 9:25:51 PM -- Instance3088.1 has 3.4 for I/O Log Writes Average Latency.
3/3/2013 9:25:51 PM -- Instance3088.1 has 3.4 for I/O Log Reads Average Latency.
3/3/2013 9:25:51 PM -- Instance3088.2 has 13.2 for I/O Database Reads Average Latency.
3/3/2013 9:25:51 PM -- Instance3088.2 has 7.5 for I/O Log Writes Average Latency.
3/3/2013 9:25:51 PM -- Instance3088.2 has 7.5 for I/O Log Reads Average Latency.
3/3/2013 9:25:51 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.
3/3/2013 9:25:51 PM -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.
3/3/2013 9:25:51 PM -- C:\Program Files\Exchange Jetstress\Performance_2013_3_1_16_38_43.xml has 5750 samples queried.
3/3/2013 9:25:51 PM -- C:\Program Files\Exchange Jetstress\Performance_2013_3_1_16_38_43.html is saved.
3/3/2013 9:25:52 PM -- Performance logging begins (interval: 30000 ms).
3/3/2013 9:25:52 PM -- Verifying database checksums ...
3/3/2013 11:36:11 PM -- C:\DB\DB1 (100% processed) and C:\DB\DB2 (100% processed)
3/3/2013 11:36:11 PM -- Performance logging ends.

Dell Compellent Storage Center (SC8000) 2500 Mailbox Exchange 2010 Resiliency Storage Solution

3/3/2013 11:36:11 PM -- [C:\Program Files\Exchange Jetstress\DBChecksum_2013_3_3_21_25_51.blg](#) has 260 samples.
3/3/2013 11:36:13 PM -- [C:\Program Files\Exchange Jetstress\DBChecksum_2013_3_3_21_25_51.html](#) is saved.
3/3/2013 11:36:13 PM -- Verifying log checksums ...
3/3/2013 11:36:13 PM -- C:\DB\DB1 (7 log(s) processed) and C:\DB\DB2 (8 log(s) processed)
3/3/2013 11:36:13 PM -- [C:\Program Files\Exchange Jetstress\Application_2013_3_3_23_36_13.evt](#) is saved.
3/3/2013 11:36:13 PM -- [C:\Program Files\Exchange Jetstress\System_2013_3_3_23_36_13.evt](#) is saved.
3/3/2013 11:36:13 PM -- [C:\Program Files\Exchange Jetstress\XmlConfig_2013_3_3_23_36_13.xml](#) is saved.
3/3/2013 11:36:13 PM -- Jetstress testing ends.
3/4/2013 8:30:51 AM -- Jetstress testing begins ...
3/4/2013 8:30:51 AM -- Prepare testing begins ...
3/4/2013 8:30:53 AM -- Attaching databases ...
3/4/2013 8:30:53 AM -- Prepare testing ends.
3/4/2013 8:30:58 AM -- Performance logging begins (interval: 30000 ms).
3/4/2013 8:30:58 AM -- Backing up databases ...
3/4/2013 11:27:19 AM -- Performance logging ends.
3/4/2013 11:27:19 AM -- Instance3088.1 (100% processed) and Instance3088.2 (100% processed)
3/4/2013 11:27:19 AM -- [C:\Program Files\Exchange Jetstress\DatabaseBackup_2013_3_4_8_30_53.blg](#) has 352 samples.
3/4/2013 11:27:19 AM -- Creating test report ...

Appendix D: Recovery testing

Server 1 - JS6

Soft-Recovery Statistics - All

Database Instance	Log files replayed	Elapsed seconds
Instance2424.1	507	836.1809601
Instance2424.2	501	824.5120853

Database Configuration

Instance2424.1	Log Path: C:\DB\DB1 Database: C:\DB\DB1\Jetstress001001.edb
Instance2424.2	Log Path: C:\DB\DB2 Database: C:\DB\DB2\Jetstress002001.edb

