



Dell Compellent Storage Center 6.5 SC4020 10,000 Mailbox Exchange 2013 Resiliency Storage Solution

Microsoft ESRP 4.0

Mark Boeser, Exchange Product Specialist
Dell Compellent Technical Solutions
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Revisions

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1 Executive summary

This document provides information on Dell Compellent's storage solution for Microsoft Exchange Server, based the Microsoft Exchange Solution Reviewed Program (ESRP) – Storage program.

The ESRP – Storage program was developed by Microsoft Corporation to provide a common storage testing framework for vendors to provide information on its storage solutions for Microsoft Exchange Server software. For more details on the Microsoft ESRP – Storage program, please click <http://technet.microsoft.com/en-us/exchange/ff182054.aspx>

1.1 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 2013 have greatly enhanced the availability of Exchange Server, 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, or half of the solution. The number of users simulated was 10,000 across 4 servers, with 2,500 users per server. The mailbox size was 1GB per user. Each server has 4 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 2013 DAG database replication engine. This is a very efficient and reliable replication mechanism and is the recommended method for providing highly-available and redundant Exchange solutions.

1.2 Solution description

Testing was performed on a Dell Compellent Storage Center (SC4020) v6.5, a redundant controller pair, with redundant front-end and back-end connections. The front-end connections are fiber-channel based, over redundant fabrics, with 2 ports per server, and 4 ports per controller. One 24 bay 2.5" built-in drive enclosure is utilized with each Storage Center.

The disk connectivity is SAS 6Gbps. Disk drives used are SAS 10K 900GB. The spindle count is 23 disks/1 spares 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://www.windowsservercatalog.com/item.aspx?itemId=467135f9-8f78-bfed-b511-f62d42b2d1cb&bCatID=1338>



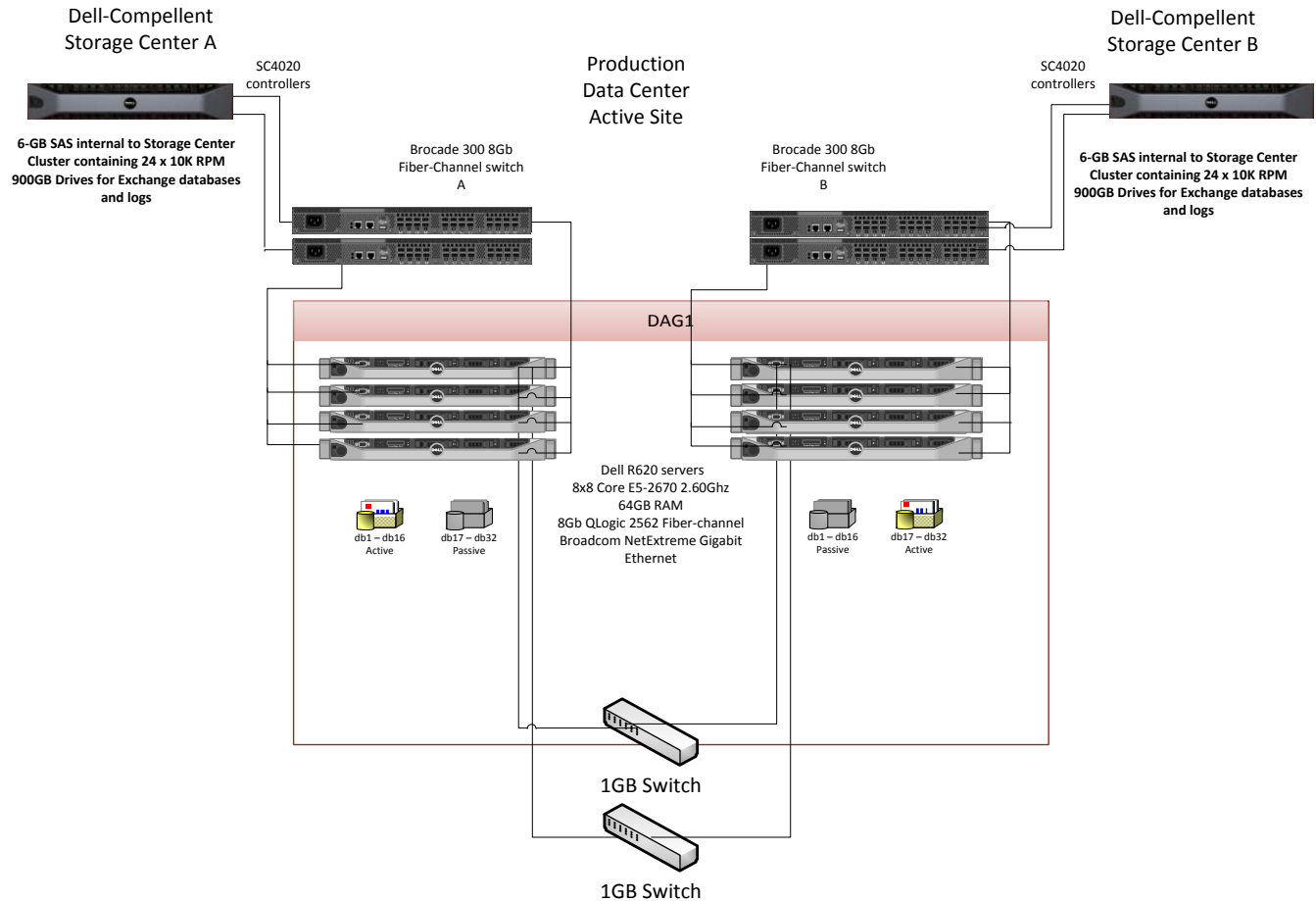


Figure 1 - Highly available data center design

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.

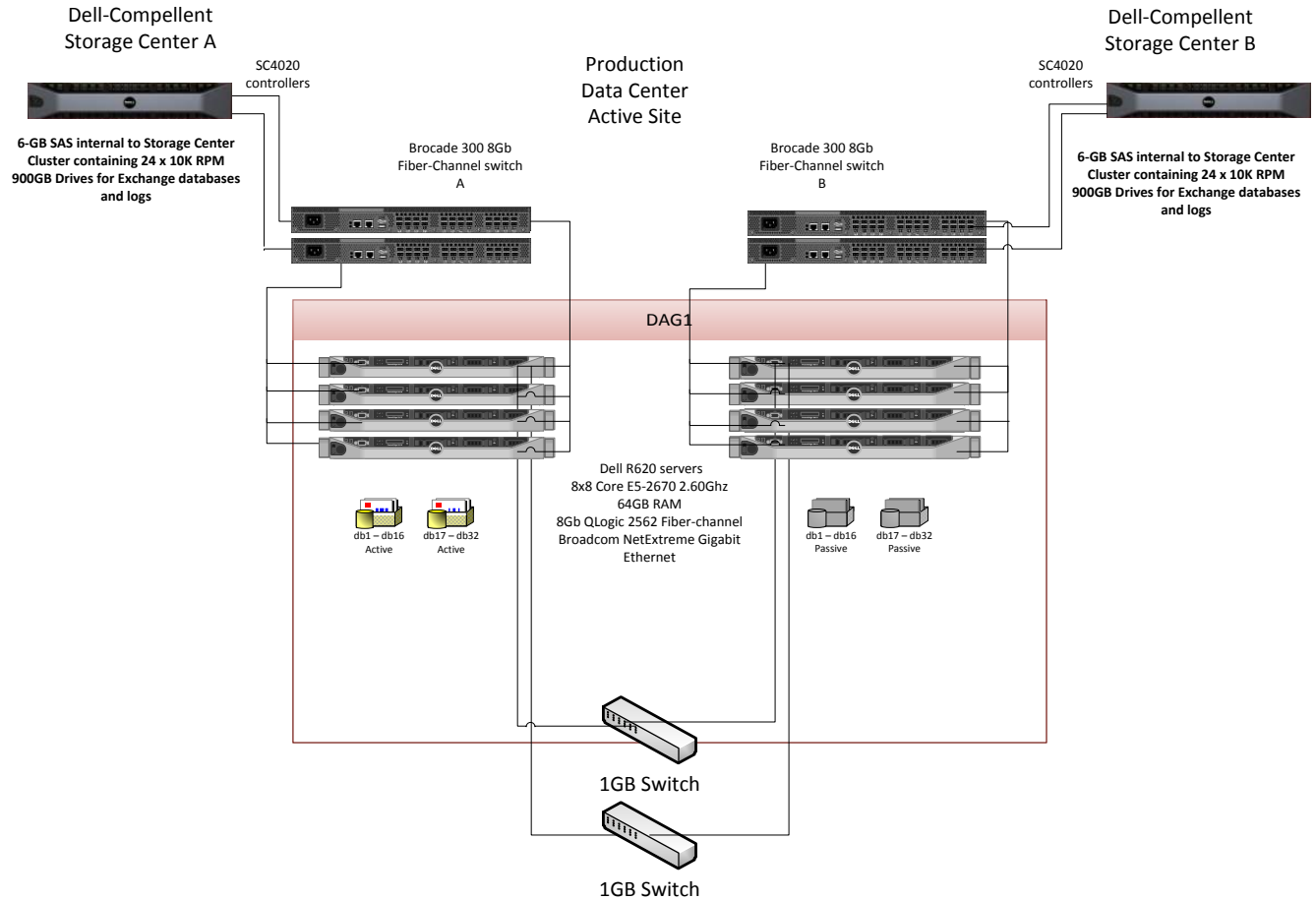


Figure 2 – Tested configuration with Storage Center A with full user load and Storage Center B offline

The tested configuration is 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.

2 The Dell Compellent Storage Center (SC4020) solution

2.1 A modular hardware design

The hardware design consists of a 24 2.5" drives Dell 12G server-based system, plus dual controllers, providing automatic failover, combined in a single chassis. Dell Compellent can seamlessly connect to any open-systems server without the need for server side agents. Organizations can utilize Fiber Channel connectivity, and disk enclosures support any external interface and disks based on Solid State, Fiber Channel, and/or Serial ATA.

The new SC4020 arrays combine the benefits of proven Dell™ Fluid Data™ architecture with resilient Dell hardware design to provide efficiency, quality and durability. Compared to the larger SC8000 array, the SC4020 offers all of the enterprise-class features of the SC8000 in a compact "all in one" format targeted for smaller and mid-sized deployments.

2.2 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.

2.3 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 deployments.



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>.



2.4 Targeted customer profile

This solution is targeted for a medium-sized organization. Capacity can be dynamically scaled from 1TB to over a Petabyte. This provides excellent growth potential with no downtime required for upgrades.

1. A Storage Center solution can be sized for any size organization
2. Unlimited number of hosts can be attached via Fiber-Channel connection
3. User IO profile (.10 IOPS per user, .12 tested, giving 20% headroom).
4. User mailbox size (1 GB quota)
5. Backup strategy - VSS backup using SAN based snapshots, use Mailbox Resiliency as primary data protection mechanism.
6. Using SAN based snapshots, and boot from SAN, a complete server can be restored in minutes.
7. 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.

2.5 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 58% storage utilization. If the storage requirement grows beyond the design specified, additional spindles will provide additional capacity for any volume to be expanded.



3 Tested deployment

The following tables summarize the testing environment.

3.1 Simulated Exchange configuration

Table 1 Simulated Exchange configuration

Number of Exchange mailboxes simulated	10,000
Number of Database Availability Groups (DAGs)	1
Number of servers/DAG	8
Number of active mailboxes/server	1250
Number of databases/host	4
Number of copies/database	2
Number of mailboxes/database	312 or 313
Simulated profile: I/O's per second per mailbox (IOPS, include 20% headroom)	.10 (.12 tested)
Database/Log LUN size	750 GB
Total database size for performance testing	12.0 TB
% storage capacity used by Exchange database**	56%

* 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.



3.2 Primary storage hardware

Table 2 Primary storage hardware

Storage Connectivity (Fiber Channel, SAS, SATA, iSCSI)	SAS
Storage model and OS/firmware revision	Dell Compellent Storage Center (SC4020) v6.5 http://www.windowsservercatalog.com/item.aspx?idItem=467135f9-8f78-bfed-b511-f62d42b2d1cb&bCatID=1338
Storage cache	16 GB
Number of storage controllers	2
Number of storage ports	4 active ports per controller
Maximum bandwidth of storage connectivity to host	32 Gb/sec (4x8Gb GB HBA)
Switch type/model/firmware revision	Brocade Model 300 24-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	23 Active for DB and los 1 hot spare = 24 total spindles
Maximum number of spindles can be hosted in the storage	24 drive bay + dual controllers in a 2U chassis Scalable to 120 drives (409TB) via modular expansion enclosures



3.3 Primary storage software

Table 3 Primary storage software

Configuration	Detail
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	15.00.0712.008
Replication solution name/version	Microsoft Exchange Server 2013 DAG replication

3.4 Primary storage disk configuration (Mailbox store/Log disks)

Table 4 Primary storage disk configuration

Configuration	Detail
Disk type, speed and firmware revision	SAS 10k 900GB, XRC0
Raw capacity per disk (GB)	838.36 GB
Number of physical disks in test	23
Total raw storage capacity (GB)	19.28 TB
Raid level	RAID5
Total formatted capacity	12.00 TB
Storage capacity utilization	57.69 %
Database capacity utilization	56%



4 Best practices

Exchange Server 2013 has changed dramatically from previous versions. For a list of what has changed see the following: [http://technet.microsoft.com/en-us/library/jj150540\(v=exchg.150\).aspx](http://technet.microsoft.com/en-us/library/jj150540(v=exchg.150).aspx)

The best practices have also changed, based on the changes in behavior in Exchange 2013. Significant I/O reduction in Exchange 2013 has made it preferable to utilize RAID-5 volumes for both Database and logs. This provides overall storage savings due to the smaller capacity overhead vs. RAID-10.