Transactional I/O Performance

MSExchange Database ==> Instances	I/O Database Reads Average Latency (msec)	I/O Database Writes Average Latency (msec)	I/O Database Reads/sec	I/O Database Writes/sec	I/O Database Reads Average Bytes	I/O Database Writes Average Bytes	I/O Log Reads Average Latency (msec)	I/O Log Writes Average Latency (msec)	I/O Log Reads/sec	I/O Log Writes/sec	I/O Log Reads Average Bytes	I/O Log Writes Average Bytes
Instance2424.1	11.316	1.177	534.416	3.634	39546.555	32688.659	8.337	0.001	5.455	0.006	231303.311	1.240
Instance2424.2	11.166	1.165	541.872	3.636	39558.880	32526.467	8.358	0.000	5.454	0.000	230656.289	0.000

Background Database Maintenance I/O Performance

MSExchange Database ==> Instances	Database Maintenance IO Reads/sec	Database Maintenance IO Reads Average Bytes
Instance2424.1	0.000	0.000
Instance2424.2	0.000	0.000

Total I/O Performance

MSExchange Database ==> Instances	I/O Database Reads Average Latency (msec)	I/O Database Writes Average Latency (msec)	I/O Database Reads/sec	I/O Database Writes/sec	I/O Database Reads Average Bytes	I/O Database Writes Average Bytes	I/O Log Reads Average Latency (msec)	I/O Log Writes Average Latency (msec)	I/O Log Reads/sec	I/O Log Writes/sec	I/O Log Reads Average Bytes	I/O Log Writes Average Bytes
Instance2424.1	11.316	1.177	534.416	3.634	39546.555	32688.659	8.337	0.001	5.455	0.006	231303.311	1.240
Instance2424.2	11.166	1.165	541.872	3.636	39558.880	32526.467	8.358	0.000	5.454	0.000	230656.289	0.000

Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	1.757	0.000	12.043
Available MBytes	29899.510	29871.000	30390.000
Free System Page Table Entries	33555674.143	33555672.000	33555676.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	76084110.222	76070912.000	76120064.000
Pool Paged Bytes	154562708.406	154550272.000	154615808.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log

3/6/2013 9:50:02 AM -- Jetstress testing begins ...
3/6/2013 9:50:02 AM -- Prepare testing begins ...
3/6/2013 9:50:05 AM -- Attaching databases ...
3/6/2013 9:50:05 AM -- Prepare testing ends.
3/6/2013 9:50:05 AM -- Dispatching transactions begins ...
3/6/2013 9:50:05 AM -- Database cache settings: (minimum: 64.0 MB, maximum: 512.0 MB)
3/6/2013 9:50:05 AM -- Database flush thresholds: (start: 5.1 MB, stop: 10.2 MB)
3/6/2013 9:50:07 AM -- Database read latency thresholds: (average: 20 msec/read, maximum: 200 msec/read).
3/6/2013 9:50:07 AM -- Log write latency thresholds: (average: 10 msec/write, maximum: 200 msec/write).
3/6/2013 9:50:10 AM -- Operation mix: Sessions 3, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
3/6/2013 9:50:10 AM -- Performance logging begins (interval: 15000 ms).
3/6/2013 9:50:10 AM -- Attaining prerequisites:
3/6/2013 9:52:40 AM -- \MSEExchange Database(JetstressWin)\Database Cache Size, Last: 487301100.0 (lower bound: 483183800.0, upper bound: none)
3/7/2013 9:52:40 AM -- Performance logging ends.
3/7/2013 9:55:05 AM -- JetInterop batch transaction stats: 339182 and 340326.
3/7/2013 9:55:06 AM -- Dispatching transactions ends.
3/7/2013 9:55:06 AM -- Shutting down databases ...
3/7/2013 9:55:07 AM -- Instance2424.1 (complete) and Instance2424.2 (complete)
3/7/2013 9:55:07 AM -- C:\Program Files\Exchange Jetstress\Stress_2013_3_6_9_50_7.blg has 5761 samples.
3/7/2013 9:55:07 AM -- Creating test report ...
3/7/2013 9:55:24 AM -- Instance2424.1 has 12.0 for I/O Database Reads Average Latency.
3/7/2013 9:55:24 AM -- Instance2424.1 has 0.9 for I/O Log Writes Average Latency.
3/7/2013 9:55:24 AM -- Instance2424.1 has 0.9 for I/O Log Reads Average Latency.
3/7/2013 9:55:24 AM -- Instance2424.2 has 11.6 for I/O Database Reads Average Latency.
3/7/2013 9:55:24 AM -- Instance2424.2 has 0.9 for I/O Log Writes Average Latency.
3/7/2013 9:55:24 AM -- Instance2424.2 has 0.9 for I/O Log Reads Average Latency.
3/7/2013 9:55:24 AM -- Test has 0 Maximum Database Page Fault Stalls/sec.
3/7/2013 9:55:24 AM -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.
3/7/2013 9:55:24 AM -- C:\Program Files\Exchange Jetstress\Stress_2013_3_6_9_50_7.xml has 5751 samples queried.

3/7/2013 9:55:24 AM -- [C:\Program Files\Exchange Jetstress\Stress_2013_3_6_9_50_7.html](#) is saved.
3/7/2013 9:55:25 AM -- Performance logging begins (interval: 30000 ms).
3/7/2013 9:55:25 AM -- Verifying database checksums ...
3/7/2013 12:08:09 PM -- C:\DB\DB1 (100% processed) and C:\DB\DB2 (100% processed)
3/7/2013 12:08:09 PM -- Performance logging ends.
3/7/2013 12:08:09 PM -- [C:\Program Files\Exchange Jetstress\DBChecksum_2013_3_7_9_55_24.blg](#) has 265 samples.
3/7/2013 12:08:11 PM -- [C:\Program Files\Exchange Jetstress\DBChecksum_2013_3_7_9_55_24.html](#) is saved.
3/7/2013 12:08:11 PM -- Verifying log checksums ...
3/7/2013 12:08:13 PM -- C:\DB\DB1 (8 log(s) processed) and C:\DB\DB2 (7 log(s) processed)
3/7/2013 12:08:13 PM -- [C:\Program Files\Exchange Jetstress\Application_2013_3_7_12_8_13.evt](#) is saved.
3/7/2013 12:08:13 PM -- [C:\Program Files\Exchange Jetstress\System_2013_3_7_12_8_13.evt](#) is saved.
3/7/2013 12:08:13 PM -- [C:\Program Files\Exchange Jetstress\XmlConfig_2013_3_7_12_8_13.xml](#) is saved.
3/7/2013 12:08:13 PM -- Jetstress testing ends.
3/7/2013 12:17:25 PM -- Jetstress testing begins ...
3/7/2013 12:17:25 PM -- Prepare testing begins ...
3/7/2013 12:17:27 PM -- Attaching databases ...
3/7/2013 12:17:27 PM -- Prepare testing ends.
3/7/2013 12:17:27 PM -- Dispatching transactions begins ...
3/7/2013 12:17:27 PM -- Database cache settings: (minimum: 64.0 MB, maximum: 512.0 MB)
3/7/2013 12:17:27 PM -- Database flush thresholds: (start: 5.1 MB, stop: 10.2 MB)
3/7/2013 12:17:29 PM -- Database read latency thresholds: (average: 20 msec/read, maximum: 100 msec/read).
3/7/2013 12:17:29 PM -- Log write latency thresholds: (average: 10 msec/write, maximum: 100 msec/write).
3/7/2013 12:17:32 PM -- Operation mix: Sessions 3, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
3/7/2013 12:17:32 PM -- Performance logging begins (interval: 15000 ms).
3/7/2013 12:17:32 PM -- Generating log files ...
3/7/2013 1:48:22 PM -- C:\DB\DB1 (101.4% generated) and C:\DB\DB2 (100.2% generated)
3/7/2013 1:48:22 PM -- Performance logging ends.
3/7/2013 1:48:22 PM -- JetInterop batch transaction stats: 22171 and 22151.
3/7/2013 1:48:22 PM -- Dispatching transactions ends.
3/7/2013 1:48:22 PM -- Shutting down databases ...
3/7/2013 1:48:23 PM -- Instance2424.1 (complete) and Instance2424.2 (complete)
3/7/2013 1:48:23 PM -- [C:\Program Files\Exchange Jetstress\Performance_2013_3_7_12_17_29.blg](#) has 362 samples.
3/7/2013 1:48:23 PM -- Creating test report ...
3/7/2013 1:48:24 PM -- Instance2424.1 has 15.0 for I/O Database Reads Average Latency.
3/7/2013 1:48:24 PM -- Instance2424.1 has 1.0 for I/O Log Writes Average Latency.