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 Exchange Server 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 2013 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 server health please see the following:
[http://technet.microsoft.com/en-us/library/jj150551\(v=exchg.150\).aspx](http://technet.microsoft.com/en-us/library/jj150551(v=exchg.150).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/>.



4.1 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:

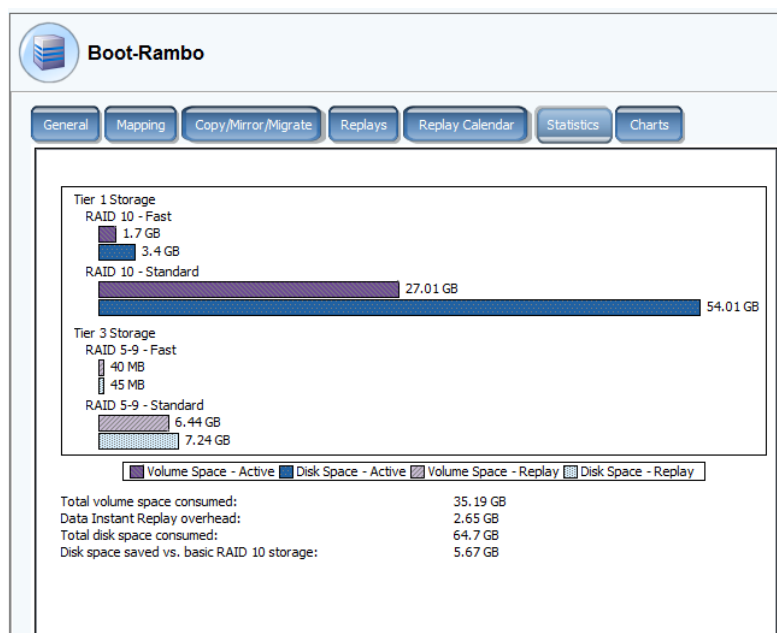


Figure 3 Volume Statistics showing Data Progression

4.2 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 2013 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.

4.3 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 should be implemented. This provides a full interface for scheduling database backups. Using Replay Manager, Exchange Servers can be restored in minutes 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.

4.4 Additional Information

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



5 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.

5.1 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)

1. No errors were reported in either the application or system log
2. No errors were reported during the [database](#) and [log](#) checksum process
3. No errors were reported during either the backup or restore process

5.2 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.



5.2.1 Server 1 – JS12

Database I/O	
Database Disks Transfers/sec	351.648
Database Disks Reads/sec	243.678
Database Disks Writes/sec	107.970
Average Database Disk Read Latency (ms)	14.435
Average Database Disk Write Latency (ms)	1.841
Transaction Log I/O	
Log Disks Writes/sec	25.013
Average Log Disk Write Latency (ms)	1.229

5.2.2 Server 2 – JS13

Database I/O	
Database Disks Transfers/sec	335.657
Database Disks Reads/sec	233.513
Database Disks Writes/sec	102.144
Average Database Disk Read Latency (ms)	14.166
Average Database Disk Write Latency (ms)	1.893
Transaction Log I/O	
Log Disks Writes/sec	23.609
Average Log Disk Write Latency (ms)	1.235



5.2.3 Server 3 – JS14

Database I/O	
Database Disks Transfers/sec	359.618
Database Disks Reads/sec	249.209
Database Disks Writes/sec	110.409
Average Database Disk Read Latency (ms)	13.878
Average Database Disk Write Latency (ms)	2.058
Transaction Log I/O	
Log Disks Writes/sec	25.517
Average Log Disk Write Latency (ms)	1.204

5.2.4 Server 4 – JS15

Database I/O	
Database Disks Transfers/sec	351.470
Database Disks Reads/sec	243.185
Database Disks Writes/sec	108.285
Average Database Disk Read Latency (ms)	14.468
Average Database Disk Write Latency (ms)	2.047
Transaction Log I/O	
Log Disks Writes/sec	25.033
Average Log Disk Write Latency (ms)	1.209



5.3 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).

5.3.1 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.

Performance item	Detail
MB read/sec per database	65.65
MB read/sec total per server	262.6

5.3.2 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 database. Each log file is 1 MB in size.

Performance item	Detail
Average time to play one Log file (sec)	1.827



6 Conclusion

The testing shows the scalability and performance of the Dell Compellent Storage Center SC4020.

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 v4.0 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.



7 Additional resources

- 7.1 Microsoft ESRP Program Website:
<http://technet.microsoft.com/en-us/exchange/ff182054.aspx>
- 7.2 Dell Compellent Knowledge Center:
<http://kc.compellent.com>
- 7.3 Dell Storage Website:
<http://www.dellstorage.com/compellent/>
- 7.4 Dell TechCenter:
<http://en.community.dell.com/techcenter/storage/>



A Performance testing

A.1 Server 1 – JS12

Table 5 Test Summary

Overall Test Result	Pass
Machine Name	JS12
Test Description	2500 users/server 4 servers 1GB mailboxes .10 IOPS/user .12 IOPS tested 4 dbs per server 750GB db/log combined volumes 2 copies 5 threads/db
Test Start Time	2/18/2014 12:30:37 PM
Test End Time	2/18/2014 2:35:15 PM
Collection Start Time	2/18/2014 12:34:40 PM
Collection End Time	2/18/2014 2:34:32 PM
Jetstress Version	15.00.0658.004
ESE Version	15.00.0712.008
Operating System	Windows Server 2008 R2 Enterprise Service Pack 1 (6.1.7601.65536)
Performance Log	C:\Program Files\Exchange Jetstress\Performance_2014_2_18_12_30_46.blg



Table 6 Database sizing and throughput

Performance counter	Value
Achieved Transactional I/O per Second	317.945
Target Transactional I/O per Second	300
Initial Database Size (bytes)	2723225534464
Final Database Size (bytes)	2724081172480
Database Files (Count)	4

Table 7 Jetstress system parameters

Performance counter	Value
Thread Count	5
Minimum Database Cache	128.0 MB
Maximum Database Cache	1024.0 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



Table 8 Database configuration

Performance counter	Value
Instance3320.1	Log path: C:\DB\DB1 Database: C:\DB\DB1\Jetstress001001.edb
Instance3320.2	Log path: C:\DB\DB2 Database: C:\DB\DB2\Jetstress002001.edb
Instance3320.3	Log path: C:\DB\DB3 Database: C:\DB\DB3\Jetstress003001.edb
Instance3320.4	Log path: C:\DB\DB4 Database: C:\DB\DB4\Jetstress004001.edb

Table 9 Transactional I/O performance

MSEExchange 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
Instance3320.1	14.988	1.907	52.342	26.852	32960.924	35229.210	0.000	1.245	0.000	6.234	0.000	20374.939
Instance3320.2	14.169	1.876	52.549	27.025	32962.510	35142.941	0.000	1.253	0.000	6.267	0.000	20320.277
Instance3320.3	14.398	1.809	52.740	27.342	32969.559	35230.558	0.000	1.212	0.000	6.286	0.000	20231.509
Instance3320.4	14.185	1.773	52.345	26.751	32948.559	35311.894	0.000	1.207	0.000	6.226	0.000	20437.425



Table 10 Background Database Maintenance I/O performance

MSEExchange Database ==> Instances	Database Maintenance IO Reads/sec	Database Maintenance IO Reads Average Bytes
Instance3320.1	8.517	261455.358
Instance3320.2	8.435	261610.154
Instance3320.3	8.332	261513.956
Instance3320.4	8.418	261437.822

Table 11 Log replication I/O performance

MSEExchange Database ==> Instances	I/O Log Reads/sec	I/O Log Reads Average Bytes
Instance3320.1	0.543	206178.348
Instance3320.2	0.543	205045.760
Instance3320.3	0.543	206347.718
Instance3320.4	0.543	205256.538

Table 12 Total I/O performance

MSEExchange 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
Instance3320.1	14.988	1.907	60.859	26.852	64938.238	35229.210	10.482	1.245	0.543	6.234	206178.348	20374.939
Instance3320.2	14.169	1.876	60.984	27.025	64589.316	35142.941	11.214	1.253	0.543	6.267	205045.760	20320.277
Instance3320.3	14.398	1.809	61.072	27.342	64150.126	35230.558	11.398	1.212	0.543	6.286	206347.718	20231.509
Instance3320.4	14.185	1.773	60.763	26.751	64602.409	35311.894	10.251	1.207	0.543	6.226	205256.538	20437.425



Table 13 Host system performance

Counter	Average	Minimum	Maximum
% Processor Time	0.412	0.000	2.649
Available MBytes	60688.102	60676.000	60729.000
Free System Page Table Entries	33555674.246	33555670.000	33555676.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	67961233.904	67948544.000	68014080.000
Pool Paged Bytes	155754496.000	155738112.000	155869184.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

A.2 Test log

2/18/2014 12:30:37 PM -- Preparing for testing ...
 2/18/2014 12:30:41 PM -- Attaching databases ...
 2/18/2014 12:30:41 PM -- Preparations for testing are complete.
 2/18/2014 12:30:41 PM -- Starting transaction dispatch ..
 2/18/2014 12:30:41 PM -- Database cache settings: (minimum: 128.0 MB, maximum: 1.0 GB)
 2/18/2014 12:30:41 PM -- Database flush thresholds: (start: 10.2 MB, stop: 20.5 MB)
 2/18/2014 12:30:46 PM -- Database read latency thresholds: (average: 20 msec/read, maximum: 100 msec/read).
 2/18/2014 12:30:46 PM -- Log write latency thresholds: (average: 10 msec/write, maximum: 100 msec/write).
 2/18/2014 12:30:50 PM -- Operation mix: Sessions 5, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
 2/18/2014 12:30:50 PM -- Performance logging started (interval: 15000 ms).
 2/18/2014 12:30:50 PM -- Attaining prerequisites:
 2/18/2014 12:34:40 PM -- \MSEExchange Database(JetstressWin)\Database Cache Size, Last: 970645500.0 (lower bound: 966367600.0, upper bound: none)
 2/18/2014 2:34:40 PM -- Performance logging has ended.



2/18/2014 2:35:05 PM -- JetInterop batch transaction stats: 15244, 15244, 15243 and 15243.
2/18/2014 2:35:05 PM -- Dispatching transactions ends.
2/18/2014 2:35:08 PM -- Shutting down databases ...
2/18/2014 2:35:15 PM -- Instance3320.1 (complete), Instance3320.2 (complete), Instance3320.3 (complete) and Instance3320.4 (complete)
2/18/2014 2:35:15 PM -- C:\Program Files\Exchange Jetstress\Performance_2014_2_18_12_30_46.blg has 494 samples.
2/18/2014 2:35:15 PM -- Creating test report ...
2/18/2014 2:35:18 PM -- Instance3320.1 has 15.0 for I/O Database Reads Average Latency.
2/18/2014 2:35:18 PM -- Instance3320.1 has 1.2 for I/O Log Writes Average Latency.
2/18/2014 2:35:18 PM -- Instance3320.1 has 1.2 for I/O Log Reads Average Latency.
2/18/2014 2:35:18 PM -- Instance3320.2 has 14.2 for I/O Database Reads Average Latency.
2/18/2014 2:35:18 PM -- Instance3320.2 has 1.3 for I/O Log Writes Average Latency.
2/18/2014 2:35:18 PM -- Instance3320.2 has 1.3 for I/O Log Reads Average Latency.
2/18/2014 2:35:18 PM -- Instance3320.3 has 14.4 for I/O Database Reads Average Latency.
2/18/2014 2:35:18 PM -- Instance3320.3 has 1.2 for I/O Log Writes Average Latency.
2/18/2014 2:35:18 PM -- Instance3320.3 has 1.2 for I/O Log Reads Average Latency.
2/18/2014 2:35:18 PM -- Instance3320.4 has 14.2 for I/O Database Reads Average Latency.
2/18/2014 2:35:18 PM -- Instance3320.4 has 1.2 for I/O Log Writes Average Latency.
2/18/2014 2:35:18 PM -- Instance3320.4 has 1.2 for I/O Log Reads Average Latency.
2/18/2014 2:35:18 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.
2/18/2014 2:35:18 PM -- The test has 0 Database Page Fault Stalls/sec samples higher than 0.
2/18/2014 2:35:18 PM -- C:\Program Files\Exchange Jetstress\Performance_2014_2_18_12_30_46.xml has 478 samples queried.