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3/7/2013 1:48:24 PM -- Instance2424.1 has 1.0 for I/O Log Reads Average Latency.
3/7/2013 1:48:24 PM -- Instance2424.2 has 14.4 for I/O Database Reads Average Latency.
3/7/2013 1:48:24 PM -- Instance2424.2 has 1.0 for I/O Log Writes Average Latency.
3/7/2013 1:48:24 PM -- Instance2424.2 has 1.0 for I/O Log Reads Average Latency.
3/7/2013 1:48:24 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.
3/7/2013 1:48:24 PM -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.
3/7/2013 1:48:24 PM -- C:\Program Files\Exchange Jetstress\Performance_2013_3_7_12_17_29.xml has 361 samples queried.
3/7/2013 1:48:24 PM -- C:\Program Files\Exchange Jetstress\Performance_2013_3_7_12_17_29.html is saved.
3/7/2013 1:49:53 PM -- Performance logging begins (interval: 2000 ms).
3/7/2013 1:49:53 PM -- Recovering databases ...
3/7/2013 2:03:50 PM -- Performance logging ends.
3/7/2013 2:03:50 PM -- Instance2424.1 (836.1809601) and Instance2424.2 (824.5120853)
3/7/2013 2:03:50 PM -- C:\Program Files\Exchange Jetstress\SoftRecovery_2013_3_7_13_49_51.blg has 414 samples.
3/7/2013 2:03:50 PM -- Creating test report ...

Server 2 - JS7

Soft-Recovery Statistics - All

Database Instance	Log files replayed	Elapsed seconds
Instance2380.1	504	830.086642
Instance2380.2	501	849.7116936

Database Configuration

Instance2380.1	Log Path: C:\DB\DB1 Database: C:\DB\DB1\Jetstress001001.edb
Instance2380.2	Log Path: C:\DB\DB2 Database: C:\DB\DB2\Jetstress002001.edb

Transactional I/O Performance

MSExchange Database ==> Instances	I/O Database Reads Average Latency (msec)	I/O Database Writes Average Latency (msec)	I/O Database Reads/sec	I/O Database Writes/sec	I/O Database Reads Average Bytes	I/O Database Writes Average Bytes	I/O Log Reads Average Latency (msec)	I/O Log Writes Average Latency (msec)	I/O Log Reads/sec	I/O Log Writes/sec	I/O Log Reads Average Bytes	I/O Log Writes Average Bytes
Instance2380.1	11.369	1.198	522.551	3.644	39654.405	32687.883	8.254	0.002	5.466	0.004	231821.255	1.252
Instance2380.2	11.708	1.268	512.676	3.529	39686.833	32611.589	7.928	0.000	5.294	0.000	231272.334	0.000

Background Database Maintenance I/O Performance

MSExchange Database ==> Instances	Database Maintenance IO Reads/sec	Database Maintenance IO Reads Average Bytes
Instance2380.1	0.000	0.000
Instance2380.2	0.000	0.000

Total I/O Performance

MSExchange Database ==> Instances	I/O Database Reads Average Latency (msec)	I/O Database Writes Average Latency (msec)	I/O Database Reads/sec	I/O Database Writes/sec	I/O Database Reads Average Bytes	I/O Database Writes Average Bytes	I/O Log Reads Average Latency (msec)	I/O Log Writes Average Latency (msec)	I/O Log Reads/sec	I/O Log Writes/sec	I/O Log Reads Average Bytes	I/O Log Writes Average Bytes
Instance2380.1	11.369	1.198	522.551	3.644	39654.405	32687.883	8.254	0.002	5.466	0.004	231821.255	1.252
Instance2380.2	11.708	1.268	512.676	3.529	39686.833	32611.589	7.928	0.000	5.294	0.000	231272.334	0.000

Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	1.925	0.000	16.498
Available MBytes	29895.062	29863.000	30385.000
Free System Page Table Entries	33555161.050	33555159.000	33555163.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	75128051.810	75116544.000	75165696.000
Pool Paged Bytes	153537848.076	153518080.000	153604096.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log