A.3 Server 2 – JS13

Table 14 Test summary

Overall Test Result	Pass
Machine Name	JS13
Test Description	2500 users/server 4 servers 1GB mailboxes .10 IOPS/user .12 IOPS tested 4 dbs per server 750GB db/log combined volumes 2 copies 5 threads/db
Test Start Time	2/18/2014 12:30:29 PM
Test End Time	2/18/2014 2:35:13 PM
Collection Start Time	2/18/2014 12:34:38 PM
Collection End Time	2/18/2014 2:34:25 PM
Jetstress Version	15.00.0658.004
ESE Version	15.00.0712.008
Operating System	Windows Server 2008 R2 Enterprise Service Pack 1 (6.1.7601.65536)
Performance Log	C:\Program Files\Exchange Jetstress\Performance_2014_2_18_12_30_38.blg



Table 15 Database sizing and throughput

Performance counter	Value
Achieved Transactional I/O per Second	301.03
Target Transactional I/O per Second	300
Initial Database Size (bytes)	2720876724224
Final Database Size (bytes)	2721690419200
Database Files (Count)	4

Table 16 Jetstress system parameters

Performance counter	Value
Thread Count	5
Minimum Database Cache	128.0 MB
Maximum Database Cache	1024.0 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



Table 17 Database configuration

Performance counter	Value
Instance3944.1	Log path: C:\DB\DB1 Database: C:\DB\DB1\Jetstress001001.edb
Instance3944.2	Log path: C:\DB\DB2 Database: C:\DB\DB2\Jetstress002001.edb
Instance3944.3	Log path: C:\DB\DB3 Database: C:\DB\DB3\Jetstress003001.edb
Instance3944.4	Log path: C:\DB\DB4 Database: C:\DB\DB4\Jetstress004001.edb

Table 18 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
Instance3944.1	14.712	1.910	49.752	25.481	32995.397	35220.981	0.000	1.246	0.000	5.889	0.000	20223.000
Instance3944.2	12.913	1.921	49.677	25.533	32999.368	35251.642	0.000	1.234	0.000	5.929	0.000	20430.068
Instance3944.3	14.381	1.874	49.692	25.600	32999.482	35257.632	0.000	1.220	0.000	5.881	0.000	20531.142
Instance3944.4	14.659	1.867	49.765	25.530	32985.660	35203.550	0.000	1.238	0.000	5.910	0.000	20182.287



Table 19 Background Database Maintenance I/O performance

MSExchange Database ==> Instances	Database Maintenance IO Reads/sec	Database Maintenance IO Reads Average Bytes
Instance3944.1	8.616	261544.020
Instance3944.2	8.935	261431.855
Instance3944.3	8.474	261454.003
Instance3944.4	8.601	261547.956

Table 20 Log Replication I/O performance

MSExchange Database ==> Instances	I/O Log Reads/sec	I/O Log Reads Average Bytes
Instance3944.1	0.509	193737.134
Instance3944.2	0.518	197449.840
Instance3944.3	0.514	197572.697
Instance3944.4	0.509	195032.928

Table 21 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
Instance3944.1	14.712	1.910	58.368	25.481	66733.676	35220.981	10.196	1.246	0.509	5.889	193737.134	20223.000
Instance3944.2	12.913	1.921	58.612	25.533	67821.209	35251.642	9.332	1.234	0.518	5.929	197449.840	20430.068
Instance3944.3	14.381	1.874	58.167	25.600	66283.439	35257.632	9.580	1.220	0.514	5.881	197572.697	20531.142
Instance3944.4	14.659	1.867	58.366	25.530	66668.885	35203.550	10.534	1.238	0.509	5.910	195032.928	20182.287



Table 22 Host system performance

Counter	Average	Minimum	Maximum
% Processor Time	0.395	0.000	2.325
Available MBytes	60547.697	60540.000	60615.000
Free System Page Table Entries	33555162.054	33555160.000	33555164.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	70443478.313	70344704.000	70615040.000
Pool Paged Bytes	222423155.441	222412800.000	222515200.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

A.4 Test log

2/18/2014 12:30:29 PM -- Preparing for testing ...
 2/18/2014 12:30:34 PM -- Attaching databases ...
 2/18/2014 12:30:34 PM -- Preparations for testing are complete.
 2/18/2014 12:30:34 PM -- Starting transaction dispatch ..
 2/18/2014 12:30:34 PM -- Database cache settings: (minimum: 128.0 MB, maximum: 1.0 GB)
 2/18/2014 12:30:34 PM -- Database flush thresholds: (start: 10.2 MB, stop: 20.5 MB)
 2/18/2014 12:30:38 PM -- Database read latency thresholds: (average: 20 msec/read, maximum: 100 msec/read).
 2/18/2014 12:30:38 PM -- Log write latency thresholds: (average: 10 msec/write, maximum: 100 msec/write).
 2/18/2014 12:30:44 PM -- Operation mix: Sessions 5, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
 2/18/2014 12:30:44 PM -- Performance logging started (interval: 15000 ms).
 2/18/2014 12:30:44 PM -- Attaining prerequisites:
 2/18/2014 12:34:38 PM -- \MSEExchange Database(JetstressWin)\Database Cache Size, Last: 969060400.0 (lower bound: 966367600.0, upper bound: none)



2/18/2014 2:34:39 PM -- Performance logging has ended.
2/18/2014 2:35:03 PM -- JetInterop batch transaction stats: 14415, 14415, 14415 and 14415.
2/18/2014 2:35:03 PM -- Dispatching transactions ends.
2/18/2014 2:35:03 PM -- Shutting down databases ...
2/18/2014 2:35:13 PM -- Instance3944.1 (complete), Instance3944.2 (complete), Instance3944.3 (complete) and Instance3944.4 (complete)
2/18/2014 2:35:13 PM -- [C:\Program Files\Exchange Jetstress\Performance_2014_2_18_12_30_38.blg](#) has 494 samples.
2/18/2014 2:35:13 PM -- Creating test report ...
2/18/2014 2:35:16 PM -- Instance3944.1 has 14.7 for I/O Database Reads Average Latency.
2/18/2014 2:35:16 PM -- Instance3944.1 has 1.2 for I/O Log Writes Average Latency.
2/18/2014 2:35:16 PM -- Instance3944.1 has 1.2 for I/O Log Reads Average Latency.
2/18/2014 2:35:16 PM -- Instance3944.2 has 12.9 for I/O Database Reads Average Latency.
2/18/2014 2:35:16 PM -- Instance3944.2 has 1.2 for I/O Log Writes Average Latency.
2/18/2014 2:35:16 PM -- Instance3944.2 has 1.2 for I/O Log Reads Average Latency.
2/18/2014 2:35:16 PM -- Instance3944.3 has 14.4 for I/O Database Reads Average Latency.
2/18/2014 2:35:16 PM -- Instance3944.3 has 1.2 for I/O Log Writes Average Latency.
2/18/2014 2:35:16 PM -- Instance3944.3 has 1.2 for I/O Log Reads Average Latency.
2/18/2014 2:35:16 PM -- Instance3944.4 has 14.7 for I/O Database Reads Average Latency.
2/18/2014 2:35:16 PM -- Instance3944.4 has 1.2 for I/O Log Writes Average Latency.
2/18/2014 2:35:16 PM -- Instance3944.4 has 1.2 for I/O Log Reads Average Latency.
2/18/2014 2:35:16 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.
2/18/2014 2:35:16 PM -- The test has 0 Database Page Fault Stalls/sec samples higher than 0.
2/18/2014 2:35:16 PM -- [C:\Program Files\Exchange Jetstress\Performance_2014_2_18_12_30_38.xml](#) has 478 samples queried.



A.5 Server 3 – JS14

Table 23 Test summary

Overall Test Result	Pass
Machine Name	JS14
Test Description	2500 users/server 4 servers 1GB mailboxes .10 IOPS/user .12 IOPS tested 4 dbs per server 750GB db/log combined volumes 2 copies 5 threads/db
Test Start Time	2/18/2014 12:30:40 PM
Test End Time	2/18/2014 2:35:02 PM
Collection Start Time	2/18/2014 12:34:37 PM
Collection End Time	2/18/2014 2:34:36 PM
Jetstress Version	15.00.0658.004
ESE Version	15.00.0712.008
Operating System	Windows Server 2008 R2 Enterprise Service Pack 1 (6.1.7601.65536)
Performance Log	C:\Program Files\Exchange Jetstress\Performance_2014_2_18_12_30_49.blg



Table 24 Database sizing and throughput

Performance counter	Value
Achieved Transactional I/O per Second	325.576
Target Transactional I/O per Second	300
Initial Database Size (bytes)	2724383162368
Final Database Size (bytes)	2725255577600
Database Files (Count)	4

Table 25 Jetstress system parameters

Performance counter	Value
Thread Count	5
Minimum Database Cache	128.0 MB
Maximum Database Cache	1024.0 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



Table 26 Database configuration

Performance counter	Value
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
Instance3088.3	Log path: C:\DB\DB3 Database: C:\DB\DB3\Jetstress003001.edb
Instance3088.4	Log path: C:\DB\DB4 Database: C:\DB\DB4\Jetstress004001.edb

Table 27 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	13.143	2.135	53.771	27.680	32927.099	35238.699	0.000	1.236	0.000	6.411	0.000	20308.494
Instance3088.2	13.681	2.082	53.729	27.325	32953.609	35226.227	0.000	1.210	0.000	6.302	0.000	20347.782
Instance3088.3	14.463	2.006	54.183	27.983	32954.115	35130.851	0.000	1.179	0.000	6.414	0.000	20046.866
Instance3088.4	14.223	2.007	53.484	27.421	32974.592	35249.779	0.000	1.192	0.000	6.390	0.000	20433.124



Table 28 Background Database Maintenance I/O performance

MSEExchange Database ==> Instances	Database Maintenance IO Reads/sec	Database Maintenance IO Reads Average Bytes
Instance3088.1	8.792	261607.650
Instance3088.2	8.565	261601.038
Instance3088.3	8.286	261547.815
Instance3088.4	8.398	261560.314

Table 29 Log Replication I/O performance

MSEExchange Database ==> Instances	I/O Log Reads/sec	I/O Log Reads Average Bytes
Instance3088.1	0.555	208688.002
Instance3088.2	0.547	205894.342
Instance3088.3	0.548	205372.927
Instance3088.4	0.557	212974.387

Table 30 Total I/O performance

MSEExchange 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	13.143	2.135	62.564	27.680	65064.451	35238.699	9.796	1.236	0.555	6.411	208688.002	20308.494
Instance3088.2	13.681	2.082	62.294	27.325	64389.411	35226.227	10.028	1.210	0.547	6.302	205894.342	20347.782
Instance3088.3	14.463	2.006	62.469	27.983	63276.378	35130.851	9.664	1.179	0.548	6.414	205372.927	20046.866
Instance3088.4	14.223	2.007	61.882	27.421	63995.905	35249.779	10.330	1.192	0.557	6.390	212974.387	20433.124



Table 31 Host system performance

Counter	Average	Minimum	Maximum
% Processor Time	0.417	0.000	2.286
Available MBytes	60536.340	60529.000	60621.000
Free System Page Table Entries	33555162.033	33555161.000	33555164.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	70164087.467	70135808.000	70209536.000
Pool Paged Bytes	220748578.133	220516352.000	221114368.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

A.6 Test log

2/18/2014 12:30:40 PM -- Preparing for testing ...
 2/18/2014 12:30:44 PM -- Attaching databases ...
 2/18/2014 12:30:44 PM -- Preparations for testing are complete.
 2/18/2014 12:30:44 PM -- Starting transaction dispatch ..
 2/18/2014 12:30:44 PM -- Database cache settings: (minimum: 128.0 MB, maximum: 1.0 GB)
 2/18/2014 12:30:44 PM -- Database flush thresholds: (start: 10.2 MB, stop: 20.5 MB)
 2/18/2014 12:30:49 PM -- Database read latency thresholds: (average: 20 msec/read, maximum: 100 msec/read).
 2/18/2014 12:30:49 PM -- Log write latency thresholds: (average: 10 msec/write, maximum: 100 msec/write).
 2/18/2014 12:30:54 PM -- Operation mix: Sessions 5, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
 2/18/2014 12:30:54 PM -- Performance logging started (interval: 15000 ms).
 2/18/2014 12:30:54 PM -- Attaining prerequisites:
 2/18/2014 12:34:37 PM -- \MSEExchange Database(JetstressWin)\Database Cache Size, Last: 970264600.0 (lower bound: 966367600.0, upper bound: none)
 2/18/2014 2:34:38 PM -- Performance logging has ended.



2/18/2014 2:34:59 PM -- JetInterop batch transaction stats: 15552, 15551, 15551 and 15551.
2/18/2014 2:34:59 PM -- Dispatching transactions ends.
2/18/2014 2:35:00 PM -- Shutting down databases ...
2/18/2014 2:35:02 PM -- Instance3088.1 (complete), Instance3088.2 (complete), Instance3088.3 (complete) and Instance3088.4 (complete)
2/18/2014 2:35:02 PM -- [C:\Program Files\Exchange Jetstress\Performance_2014_2_18_12_30_49.blg](#) has 494 samples.
2/18/2014 2:35:02 PM -- Creating test report ...
2/18/2014 2:35:05 PM -- Instance3088.1 has 13.1 for I/O Database Reads Average Latency.
2/18/2014 2:35:05 PM -- Instance3088.1 has 1.2 for I/O Log Writes Average Latency.
2/18/2014 2:35:05 PM -- Instance3088.1 has 1.2 for I/O Log Reads Average Latency.
2/18/2014 2:35:05 PM -- Instance3088.2 has 13.7 for I/O Database Reads Average Latency.
2/18/2014 2:35:05 PM -- Instance3088.2 has 1.2 for I/O Log Writes Average Latency.
2/18/2014 2:35:05 PM -- Instance3088.2 has 1.2 for I/O Log Reads Average Latency.
2/18/2014 2:35:05 PM -- Instance3088.3 has 14.5 for I/O Database Reads Average Latency.
2/18/2014 2:35:05 PM -- Instance3088.3 has 1.2 for I/O Log Writes Average Latency.
2/18/2014 2:35:05 PM -- Instance3088.3 has 1.2 for I/O Log Reads Average Latency.
2/18/2014 2:35:05 PM -- Instance3088.4 has 14.2 for I/O Database Reads Average Latency.
2/18/2014 2:35:05 PM -- Instance3088.4 has 1.2 for I/O Log Writes Average Latency.
2/18/2014 2:35:05 PM -- Instance3088.4 has 1.2 for I/O Log Reads Average Latency.
2/18/2014 2:35:05 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.
2/18/2014 2:35:05 PM -- The test has 0 Database Page Fault Stalls/sec samples higher than 0.
2/18/2014 2:35:05 PM -- [C:\Program Files\Exchange Jetstress\Performance_2014_2_18_12_30_49.xml](#) has 479 samples queried.



A.7 Server 4 – JS15

Table 32 Test summary

Overall Test Result	Pass
Machine Name	JS15
Test Description	2500 users/server 4 servers 1GB mailboxes .10 IOPS/user .12 IOPS tested 4 dbs per server 750GB db/log combined volumes 2 copies 5 threads/db
Test Start Time	2/18/2014 12:30:42 PM
Test End Time	2/18/2014 2:34:55 PM
Collection Start Time	2/18/2014 12:34:49 PM
Collection End Time	2/18/2014 2:34:37 PM
Jetstress Version	15.00.0658.004
ESE Version	15.00.0712.008
Operating System	Windows Server 2008 R2 Enterprise Service Pack 1 (6.1.7601.65536)
Performance Log	C:\Program Files\Exchange Jetstress\Performance_2014_2_18_12_30_51.blg



Table 33 Database sizing and throughput

Performance counter	Value
Achieved Transactional I/O per Second	317.749
Target Transactional I/O per Second	300
Initial Database Size (bytes)	2724752261120
Final Database Size (bytes)	2725616287744
Database Files (Count)	4

Table 34 Jetstress system parameters

Performance counter	Value
Thread Count	5
Minimum Database Cache	128.0 MB
Maximum Database Cache	1024.0 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



Table 35 Database configuration

Performance counter	Value
Instance2528.1	Log path: C:\DB\DB1 Database: C:\DB\DB1\Jetstress001001.edb
Instance2528.2	Log path: C:\DB\DB2 Database: C:\DB\DB2\Jetstress002001.edb
Instance2528.3	Log path: C:\DB\DB3 Database: C:\DB\DB3\Jetstress003001.edb
Instance2528.4	Log path: C:\DB\DB4 Database: C:\DB\DB4\Jetstress004001.edb

Table 36 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
Instance2528.1	14.639	2.088	52.260	26.837	32992.571	35184.370	0.000	1.246	0.000	6.185	0.000	20255.552
Instance2528.2	14.153	2.108	52.396	27.157	32975.356	35216.277	0.000	1.209	0.000	6.289	0.000	20223.388
Instance2528.3	14.136	2.015	52.607	27.253	32965.398	35201.207	0.000	1.197	0.000	6.263	0.000	20255.804
Instance2528.4	14.944	1.976	52.201	27.038	32964.858	35176.111	0.000	1.185	0.000	6.296	0.000	20162.526



Table 37 Background Database Maintenance I/O performance

MSExchange Database ==> Instances	Database Maintenance IO Reads/sec	Database Maintenance IO Reads Average Bytes
Instance2528.1	8.536	261495.964
Instance2528.2	8.393	261628.053
Instance2528.3	8.402	261641.695
Instance2528.4	8.390	261351.087

Table 38 Log Replication I/O performance

MSExchange Database ==> Instances	I/O Log Reads/sec	I/O Log Reads Average Bytes
Instance2528.1	0.534	202866.111
Instance2528.2	0.543	206994.490
Instance2528.3	0.541	202382.246
Instance2528.4	0.541	204179.629

Table 39 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
Instance2528.1	14.639	2.088	60.796	26.837	65075.949	35184.370	10.319	1.246	0.534	6.185	202866.111	20255.552
Instance2528.2	14.153	2.108	60.789	27.157	64545.781	35216.277	10.307	1.209	0.543	6.289	206994.490	20223.388
Instance2528.3	14.136	2.015	61.009	27.253	64458.019	35201.207	10.301	1.197	0.541	6.263	202382.246	20255.804
Instance2528.4	14.944	1.976	60.591	27.038	64589.564	35176.111	9.732	1.185	0.541	6.296	204179.629	20162.526



Table 40 Host system performance

Counter	Average	Minimum	Maximum
% Processor Time	0.409	0.000	2.523
Available MBytes	60707.347	60698.000	60762.000
Free System Page Table Entries	33555163.511	33555160.000	33555674.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	67266051.207	67227648.000	67354624.000
Pool Paged Bytes	154647643.925	153878528.000	155066368.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

A.8 Test log

2/18/2014 12:30:42 PM -- Preparing for testing ...
 2/18/2014 12:30:47 PM -- Attaching databases ...
 2/18/2014 12:30:47 PM -- Preparations for testing are complete.
 2/18/2014 12:30:47 PM -- Starting transaction dispatch ..
 2/18/2014 12:30:47 PM -- Database cache settings: (minimum: 128.0 MB, maximum: 1.0 GB)
 2/18/2014 12:30:47 PM -- Database flush thresholds: (start: 10.2 MB, stop: 20.5 MB)
 2/18/2014 12:30:51 PM -- Database read latency thresholds: (average: 20 msec/read, maximum: 100 msec/read).
 2/18/2014 12:30:51 PM -- Log write latency thresholds: (average: 10 msec/write, maximum: 100 msec/write).
 2/18/2014 12:30:55 PM -- Operation mix: Sessions 5, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
 2/18/2014 12:30:55 PM -- Performance logging started (interval: 15000 ms).
 2/18/2014 12:30:55 PM -- Attaining prerequisites:
 2/18/2014 12:34:49 PM -- \MSEExchange Database(JetstressWin)\Database Cache Size, Last: 972345300.0 (lower bound: 966367600.0, upper bound: none)



2/18/2014 2:34:49 PM -- Performance logging has ended.
2/18/2014 2:34:54 PM -- JetInterop batch transaction stats: 15119, 15118, 15118 and 15118.
2/18/2014 2:34:54 PM -- Dispatching transactions ends.
2/18/2014 2:34:55 PM -- Shutting down databases ...
2/18/2014 2:34:55 PM -- Instance2528.1 (complete), Instance2528.2 (complete), Instance2528.3 (complete) and Instance2528.4 (complete)
2/18/2014 2:34:55 PM -- [C:\Program Files\Exchange Jetstress\Performance_2014_2_18_12_30_51.blg](#) has 494 samples.
2/18/2014 2:34:55 PM -- Creating test report ...
2/18/2014 2:34:59 PM -- Instance2528.1 has 14.6 for I/O Database Reads Average Latency.
2/18/2014 2:34:59 PM -- Instance2528.1 has 1.2 for I/O Log Writes Average Latency.
2/18/2014 2:34:59 PM -- Instance2528.1 has 1.2 for I/O Log Reads Average Latency.
2/18/2014 2:34:59 PM -- Instance2528.2 has 14.2 for I/O Database Reads Average Latency.
2/18/2014 2:34:59 PM -- Instance2528.2 has 1.2 for I/O Log Writes Average Latency.
2/18/2014 2:34:59 PM -- Instance2528.2 has 1.2 for I/O Log Reads Average Latency.
2/18/2014 2:34:59 PM -- Instance2528.3 has 14.1 for I/O Database Reads Average Latency.
2/18/2014 2:34:59 PM -- Instance2528.3 has 1.2 for I/O Log Writes Average Latency.
2/18/2014 2:34:59 PM -- Instance2528.3 has 1.2 for I/O Log Reads Average Latency.
2/18/2014 2:34:59 PM -- Instance2528.4 has 14.9 for I/O Database Reads Average Latency.
2/18/2014 2:34:59 PM -- Instance2528.4 has 1.2 for I/O Log Writes Average Latency.
2/18/2014 2:34:59 PM -- Instance2528.4 has 1.2 for I/O Log Reads Average Latency.
2/18/2014 2:34:59 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.
2/18/2014 2:34:59 PM -- The test has 0 Database Page Fault Stalls/sec samples higher than 0.
2/18/2014 2:34:59 PM -- [C:\Program Files\Exchange Jetstress\Performance_2014_2_18_12_30_51.xml](#) has 478 samples queried.



B Stress testing

B.1 Server 1 – JS12

Table 41 Test summary

Overall Test Result	Pass
Machine Name	JS12
Test Description	2500 users/server 4 servers 1GB mailboxes .10 IOPS/user .12 IOPS tested 4 dbs per server 750GB db/log combined volumes 2 copies 5 threads/db
Test Start Time	2/19/2014 8:46:38 AM
Test End Time	2/20/2014 9:02:14 AM
Collection Start Time	2/19/2014 8:50:42 AM
Collection End Time	2/20/2014 8:50:37 AM
Jetstress Version	15.00.0658.004
ESE Version	15.00.0712.008
Operating System	Windows Server 2008 R2 Enterprise Service Pack 1 (6.1.7601.65536)
Performance Log	C:\Program Files\Exchange Jetstress\Stress_2014_2_19_8_46_47.blg



Table 42 Database sizing and throughput

Performance Counter	Value
Achieved Transactional I/O per Second	318.542
Target Transactional I/O per Second	300
Initial Database Size (bytes)	2724081172480
Final Database Size (bytes)	2734155890688
Database Files (Count)	4

Table 43 Jetstress system parameters

Performance Counter	Value
Thread Count	5
Minimum Database Cache	128.0 MB
Maximum Database Cache	1024.0 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



Table 44 Database configuration

Performance Counter	Value
Instance3320.1	Log path: C:\DB\DB1 Database: C:\DB\DB1\Jetstress001001.edb
Instance3320.2	Log path: C:\DB\DB2 Database: C:\DB\DB2\Jetstress002001.edb
Instance3320.3	Log path: C:\DB\DB3 Database: C:\DB\DB3\Jetstress003001.edb
Instance3320.4	Log path: C:\DB\DB4 Database: C:\DB\DB4\Jetstress004001.edb

Table 45 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
Instance3320.1	15.332	1.864	52.521	27.015	32946.325	35177.052	0.000	1.214	0.000	6.241	0.000	20302.881
Instance3320.2	14.545	1.859	52.528	27.085	32949.120	35192.539	0.000	1.213	0.000	6.249	0.000	20353.910
Instance3320.3	14.285	1.794	52.542	27.186	32954.440	35185.410	0.000	1.208	0.000	6.269	0.000	20364.604
Instance3320.4	14.264	1.746	52.531	27.134	32954.620	35197.977	0.000	1.201	0.000	6.270	0.000	20353.176



Table 46 Background Database Maintenance I/O performance

MSEExchange Database ==> Instances	Database Maintenance IO Reads/sec	Database Maintenance IO Reads Average Bytes
Instance3320.1	8.408	261537.987
Instance3320.2	8.318	261576.773
Instance3320.3	8.381	261529.139
Instance3320.4	8.390	261533.996