3/6/2013 9:50:05 AM -- Jetstress testing begins ...
3/6/2013 9:50:05 AM -- Prepare testing begins ...
3/6/2013 9:50:08 AM -- Attaching databases ...
3/6/2013 9:50:08 AM -- Prepare testing ends.
3/6/2013 9:50:08 AM -- Dispatching transactions begins ...
3/6/2013 9:50:08 AM -- Database cache settings: (minimum: 64.0 MB, maximum: 512.0 MB)
3/6/2013 9:50:08 AM -- Database flush thresholds: (start: 5.1 MB, stop: 10.2 MB)
3/6/2013 9:50:10 AM -- Database read latency thresholds: (average: 20 msec/read, maximum: 200 msec/read).
3/6/2013 9:50:10 AM -- Log write latency thresholds: (average: 10 msec/write, maximum: 200 msec/write).
3/6/2013 9:50:13 AM -- Operation mix: Sessions 3, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
3/6/2013 9:50:13 AM -- Performance logging begins (interval: 15000 ms).
3/6/2013 9:50:13 AM -- Attaining prerequisites:
3/6/2013 9:52:35 AM -- \MSEExchange Database(JetstressWin)\Database Cache Size, Last: 483299300.0 (lower bound: 483183800.0, upper bound: none)
3/7/2013 9:52:36 AM -- Performance logging ends.
3/7/2013 9:55:07 AM -- JetInterop batch transaction stats: 331490 and 332235.
3/7/2013 9:55:09 AM -- Dispatching transactions ends.
3/7/2013 9:55:09 AM -- Shutting down databases ...
3/7/2013 9:55:11 AM -- Instance2380.1 (complete) and Instance2380.2 (complete)
3/7/2013 9:55:11 AM -- C:\Program Files\Exchange Jetstress\Stress_2013_3_6_9_50_10.blg has 5760 samples.
3/7/2013 9:55:11 AM -- Creating test report ...
3/7/2013 9:55:29 AM -- Instance2380.1 has 11.9 for I/O Database Reads Average Latency.
3/7/2013 9:55:29 AM -- Instance2380.1 has 0.9 for I/O Log Writes Average Latency.
3/7/2013 9:55:29 AM -- Instance2380.1 has 0.9 for I/O Log Reads Average Latency.
3/7/2013 9:55:29 AM -- Instance2380.2 has 12.1 for I/O Database Reads Average Latency.
3/7/2013 9:55:29 AM -- Instance2380.2 has 0.9 for I/O Log Writes Average Latency.
3/7/2013 9:55:29 AM -- Instance2380.2 has 0.9 for I/O Log Reads Average Latency.
3/7/2013 9:55:29 AM -- Test has 0 Maximum Database Page Fault Stalls/sec.
3/7/2013 9:55:30 AM -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.
3/7/2013 9:55:30 AM -- C:\Program Files\Exchange Jetstress\Stress_2013_3_6_9_50_10.xml has 5750 samples queried.
3/7/2013 9:55:30 AM -- C:\Program Files\Exchange Jetstress\Stress_2013_3_6_9_50_10.html is saved.
3/7/2013 9:55:31 AM -- Performance logging begins (interval: 30000 ms).
3/7/2013 9:55:31 AM -- Verifying database checksums ...
3/7/2013 12:11:26 PM -- C:\DB\DB1 (100% processed) and C:\DB\DB2 (100% processed)