Table 47 Log replication I/O performance

MSEExchange Database ==> Instances	I/O Log Reads/sec	I/O Log Reads Average Bytes
Instance3320.1	0.541	204487.959
Instance3320.2	0.542	204395.397
Instance3320.3	0.545	206389.628
Instance3320.4	0.544	206396.098

Table 48 Total I/O performance

MSEExchange 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
Instance3320.1	15.332	1.864	60.928	27.015	64490.039	35177.052	9.981	1.214	0.541	6.241	204487.959	20302.881
Instance3320.2	14.545	1.859	60.845	27.085	64203.875	35192.539	10.675	1.213	0.542	6.249	204395.397	20353.910
Instance3320.3	14.285	1.794	60.923	27.186	64397.592	35185.410	10.928	1.208	0.545	6.269	206389.628	20364.604
Instance3320.4	14.264	1.746	60.920	27.134	64433.625	35197.977	10.252	1.201	0.544	6.270	206396.098	20353.176



Table 49 Host system performance

Counter	Average	Minimum	Maximum
% Processor Time	0.407	0.000	2.860
Available MBytes	60680.188	60662.000	60716.000
Free System Page Table Entries	33555670.177	33555666.000	33555672.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	68115571.914	68079616.000	68222976.000
Pool Paged Bytes	154719175.912	153763840.000	159690752.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

B.2 Test log

2/19/2014 8:46:38 AM -- Preparing for testing ...
 2/19/2014 8:46:43 AM -- Attaching databases ...
 2/19/2014 8:46:43 AM -- Preparations for testing are complete.
 2/19/2014 8:46:43 AM -- Starting transaction dispatch ..
 2/19/2014 8:46:43 AM -- Database cache settings: (minimum: 128.0 MB, maximum: 1.0 GB)
 2/19/2014 8:46:43 AM -- Database flush thresholds: (start: 10.2 MB, stop: 20.5 MB)
 2/19/2014 8:46:47 AM -- Database read latency thresholds: (average: 20 msec/read, maximum: 200 msec/read).
 2/19/2014 8:46:47 AM -- Log write latency thresholds: (average: 10 msec/write, maximum: 200 msec/write).
 2/19/2014 8:46:52 AM -- Operation mix: Sessions 5, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
 2/19/2014 8:46:52 AM -- Performance logging started (interval: 15000 ms).
 2/19/2014 8:46:52 AM -- Attaining prerequisites:
 2/19/2014 8:50:42 AM -- \MSExchange Database(JetstressWin)\Database Cache Size, Last: 972906500.0 (lower bound: 966367600.0, upper bound: none)
 2/20/2014 8:50:43 AM -- Performance logging has ended.



2/20/2014 9:02:10 AM -- JetInterop batch transaction stats: 177906, 177906, 177906 and 177905.
2/20/2014 9:02:10 AM -- Dispatching transactions ends.
2/20/2014 9:02:11 AM -- Shutting down databases ...
2/20/2014 9:02:14 AM -- Instance3320.1 (complete), Instance3320.2 (complete), Instance3320.3 (complete) and Instance3320.4 (complete)
2/20/2014 9:02:14 AM -- C:\Program Files\Exchange Jetstress\Stress_2014_2_19_8_46_47.blg has 5766 samples.
2/20/2014 9:02:14 AM -- Creating test report ...
2/20/2014 9:02:37 AM -- Instance3320.1 has 15.3 for I/O Database Reads Average Latency.
2/20/2014 9:02:37 AM -- Instance3320.1 has 1.2 for I/O Log Writes Average Latency.
2/20/2014 9:02:37 AM -- Instance3320.1 has 1.2 for I/O Log Reads Average Latency.
2/20/2014 9:02:37 AM -- Instance3320.2 has 14.5 for I/O Database Reads Average Latency.
2/20/2014 9:02:37 AM -- Instance3320.2 has 1.2 for I/O Log Writes Average Latency.
2/20/2014 9:02:37 AM -- Instance3320.2 has 1.2 for I/O Log Reads Average Latency.
2/20/2014 9:02:37 AM -- Instance3320.3 has 14.3 for I/O Database Reads Average Latency.
2/20/2014 9:02:37 AM -- Instance3320.3 has 1.2 for I/O Log Writes Average Latency.
2/20/2014 9:02:37 AM -- Instance3320.3 has 1.2 for I/O Log Reads Average Latency.
2/20/2014 9:02:37 AM -- Instance3320.4 has 14.3 for I/O Database Reads Average Latency.
2/20/2014 9:02:37 AM -- Instance3320.4 has 1.2 for I/O Log Writes Average Latency.
2/20/2014 9:02:37 AM -- Instance3320.4 has 1.2 for I/O Log Reads Average Latency.
2/20/2014 9:02:37 AM -- Test has 0 Maximum Database Page Fault Stalls/sec.
2/20/2014 9:02:37 AM -- The test has 0 Database Page Fault Stalls/sec samples higher than 0.
2/20/2014 9:02:37 AM -- C:\Program Files\Exchange Jetstress\Stress_2014_2_19_8_46_47.xml has 5750 samples queried.



B.3 Server 2 – JS13

Test Summary

Overall Test Result	Pass
Machine Name	JS13
Test Description	2500 users/server 4 servers 1GB mailboxes .10 IOPS/user .12 IOPS tested 4 dbs per server 750GB db/log combined volumes 2 copies 5 threads/db
Test Start Time	2/19/2014 8:46:27 AM
Test End Time	2/20/2014 9:02:06 AM
Collection Start Time	2/19/2014 8:50:27 AM
Collection End Time	2/20/2014 8:50:25 AM
Jetstress Version	15.00.0658.004
ESE Version	15.00.0712.008
Operating System	Windows Server 2008 R2 Enterprise Service Pack 1 (6.1.7601.65536)
Performance Log	C:\Program Files\Exchange Jetstress\Stress_2014_2_19_8_46_36.blg



Database Sizing and Throughput

Performance Counter	Value
Achieved Transactional I/O per Second	300.436
Target Transactional I/O per Second	300
Initial Database Size (bytes)	2721690419200
Final Database Size (bytes)	2731194712064
Database Files (Count)	4

Jetstress System Parameters

Performance Counter	Value
Thread Count	5
Minimum Database Cache	128.0 MB
Maximum Database Cache	1024.0 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



Table 50 Database configuration

Performance Counter	Value
Instance3944.1	Log path: C:\DB\DB1 Database: C:\DB\DB1\Jetstress001001.edb
Instance3944.2	Log path: C:\DB\DB2 Database: C:\DB\DB2\Jetstress002001.edb
Instance3944.3	Log path: C:\DB\DB3 Database: C:\DB\DB3\Jetstress003001.edb
Instance3944.4	Log path: C:\DB\DB4 Database: C:\DB\DB4\Jetstress004001.edb

Table 51 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
Instance3944.1	15.506	1.940	49.601	25.624	32966.627	35195.313	0.000	1.226	0.000	5.919	0.000	20344.132
Instance3944.2	14.823	1.937	49.542	25.588	32971.800	35208.008	0.000	1.225	0.000	5.914	0.000	20388.950
Instance3944.3	14.957	1.886	49.546	25.529	32967.896	35217.216	0.000	1.205	0.000	5.910	0.000	20342.511
Instance3944.4	15.945	1.882	49.519	25.486	32961.198	35212.751	0.000	1.231	0.000	5.888	0.000	20356.322



Table 52 Background Database Maintenance I/O performance

MSEExchange Database ==> Instances	Database Maintenance IO Reads/sec	Database Maintenance IO Reads Average Bytes
Instance3944.1	8.409	261536.245
Instance3944.2	8.354	261560.345
Instance3944.3	8.322	261535.140
Instance3944.4	8.208	261531.769

Table 53 Log Replication I/O performance

MSEExchange Database ==> Instances	I/O Log Reads/sec	I/O Log Reads Average Bytes
Instance3944.1	0.513	196946.222
Instance3944.2	0.514	197000.527
Instance3944.3	0.513	196570.353
Instance3944.4	0.511	195361.301

Table 54 Total I/O performance

MSEExchange 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
Instance3944.1	15.506	1.940	58.010	25.624	66098.764	35195.313	9.903	1.226	0.513	5.919	196946.222	20344.132
Instance3944.2	14.823	1.937	57.897	25.588	65957.104	35208.008	9.567	1.225	0.514	5.914	197000.527	20388.950
Instance3944.3	14.957	1.886	57.868	25.529	65837.095	35217.216	9.121	1.205	0.513	5.910	196570.353	20342.511
Instance3944.4	15.945	1.882	57.728	25.486	65462.222	35212.751	9.190	1.231	0.511	5.888	195361.301	20356.322



Table 55 Host system performance

Counter	Average	Minimum	Maximum
% Processor Time	0.405	0.000	2.730
Available MBytes	60538.174	60518.000	60576.000
Free System Page Table Entries	33555158.040	33555151.000	33555160.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	70524533.428	70463488.000	70688768.000
Pool Paged Bytes	221289791.611	219844608.000	225656832.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

B.4 Test log

2/19/2014 8:46:27 AM -- Preparing for testing ...
 2/19/2014 8:46:31 AM -- Attaching databases ...
 2/19/2014 8:46:31 AM -- Preparations for testing are complete.
 2/19/2014 8:46:31 AM -- Starting transaction dispatch ..
 2/19/2014 8:46:31 AM -- Database cache settings: (minimum: 128.0 MB, maximum: 1.0 GB)
 2/19/2014 8:46:31 AM -- Database flush thresholds: (start: 10.2 MB, stop: 20.5 MB)
 2/19/2014 8:46:36 AM -- Database read latency thresholds: (average: 20 msec/read, maximum: 200 msec/read).
 2/19/2014 8:46:36 AM -- Log write latency thresholds: (average: 10 msec/write, maximum: 200 msec/write).
 2/19/2014 8:46:41 AM -- Operation mix: Sessions 5, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
 2/19/2014 8:46:41 AM -- Performance logging started (interval: 15000 ms).
 2/19/2014 8:46:41 AM -- Attaining prerequisites:
 2/19/2014 8:50:27 AM -- \MSExchange Database(JetstressWin)\Database Cache Size, Last: 966643700.0 (lower bound: 966367600.0, upper bound: none)



2/20/2014 8:50:28 AM -- Performance logging has ended.
2/20/2014 9:02:04 AM -- JetInterop batch transaction stats: 167765, 167764, 167764 and 167764.
2/20/2014 9:02:04 AM -- Dispatching transactions ends.
2/20/2014 9:02:05 AM -- Shutting down databases ...
2/20/2014 9:02:06 AM -- Instance3944.1 (complete), Instance3944.2 (complete), Instance3944.3 (complete) and Instance3944.4 (complete)
2/20/2014 9:02:06 AM -- [C:\Program Files\Exchange Jetstress\Stress_2014_2_19_8_46_36.blg](#) has 5766 samples.
2/20/2014 9:02:06 AM -- Creating test report ...
2/20/2014 9:02:29 AM -- Instance3944.1 has 15.5 for I/O Database Reads Average Latency.
2/20/2014 9:02:29 AM -- Instance3944.1 has 1.2 for I/O Log Writes Average Latency.
2/20/2014 9:02:29 AM -- Instance3944.1 has 1.2 for I/O Log Reads Average Latency.
2/20/2014 9:02:29 AM -- Instance3944.2 has 14.8 for I/O Database Reads Average Latency.
2/20/2014 9:02:29 AM -- Instance3944.2 has 1.2 for I/O Log Writes Average Latency.
2/20/2014 9:02:29 AM -- Instance3944.2 has 1.2 for I/O Log Reads Average Latency.
2/20/2014 9:02:29 AM -- Instance3944.3 has 15.0 for I/O Database Reads Average Latency.
2/20/2014 9:02:29 AM -- Instance3944.3 has 1.2 for I/O Log Writes Average Latency.
2/20/2014 9:02:29 AM -- Instance3944.3 has 1.2 for I/O Log Reads Average Latency.
2/20/2014 9:02:29 AM -- Instance3944.4 has 15.9 for I/O Database Reads Average Latency.
2/20/2014 9:02:29 AM -- Instance3944.4 has 1.2 for I/O Log Writes Average Latency.
2/20/2014 9:02:29 AM -- Instance3944.4 has 1.2 for I/O Log Reads Average Latency.
2/20/2014 9:02:29 AM -- Test has 0 Maximum Database Page Fault Stalls/sec.
2/20/2014 9:02:29 AM -- The test has 0 Database Page Fault Stalls/sec samples higher than 0.
2/20/2014 9:02:29 AM -- [C:\Program Files\Exchange Jetstress\Stress_2014_2_19_8_46_36.xml](#) has 5750 samples queried.



B.5 Server 3 – JS14

Test Summary

Overall Test Result	Pass
Machine Name	JS14
Test Description	2500 users/server 4 servers 1GB mailboxes .10 IOPS/user .12 IOPS tested 4 dbs per server 750GB db/log combined volumes 2 copies 5 threads/db
Test Start Time	2/19/2014 8:46:36 AM
Test End Time	2/20/2014 9:01:57 AM
Collection Start Time	2/19/2014 8:50:26 AM
Collection End Time	2/20/2014 8:50:20 AM
Jetstress Version	15.00.0658.004
ESE Version	15.00.0712.008
Operating System	Windows Server 2008 R2 Enterprise Service Pack 1 (6.1.7601.65536)
Performance Log	C:\Program Files\Exchange Jetstress\Stress_2014_2_19_8_46_46.blg



Table 56 Database sizing and throughput

Performance Counter	Value
Achieved Transactional I/O per Second	324.587
Target Transactional I/O per Second	300
Initial Database Size (bytes)	2725255577600
Final Database Size (bytes)	2735548399616
Database Files (Count)	4

Table 57 Jetstress system parameters

Performance Counter	Value
Thread Count	5
Minimum Database Cache	128.0 MB
Maximum Database Cache	1024.0 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



Table 58 Database configuration

Performance Counter	Value
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
Instance3088.3	Log path: C:\DB\DB3 Database: C:\DB\DB3\Jetstress003001.edb
Instance3088.4	Log path: C:\DB\DB4 Database: C:\DB\DB4\Jetstress004001.edb

Table 59 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	14.059	2.079	53.465	27.583	32939.565	35207.668	0.000	1.192	0.000	6.370	0.000	20426.543
Instance3088.2	14.452	2.069	53.520	27.582	32944.518	35189.537	0.000	1.190	0.000	6.356	0.000	20413.080
Instance3088.3	14.335	1.997	53.595	27.706	32945.437	35166.081	0.000	1.168	0.000	6.396	0.000	20289.078
Instance3088.4	14.616	1.941	53.514	27.621	32943.749	35184.861	0.000	1.176	0.000	6.382	0.000	20328.968



Table 60 Background Database Maintenance I/O performance

MSEExchange Database ==> Instances	Database Maintenance IO Reads/sec	Database Maintenance IO Reads Average Bytes
Instance3088.1	8.537	261580.756
Instance3088.2	8.321	261544.965
Instance3088.3	8.353	261536.686
Instance3088.4	8.296	261524.523

Table 61 Log Replication I/O performance

MSEExchange Database ==> Instances	I/O Log Reads/sec	I/O Log Reads Average Bytes
Instance3088.1	0.555	207533.826
Instance3088.2	0.553	207586.812
Instance3088.3	0.554	207339.216
Instance3088.4	0.554	207071.383

Table 62 Total I/O performance

MSEExchange 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	14.059	2.079	62.002	27.583	64420.262	35207.668	10.121	1.192	0.555	6.370	207533.826	20426.543
Instance3088.2	14.452	2.069	61.841	27.582	63703.652	35189.537	9.814	1.190	0.553	6.356	207586.812	20413.080
Instance3088.3	14.335	1.997	61.948	27.706	63768.754	35166.081	10.191	1.168	0.554	6.396	207339.216	20289.078
Instance3088.4	14.616	1.941	61.810	27.621	63623.703	35184.861	10.000	1.176	0.554	6.382	207071.383	20328.968



Table 63 Host system performance

Counter	Average	Minimum	Maximum
% Processor Time	0.361	0.000	2.767
Available MBytes	60526.415	60513.000	60582.000
Free System Page Table Entries	33555158.035	33555154.000	33555160.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	70323050.967	70287360.000	70402048.000
Pool Paged Bytes	219449923.394	217866240.000	224595968.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

B.6 Test log

2/19/2014 8:46:36 AM -- Preparing for testing ...
 2/19/2014 8:46:41 AM -- Attaching databases ...
 2/19/2014 8:46:41 AM -- Preparations for testing are complete.
 2/19/2014 8:46:41 AM -- Starting transaction dispatch ..
 2/19/2014 8:46:41 AM -- Database cache settings: (minimum: 128.0 MB, maximum: 1.0 GB)
 2/19/2014 8:46:41 AM -- Database flush thresholds: (start: 10.2 MB, stop: 20.5 MB)
 2/19/2014 8:46:45 AM -- Database read latency thresholds: (average: 20 msec/read, maximum: 200 msec/read).
 2/19/2014 8:46:46 AM -- Log write latency thresholds: (average: 10 msec/write, maximum: 200 msec/write).
 2/19/2014 8:46:50 AM -- Operation mix: Sessions 5, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
 2/19/2014 8:46:50 AM -- Performance logging started (interval: 15000 ms).
 2/19/2014 8:46:50 AM -- Attaining prerequisites:
 2/19/2014 8:50:26 AM -- \MSEExchange Database(JetstressWin)\Database Cache Size, Last: 968171500.0 (lower bound: 966367600.0, upper bound: none)



2/20/2014 8:50:26 AM -- Performance logging has ended.
2/20/2014 9:01:56 AM -- JetInterop batch transaction stats: 181464, 181464, 181464 and 181464.
2/20/2014 9:01:56 AM -- Dispatching transactions ends.
2/20/2014 9:01:56 AM -- Shutting down databases ...
2/20/2014 9:01:57 AM -- Instance3088.1 (complete), Instance3088.2 (complete), Instance3088.3 (complete) and Instance3088.4 (complete)
2/20/2014 9:01:57 AM -- C:\Program Files\Exchange Jetstress\Stress_2014_2_19_8_46_46.blg has 5765 samples.
2/20/2014 9:01:57 AM -- Creating test report ...
2/20/2014 9:02:19 AM -- Instance3088.1 has 14.1 for I/O Database Reads Average Latency.
2/20/2014 9:02:19 AM -- Instance3088.1 has 1.2 for I/O Log Writes Average Latency.
2/20/2014 9:02:19 AM -- Instance3088.1 has 1.2 for I/O Log Reads Average Latency.
2/20/2014 9:02:19 AM -- Instance3088.2 has 14.5 for I/O Database Reads Average Latency.
2/20/2014 9:02:19 AM -- Instance3088.2 has 1.2 for I/O Log Writes Average Latency.
2/20/2014 9:02:19 AM -- Instance3088.2 has 1.2 for I/O Log Reads Average Latency.
2/20/2014 9:02:19 AM -- Instance3088.3 has 14.3 for I/O Database Reads Average Latency.
2/20/2014 9:02:19 AM -- Instance3088.3 has 1.2 for I/O Log Writes Average Latency.
2/20/2014 9:02:19 AM -- Instance3088.3 has 1.2 for I/O Log Reads Average Latency.
2/20/2014 9:02:19 AM -- Instance3088.4 has 14.6 for I/O Database Reads Average Latency.
2/20/2014 9:02:19 AM -- Instance3088.4 has 1.2 for I/O Log Writes Average Latency.
2/20/2014 9:02:19 AM -- Instance3088.4 has 1.2 for I/O Log Reads Average Latency.
2/20/2014 9:02:19 AM -- Test has 0 Maximum Database Page Fault Stalls/sec.
2/20/2014 9:02:19 AM -- The test has 0 Database Page Fault Stalls/sec samples higher than 0.
2/20/2014 9:02:19 AM -- C:\Program Files\Exchange Jetstress\Stress_2014_2_19_8_46_46.xml has 5750 samples queried.



B.7 Server 4 – JS15

Table 64 Test summary

Overall Test Result	Pass
Machine Name	JS15
Test Description	2500 users/server 4 servers 1GB mailboxes .10 IOPS/user .12 IOPS tested 4 dbs per server 750GB db/log combined volumes 2 copies 5 threads/db
Test Start Time	2/19/2014 8:46:34 AM
Test End Time	2/20/2014 9:01:47 AM
Collection Start Time	2/19/2014 8:50:29 AM
Collection End Time	2/20/2014 8:50:17 AM
Jetstress Version	15.00.0658.004
ESE Version	15.00.0712.008
Operating System	Windows Server 2008 R2 Enterprise Service Pack 1 (6.1.7601.65536)
Performance Log	C:\Program Files\Exchange Jetstress\Stress_2014_2_19_8_46_43.blg



Table 65 Database sizing and throughput

Performance Counter	Value
Achieved Transactional I/O per Second	318.28
Target Transactional I/O per Second	300
Initial Database Size (bytes)	2725616287744
Final Database Size (bytes)	2735632285696
Database Files (Count)	4

Table 66 Jetstress system parameters

Performance Counter	Value
Thread Count	5
Minimum Database Cache	128.0 MB
Maximum Database Cache	1024.0 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



Table 67 Database configuration

Performance Counter	Value
Instance2528.1	Log path: C:\DB\DB1 Database: C:\DB\DB1\Jetstress001001.edb
Instance2528.2	Log path: C:\DB\DB2 Database: C:\DB\DB2\Jetstress002001.edb
Instance2528.3	Log path: C:\DB\DB3 Database: C:\DB\DB3\Jetstress003001.edb
Instance2528.4	Log path: C:\DB\DB4 Database: C:\DB\DB4\Jetstress004001.edb

Table 68 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
Instance2528.1	14.643	2.072	52.496	27.095	32945.557	35157.817	0.000	1.194	0.000	6.244	0.000	20259.417
Instance2528.2	14.244	2.069	52.480	27.079	32954.962	35172.248	0.000	1.197	0.000	6.230	0.000	20361.208
Instance2528.3	14.165	2.001	52.553	27.155	32950.525	35147.539	0.000	1.183	0.000	6.266	0.000	20215.365
Instance2528.4	14.992	1.938	52.406	27.015	32939.030	35164.485	0.000	1.187	0.000	6.229	0.000	20316.415



Table 69 Background Database Maintenance I/O performance

MSExchange Database ==> Instances	Database Maintenance IO Reads/sec	Database Maintenance IO Reads Average Bytes
Instance2528.1	8.521	261550.415
Instance2528.2	8.367	261519.017
Instance2528.3	8.397	261564.825
Instance2528.4	8.349	261551.678

Table 70 Log Replication I/O performance

MSExchange Database ==> Instances	I/O Log Reads/sec	I/O Log Reads Average Bytes
Instance2528.1	0.539	204806.593
Instance2528.2	0.541	204203.831
Instance2528.3	0.541	204740.008
Instance2528.4	0.540	203391.170

Table 71 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
Instance2528.1	14.643	2.072	61.018	27.095	64870.162	35157.817	9.985	1.194	0.539	6.244	204806.593	20259.417
Instance2528.2	14.244	2.069	60.847	27.079	64385.177	35172.248	9.840	1.197	0.541	6.230	204203.831	20361.208
Instance2528.3	14.165	2.001	60.951	27.155	64446.416	35147.539	9.776	1.183	0.541	6.266	204740.008	20215.365
Instance2528.4	14.992	1.938	60.755	27.015	64355.878	35164.485	9.834	1.187	0.540	6.229	203391.170	20316.415



Table 72 Host system performance

Counter	Average	Minimum	Maximum
% Processor Time	0.356	0.000	2.854
Available MBytes	60700.832	60674.000	60775.000
Free System Page Table Entries	33555159.147	33555152.000	33555672.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	67304343.837	67293184.000	67379200.000
Pool Paged Bytes	153120874.834	151613440.000	158162944.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

B.8 Test log

2/19/2014 8:46:34 AM -- Preparing for testing ...
 2/19/2014 8:46:39 AM -- Attaching databases ...
 2/19/2014 8:46:39 AM -- Preparations for testing are complete.
 2/19/2014 8:46:39 AM -- Starting transaction dispatch ..
 2/19/2014 8:46:39 AM -- Database cache settings: (minimum: 128.0 MB, maximum: 1.0 GB)
 2/19/2014 8:46:39 AM -- Database flush thresholds: (start: 10.2 MB, stop: 20.5 MB)
 2/19/2014 8:46:43 AM -- Database read latency thresholds: (average: 20 msec/read, maximum: 200 msec/read).
 2/19/2014 8:46:43 AM -- Log write latency thresholds: (average: 10 msec/write, maximum: 200 msec/write).
 2/19/2014 8:46:48 AM -- Operation mix: Sessions 5, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
 2/19/2014 8:46:48 AM -- Performance logging started (interval: 15000 ms).
 2/19/2014 8:46:48 AM -- Attaining prerequisites:
 2/19/2014 8:50:29 AM -- \MSExchange Database(JetstressWin)\Database Cache Size, Last: 971264000.0 (lower bound: 966367600.0, upper bound: none)
 2/20/2014 8:50:30 AM -- Performance logging has ended.