3/7/2013 12:11:26 PM -- Performance logging ends.
3/7/2013 12:11:26 PM -- [C:\Program Files\Exchange Jetstress\DBChecksum_2013_3_7_9_55_30.blg](#) has 271 samples.
3/7/2013 12:11:28 PM -- [C:\Program Files\Exchange Jetstress\DBChecksum_2013_3_7_9_55_30.html](#) is saved.
3/7/2013 12:11:28 PM -- Verifying log checksums ...
3/7/2013 12:11:29 PM -- C:\DB\DB1 (8 log(s) processed) and C:\DB\DB2 (7 log(s) processed)
3/7/2013 12:11:29 PM -- [C:\Program Files\Exchange Jetstress\Application_2013_3_7_12_11_29.evt](#) is saved.
3/7/2013 12:11:29 PM -- [C:\Program Files\Exchange Jetstress\System_2013_3_7_12_11_29.evt](#) is saved.
3/7/2013 12:11:29 PM -- [C:\Program Files\Exchange Jetstress\XmlConfig_2013_3_7_12_11_29.xml](#) is saved.
3/7/2013 12:11:29 PM -- Jetstress testing ends.
3/7/2013 12:17:28 PM -- Jetstress testing begins ...
3/7/2013 12:17:28 PM -- Prepare testing begins ...
3/7/2013 12:17:30 PM -- Attaching databases ...
3/7/2013 12:17:30 PM -- Prepare testing ends.
3/7/2013 12:17:30 PM -- Dispatching transactions begins ...
3/7/2013 12:17:30 PM -- Database cache settings: (minimum: 64.0 MB, maximum: 512.0 MB)
3/7/2013 12:17:30 PM -- Database flush thresholds: (start: 5.1 MB, stop: 10.2 MB)
3/7/2013 12:17:33 PM -- Database read latency thresholds: (average: 20 msec/read, maximum: 100 msec/read).
3/7/2013 12:17:33 PM -- Log write latency thresholds: (average: 10 msec/write, maximum: 100 msec/write).
3/7/2013 12:17:35 PM -- Operation mix: Sessions 3, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
3/7/2013 12:17:35 PM -- Performance logging begins (interval: 15000 ms).
3/7/2013 12:17:35 PM -- Generating log files ...
3/7/2013 1:49:24 PM -- C:\DB\DB1 (100.8% generated) and C:\DB\DB2 (100.2% generated)
3/7/2013 1:49:24 PM -- Performance logging ends.
3/7/2013 1:49:24 PM -- JetInterop batch transaction stats: 22045 and 21881.
3/7/2013 1:49:24 PM -- Dispatching transactions ends.
3/7/2013 1:49:24 PM -- Shutting down databases ...
3/7/2013 1:49:25 PM -- Instance2380.1 (complete) and Instance2380.2 (complete)
3/7/2013 1:49:25 PM -- [C:\Program Files\Exchange Jetstress\Performance_2013_3_7_12_17_33.blg](#) has 366 samples.
3/7/2013 1:49:25 PM -- Creating test report ...
3/7/2013 1:49:27 PM -- Instance2380.1 has 15.0 for I/O Database Reads Average Latency.
3/7/2013 1:49:27 PM -- Instance2380.1 has 1.0 for I/O Log Writes Average Latency.
3/7/2013 1:49:27 PM -- Instance2380.1 has 1.0 for I/O Log Reads Average Latency.
3/7/2013 1:49:27 PM -- Instance2380.2 has 15.2 for I/O Database Reads Average Latency.
3/7/2013 1:49:27 PM -- Instance2380.2 has 0.9 for I/O Log Writes Average Latency.
3/7/2013 1:49:27 PM -- Instance2380.2 has 0.9 for I/O Log Reads Average Latency.

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3/7/2013 1:49:27 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.
3/7/2013 1:49:27 PM -- Test has 0 Database Page Fault Stalls/sec samples higher than 0.
3/7/2013 1:49:27 PM -- C:\Program Files\Exchange Jetstress\Performance_2013_3_7_12_17_33.xml has 365 samples queried.
3/7/2013 1:49:27 PM -- C:\Program Files\Exchange Jetstress\Performance_2013_3_7_12_17_33.html is saved.
3/7/2013 1:49:56 PM -- Performance logging begins (interval: 2000 ms).
3/7/2013 1:49:56 PM -- Recovering databases ...
3/7/2013 2:04:06 PM -- Performance logging ends.
3/7/2013 2:04:06 PM -- Instance2380.1 (830.086642) and Instance2380.2 (849.7116936)
3/7/2013 2:04:06 PM -- C:\Program Files\Exchange Jetstress\SoftRecovery_2013_3_7_13_49_54.blg has 420 samples.
3/7/2013 2:04:07 PM -- Creating test report ...