2/20/2014 9:01:45 AM -- JetInterop batch transaction stats: 177563, 177563, 177563 and 177562.
2/20/2014 9:01:45 AM -- Dispatching transactions ends.
2/20/2014 9:01:46 AM -- Shutting down databases ...
2/20/2014 9:01:47 AM -- Instance2528.1 (complete), Instance2528.2 (complete), Instance2528.3 (complete) and Instance2528.4 (complete)
2/20/2014 9:01:47 AM -- C:\Program Files\Exchange Jetstress\Stress_2014_2_19_8_46_43.blg has 5765 samples.
2/20/2014 9:01:47 AM -- Creating test report ...
2/20/2014 9:02:04 AM -- Instance2528.1 has 14.6 for I/O Database Reads Average Latency.
2/20/2014 9:02:04 AM -- Instance2528.1 has 1.2 for I/O Log Writes Average Latency.
2/20/2014 9:02:04 AM -- Instance2528.1 has 1.2 for I/O Log Reads Average Latency.
2/20/2014 9:02:04 AM -- Instance2528.2 has 14.2 for I/O Database Reads Average Latency.
2/20/2014 9:02:04 AM -- Instance2528.2 has 1.2 for I/O Log Writes Average Latency.
2/20/2014 9:02:04 AM -- Instance2528.2 has 1.2 for I/O Log Reads Average Latency.
2/20/2014 9:02:04 AM -- Instance2528.3 has 14.2 for I/O Database Reads Average Latency.
2/20/2014 9:02:04 AM -- Instance2528.3 has 1.2 for I/O Log Writes Average Latency.
2/20/2014 9:02:04 AM -- Instance2528.3 has 1.2 for I/O Log Reads Average Latency.
2/20/2014 9:02:04 AM -- Instance2528.4 has 15.0 for I/O Database Reads Average Latency.
2/20/2014 9:02:04 AM -- Instance2528.4 has 1.2 for I/O Log Writes Average Latency.
2/20/2014 9:02:04 AM -- Instance2528.4 has 1.2 for I/O Log Reads Average Latency.
2/20/2014 9:02:04 AM -- Test has 0 Maximum Database Page Fault Stalls/sec.
2/20/2014 9:02:04 AM -- The test has 0 Database Page Fault Stalls/sec samples higher than 0.
2/20/2014 9:02:04 AM -- C:\Program Files\Exchange Jetstress\Stress_2014_2_19_8_46_43.xml has 5750 samples queried.



C Backup testing

C.1 Server 1 – JS12

Table 73 Database backup statistics - All

Database Instance	Database Size (MBytes)	Elapsed Backup Time	MBytes Transferred/sec
Instance3320.1	651849.59	02:57:05	61.35
Instance3320.2	651889.59	02:49:26	64.12
Instance3320.3	651865.59	02:49:43	64.01
Instance3320.4	651857.59	02:47:04	65.03
Avg			63.63
Sum			254.51

Table 74 Jetstress system parameters

Performance Counter	Value
Thread Count	5
Minimum Database Cache	128.0 MB
Maximum Database Cache	1024.0 MB
Insert Operations	40%
Delete Operations	20%
Replace Operations	5%



Read Operations	35%
Lazy Commits	70%

Table 75 Database configuration

Performance Counter	Value
Instance3320.1	Log path: C:\DB\DB1 Database: C:\DB\DB1\Jetstress001001.edb
Instance3320.2	Log path: C:\DB\DB2 Database: C:\DB\DB2\Jetstress002001.edb
Instance3320.3	Log path: C:\DB\DB3 Database: C:\DB\DB3\Jetstress003001.edb
Instance3320.4	Log path: C:\DB\DB4 Database: C:\DB\DB4\Jetstress004001.edb

Table 76 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
Instance3320.1	6.429	0.000	243.639	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance3320.2	5.942	0.000	256.295	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance3320.3	5.908	0.000	256.314	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance3320.4	5.662	0.000	260.051	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000



Table 77 Host system performance

Counter	Average	Minimum	Maximum
% Processor Time	0.383	0.000	1.182
Available MBytes	61733.822	61725.000	61736.000
Free System Page Table Entries	33555670.215	33555670.000	33555672.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	68307715.626	68296704.000	68366336.000
Pool Paged Bytes	156564471.297	155828224.000	157155328.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

C.2 Test log

2/20/2014 11:48:07 AM -- Preparing for testing ...
 2/20/2014 11:48:12 AM -- Attaching databases ...
 2/20/2014 11:48:12 AM -- Preparations for testing are complete.
 2/20/2014 11:48:19 AM -- Performance logging started (interval: 30000 ms).
 2/20/2014 11:48:19 AM -- Backing up databases ...
 2/20/2014 2:45:25 PM -- Performance logging has ended.
 2/20/2014 2:45:25 PM -- Instance3320.1 (100% processed), Instance3320.2 (100% processed), Instance3320.3 (100% processed) and Instance3320.4 (100% processed)
 2/20/2014 2:45:25 PM -- C:\Program Files\Exchange Jetstress\DatabaseBackup_2014_2_20_11_48_12.blg has 353 samples.
 2/20/2014 2:45:25 PM -- Creating test report ...



C.3 Server 2 – JS13

Table 78 Database backup statistics - All

Database Instance	Database Size (MBytes)	Elapsed Backup Time	MBytes Transferred/sec
Instance3944.1	651169.59	02:54:11	62.31
Instance3944.2	651153.59	02:42:45	66.68
Instance3944.3	651161.59	02:44:55	65.80
Instance3944.4	651153.59	02:55:42	61.76
Avg			64.14
Sum			256.55

Table 79 Jetstress system parameters

Performance Counter	Value
Thread Count	5
Minimum Database Cache	128.0 MB
Maximum Database Cache	1024.0 MB
Insert Operations	40%
Delete Operations	20%
Replace Operations	5%
Read Operations	35%
Lazy Commits	70%



Table 80 Database configuration

Performance Counter	Value
Instance3944.1	Log path: C:\DB\DB1 Database: C:\DB\DB1\Jetstress001001.edb
Instance3944.2	Log path: C:\DB\DB2 Database: C:\DB\DB2\Jetstress002001.edb
Instance3944.3	Log path: C:\DB\DB3 Database: C:\DB\DB3\Jetstress003001.edb
Instance3944.4	Log path: C:\DB\DB4 Database: C:\DB\DB4\Jetstress004001.edb

Table 81 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
Instance3944.1	6.134	0.000	249.308	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance3944.2	5.534	0.000	266.636	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance3944.3	5.580	0.000	262.815	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance3944.4	6.322	0.000	247.036	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table 82 Host system performance

Counter	Average	Minimum	Maximum
% Processor Time	0.402	0.000	1.464



Available MBytes	61591.735	61581.000	61593.000
Free System Page Table Entries	33555176.952	33555153.000	33555670.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	70889927.111	70832128.000	71024640.000
Pool Paged Bytes	222679658.484	222670848.000	222760960.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

C.4 Test log

2/20/2014 11:48:03 AM -- Preparing for testing ...
 2/20/2014 11:48:07 AM -- Attaching databases ...
 2/20/2014 11:48:07 AM -- Preparations for testing are complete.
 2/20/2014 11:48:15 AM -- Performance logging started (interval: 30000 ms).
 2/20/2014 11:48:15 AM -- Backing up databases ...
 2/20/2014 2:43:58 PM -- Performance logging has ended.
 2/20/2014 2:43:58 PM -- Instance3944.1 (100% processed), Instance3944.2 (100% processed), Instance3944.3 (100% processed) and Instance3944.4 (100% processed)
 2/20/2014 2:43:58 PM -- C:\Program Files\Exchange Jetstress\DatabaseBackup_2014_2_20_11_48_7.blg has 351 samples.
 2/20/2014 2:43:58 PM -- Creating test report ...



C.5 Server 3 – JS14

Table 83 Database backup statistics - All

Database Instance	Database Size (MBytes)	Elapsed Backup Time	MBytes Transferred/sec
Instance3088.1	652193.59	02:42:41	66.81
Instance3088.2	652193.59	02:33:01	71.03
Instance3088.3	652201.59	02:35:38	69.84
Instance3088.4	652201.59	02:36:45	69.35
Avg			69.26
Sum			277.03

Table 84 Jetstress system parameters

Performance Counter	Value
Thread Count	5
Minimum Database Cache	128.0 MB
Maximum Database Cache	1024.0 MB
Insert Operations	40%
Delete Operations	20%
Replace Operations	5%
Read Operations	35%
Lazy Commits	70%



Table 85 Database configuration

Performance Counter	Value
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
Instance3088.3	Log path: C:\DB\DB3 Database: C:\DB\DB3\Jetstress003001.edb
Instance3088.4	Log path: C:\DB\DB4 Database: C:\DB\DB4\Jetstress004001.edb

Table 86 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	5.645	0.000	267.091	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance3088.2	5.191	0.000	284.279	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance3088.3	5.231	0.000	279.112	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance3088.4	5.285	0.000	277.235	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000



Table 87 Host system performance

Counter	Average	Minimum	Maximum
% Processor Time	0.476	0.000	1.361
Available MBytes	61580.871	61573.000	61582.000
Free System Page Table Entries	33555167.508	33555158.000	33555670.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	70579776.591	70557696.000	70615040.000
Pool Paged Bytes	221571960.517	220790784.000	221884416.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

C.6 Test log

2/20/2014 11:47:58 AM -- Preparing for testing ...
 2/20/2014 11:48:03 AM -- Attaching databases ...
 2/20/2014 11:48:03 AM -- Preparations for testing are complete.
 2/20/2014 11:48:10 AM -- Performance logging started (interval: 30000 ms).
 2/20/2014 11:48:10 AM -- Backing up databases ...
 2/20/2014 2:30:52 PM -- Performance logging has ended.
 2/20/2014 2:30:52 PM -- Instance3088.1 (100% processed), Instance3088.2 (100% processed), Instance3088.3 (100% processed) and Instance3088.4 (100% processed)
 2/20/2014 2:30:52 PM -- C:\Program Files\Exchange Jetstress\DatabaseBackup_2014_2_20_11_48_3.blg has 325 samples.
 2/20/2014 2:30:52 PM -- Creating test report ...



C.7 Server 4 – JS15

Table 88 Database backup statistics - All

Database Instance	Database Size (MBytes)	Elapsed Backup Time	MBytes Transferred/sec
Instance2528.1	652201.59	02:55:21	61.99
Instance2528.2	652209.59	02:39:08	68.31
Instance2528.3	652209.59	02:35:17	70.00
Instance2528.4	652249.59	02:55:19	62.00
Avg			65.57
Sum			262.30

Table 89 Jetstress system parameters

Performance Counter	Value
Thread Count	5
Minimum Database Cache	128.0 MB
Maximum Database Cache	1024.0 MB
Insert Operations	40%
Delete Operations	20%
Replace Operations	5%
Read Operations	35%
Lazy Commits	70%



Table 90 Database configuration

Performance Counter	Value
Instance2528.1	Log path: C:\DB\DB1 Database: C:\DB\DB1\Jetstress001001.edb
Instance2528.2	Log path: C:\DB\DB2 Database: C:\DB\DB2\Jetstress002001.edb
Instance2528.3	Log path: C:\DB\DB3 Database: C:\DB\DB3\Jetstress003001.edb
Instance2528.4	Log path: C:\DB\DB4 Database: C:\DB\DB4\Jetstress004001.edb

Table 91 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
Instance2528.1	6.356	0.000	247.340	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance2528.2	5.338	0.000	272.897	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance2528.3	5.233	0.000	279.705	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance2528.4	6.514	0.000	247.264	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000



Table 92 Host system performance

Counter	Average	Minimum	Maximum
% Processor Time	0.433	0.000	1.362
Available MBytes	61756.351	61739.000	61758.000
Free System Page Table Entries	33555161.051	33555158.000	33555670.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	67571360.914	67555328.000	67661824.000
Pool Paged Bytes	154359819.703	154341376.000	154472448.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

C.8 Test log

2/20/2014 11:47:54 AM -- Preparing for testing ...
 2/20/2014 11:47:59 AM -- Attaching databases ...
 2/20/2014 11:47:59 AM -- Preparations for testing are complete.
 2/20/2014 11:48:06 AM -- Performance logging started (interval: 30000 ms).
 2/20/2014 11:48:06 AM -- Backing up databases ...
 2/20/2014 2:43:27 PM -- Performance logging has ended.
 2/20/2014 2:43:27 PM -- Instance2528.1 (100% processed), Instance2528.2 (100% processed), Instance2528.3 (100% processed) and Instance2528.4 (100% processed)
 2/20/2014 2:43:27 PM -- C:\Program Files\Exchange Jetstress\DatabaseBackup_2014_2_20_11_47_59.blg has 350 samples.
 2/20/2014 2:43:27 PM -- Creating test report ...



D Recovery testing

D.1 Server 1 – JS12

Table 93 Soft Recovery statistics - All

Database Instance	Log files replayed	Elapsed seconds
Instance3320.1	511	971.1748508
Instance3320.2	501	904.343594
Instance3320.3	509	914.1561198
Instance3320.4	509	908.321645
Avg	507	924.499
Sum	2030	3697.9962096

Table 94 Database configuration

Performance Counter	Value
Instance3320.1	Log path: C:\DB\DB1 Database: C:\DB\DB1\Jetstress001001.edb
Instance3320.2	Log path: C:\DB\DB2 Database: C:\DB\DB2\Jetstress002001.edb
Instance3320.3	Log path: C:\DB\DB3 Database: C:\DB\DB3\Jetstress003001.edb
Instance3320.4	Log path: C:\DB\DB4 Database: C:\DB\DB4\Jetstress004001.edb



Table 95 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
Instance3320.1	14.274	1.252	347.985	2.092	39973.838	31462.776	23.978	0.000	2.615	0.000	198661.639	0.000
Instance3320.2	13.099	1.163	374.656	2.212	40072.313	32472.793	25.444	0.000	2.765	0.000	207398.991	0.000
Instance3320.3	13.127	1.065	367.674	2.223	39940.593	32476.080	26.123	0.000	2.779	0.000	207578.295	0.000
Instance3320.4	13.126	1.148	372.509	2.238	39866.434	32547.587	25.585	0.000	2.797	0.000	207842.521	0.000

Table 96 Background Database Maintenance I/O performance

MSExchange Database ==> Instances	Database Maintenance IO Reads/sec	Database Maintenance IO Reads Average Bytes
Instance3320.1	7.575	261812.308
Instance3320.2	7.883	261496.562
Instance3320.3	7.828	261884.737
Instance3320.4	7.869	261827.697



Table 97 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
Instance3320.1	14.274	1.252	355.560	2.092	44700.184	31462.776	23.978	0.000	2.615	0.000	198661.639	0.000
Instance3320.2	13.099	1.163	382.539	2.212	44635.177	32472.793	25.444	0.000	2.765	0.000	207398.991	0.000
Instance3320.3	13.127	1.065	375.502	2.223	44567.458	32476.080	26.123	0.000	2.779	0.000	207578.295	0.000
Instance3320.4	13.126	1.148	380.378	2.238	44457.980	32547.587	25.585	0.000	2.797	0.000	207842.521	0.000

Table 98 Host system performance

Counter	Average	Minimum	Maximum
% Processor Time	2.264	0.000	17.861
Available MBytes	60705.490	60656.000	61687.000
Free System Page Table Entries	33555671.324	33555669.000	33555672.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	68258057.640	68251648.000	68280320.000
Pool Paged Bytes	157125602.008	157102080.000	157270016.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

D.2 Test log



2/20/2014 3:44:36 PM -- Preparing for testing ...
 2/20/2014 3:44:41 PM -- Attaching databases ...
 2/20/2014 3:44:41 PM -- Preparations for testing are complete.
 2/20/2014 3:44:41 PM -- Starting transaction dispatch ..
 2/20/2014 3:44:41 PM -- Database cache settings: (minimum: 128.0 MB, maximum: 1.0 GB)
 2/20/2014 3:44:41 PM -- Database flush thresholds: (start: 10.2 MB, stop: 20.5 MB)
 2/20/2014 3:44:46 PM -- Database read latency thresholds: (average: 20 msec/read, maximum: 100 msec/read).
 2/20/2014 3:44:46 PM -- Log write latency thresholds: (average: 10 msec/write, maximum: 100 msec/write).
 2/20/2014 3:44:50 PM -- Operation mix: Sessions 5, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
 2/20/2014 3:44:50 PM -- Performance logging started (interval: 15000 ms).
 2/20/2014 3:44:50 PM -- Generating log files ...
 2/20/2014 6:10:11 PM -- C:\DB\DB1 (102.2% generated), C:\DB\DB2 (100.2% generated), C:\DB\DB3 (101.8% generated) and C:\DB\DB4 (101.8% generated)
 2/20/2014 6:10:11 PM -- Performance logging has ended.
 2/20/2014 6:10:11 PM -- JetInterop batch transaction stats: 17163, 17162, 17162 and 17162.
 2/20/2014 6:10:11 PM -- Dispatching transactions ends.
 2/20/2014 6:10:11 PM -- Shutting down databases ...
 2/20/2014 6:10:12 PM -- Instance3320.1 (complete), Instance3320.2 (complete), Instance3320.3 (complete) and Instance3320.4 (complete)
 2/20/2014 6:10:12 PM -- C:\Program Files\Exchange Jetstress\Performance_2014_2_20_15_44_46.blg has 580 samples.
 2/20/2014 6:10:12 PM -- Creating test report ...
 2/20/2014 6:10:15 PM -- Instance3320.1 has 15.1 for I/O Database Reads Average Latency.
 2/20/2014 6:10:15 PM -- Instance3320.1 has 1.3 for I/O Log Writes Average Latency.
 2/20/2014 6:10:15 PM -- Instance3320.1 has 1.3 for I/O Log Reads Average Latency.
 2/20/2014 6:10:15 PM -- Instance3320.2 has 14.4 for I/O Database Reads Average Latency.
 2/20/2014 6:10:15 PM -- Instance3320.2 has 1.3 for I/O Log Writes Average Latency.
 2/20/2014 6:10:15 PM -- Instance3320.2 has 1.3 for I/O Log Reads Average Latency.
 2/20/2014 6:10:15 PM -- Instance3320.3 has 14.4 for I/O Database Reads Average Latency.
 2/20/2014 6:10:15 PM -- Instance3320.3 has 1.2 for I/O Log Writes Average Latency.
 2/20/2014 6:10:15 PM -- Instance3320.3 has 1.2 for I/O Log Reads Average Latency.
 2/20/2014 6:10:15 PM -- Instance3320.4 has 14.4 for I/O Database Reads Average Latency.
 2/20/2014 6:10:15 PM -- Instance3320.4 has 1.2 for I/O Log Writes Average Latency.
 2/20/2014 6:10:15 PM -- Instance3320.4 has 1.2 for I/O Log Reads Average Latency.
 2/20/2014 6:10:15 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.
 2/20/2014 6:10:15 PM -- The test has 0 Database Page Fault Stalls/sec samples higher than 0.
 2/20/2014 6:10:15 PM -- C:\Program Files\Exchange Jetstress\Performance_2014_2_20_15_44_46.xml has 579 samples queried.
 2/20/2014 6:10:15 PM -- C:\Program Files\Exchange Jetstress\Performance_2014_2_20_15_44_46.html was saved.



2/20/2014 7:32:33 PM -- Performance logging started (interval: 2000 ms).
2/20/2014 7:32:33 PM -- Recovering databases ...
2/20/2014 7:48:44 PM -- Performance logging has ended.
2/20/2014 7:48:44 PM -- Instance3320.1 (971.1748508), Instance3320.2 (904.343594), Instance3320.3 (914.1561198) and Instance3320.4 (908.321645)
2/20/2014 7:48:44 PM -- C:\Program Files\Exchange Jetstress\SoftRecovery_2014_2_20_19_32_30.blg has 478 samples.
2/20/2014 7:48:44 PM -- Creating test report ...
.



D.3 Server 2 – JS13

Table 99 Soft Recovery statistics - All

Database Instance	Log files replayed	Elapsed seconds
Instance3944.1	501	963.2249232
Instance3944.2	520	943.0693356
Instance3944.3	508	933.7871571
Instance3944.4	513	971.1810762
Avg	510	952.816
Sum	2042	3811.2624921

Table 100 Database configuration

Performance Counter	Value
Instance3944.1	Log path: C:\DB\DB1 Database: C:\DB\DB1\Jetstress001001.edb
Instance3944.2	Log path: C:\DB\DB2 Database: C:\DB\DB2\Jetstress002001.edb
Instance3944.3	Log path: C:\DB\DB3 Database: C:\DB\DB3\Jetstress003001.edb
Instance3944.4	Log path: C:\DB\DB4 Database: C:\DB\DB4\Jetstress004001.edb



Table 101 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
Instance3944.1	14.429	1.088	352.665	2.076	40271.712	31454.515	23.580	0.000	2.605	0.000	199854.990	0.000
Instance3944.2	13.575	1.226	367.181	2.202	39969.239	32414.897	25.237	0.000	2.757	0.000	206544.436	0.000
Instance3944.3	13.713	1.229	361.541	2.170	39887.047	32482.440	24.420	0.000	2.713	0.000	206570.992	0.000
Instance3944.4	14.557	1.280	348.751	2.105	40204.801	31737.560	23.696	0.000	2.631	0.000	200671.671	0.000

Table 102 Background Database Maintenance I/O performance

MSExchange Database ==> Instances	Database Maintenance IO Reads/sec	Database Maintenance IO Reads Average Bytes
Instance3944.1	7.620	261827.305
Instance3944.2	7.709	261819.647
Instance3944.3	7.720	262022.825
Instance3944.4	7.571	261824.530



Table 103 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
Instance3944.1	14.429	1.088	360.285	2.076	44957.688	31454.515	23.580	0.000	2.605	0.000	199854.990	0.000
Instance3944.2	13.575	1.226	374.890	2.202	44531.192	32414.897	25.237	0.000	2.757	0.000	206544.436	0.000
Instance3944.3	13.713	1.229	369.261	2.170	44531.069	32482.440	24.420	0.000	2.713	0.000	206570.992	0.000
Instance3944.4	14.557	1.280	356.322	2.105	44913.819	31737.560	23.696	0.000	2.631	0.000	200671.671	0.000

Table 104 Host system performance

Counter	Average	Minimum	Maximum
% Processor Time	2.253	0.000	15.145
Available MBytes	60562.429	60520.000	61542.000
Free System Page Table Entries	33555158.008	33555158.000	33555160.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	70665408.803	70656000.000	70705152.000
Pool Paged Bytes	224009931.515	223997952.000	224133120.000
Database Page Fault Stalls/sec	0.000	0.000	0.000



D.4 Test log

2/20/2014 3:44:41 PM -- Preparing for testing ...
2/20/2014 3:44:46 PM -- Attaching databases ...
2/20/2014 3:44:46 PM -- Preparations for testing are complete.
2/20/2014 3:44:46 PM -- Starting transaction dispatch ..
2/20/2014 3:44:46 PM -- Database cache settings: (minimum: 128.0 MB, maximum: 1.0 GB)
2/20/2014 3:44:46 PM -- Database flush thresholds: (start: 10.2 MB, stop: 20.5 MB)
2/20/2014 3:44:50 PM -- Database read latency thresholds: (average: 20 msec/read, maximum: 100 msec/read).
2/20/2014 3:44:50 PM -- Log write latency thresholds: (average: 10 msec/write, maximum: 100 msec/write).
2/20/2014 3:44:54 PM -- Operation mix: Sessions 5, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
2/20/2014 3:44:54 PM -- Performance logging started (interval: 15000 ms).
2/20/2014 3:44:54 PM -- Generating log files ...
2/20/2014 6:12:17 PM -- C:\DB\DB1 (100.2% generated), C:\DB\DB2 (104.0% generated), C:\DB\DB3 (101.6% generated) and C:\DB\DB4 (102.6% generated)
2/20/2014 6:12:17 PM -- Performance logging has ended.
2/20/2014 6:12:17 PM -- JetInterop batch transaction stats: 17204, 17203, 17203 and 17203.
2/20/2014 6:12:17 PM -- Dispatching transactions ends.
2/20/2014 6:12:18 PM -- Shutting down databases ...
2/20/2014 6:12:19 PM -- Instance3944.1 (complete), Instance3944.2 (complete), Instance3944.3 (complete) and Instance3944.4 (complete)
2/20/2014 6:12:19 PM -- C:\Program Files\Exchange Jetstress\Performance_2014_2_20_15_44_50.blg has 588 samples.
2/20/2014 6:12:19 PM -- Creating test report ...
2/20/2014 6:12:22 PM -- Instance3944.1 has 15.0 for I/O Database Reads Average Latency.
2/20/2014 6:12:22 PM -- Instance3944.1 has 1.3 for I/O Log Writes Average Latency.
2/20/2014 6:12:22 PM -- Instance3944.1 has 1.3 for I/O Log Reads Average Latency.
2/20/2014 6:12:22 PM -- Instance3944.2 has 14.4 for I/O Database Reads Average Latency.
2/20/2014 6:12:22 PM -- Instance3944.2 has 1.3 for I/O Log Writes Average Latency.
2/20/2014 6:12:22 PM -- Instance3944.2 has 1.3 for I/O Log Reads Average Latency.
2/20/2014 6:12:22 PM -- Instance3944.3 has 14.5 for I/O Database Reads Average Latency.
2/20/2014 6:12:22 PM -- Instance3944.3 has 1.2 for I/O Log Writes Average Latency.
2/20/2014 6:12:22 PM -- Instance3944.3 has 1.2 for I/O Log Reads Average Latency.
2/20/2014 6:12:22 PM -- Instance3944.4 has 15.1 for I/O Database Reads Average Latency.
2/20/2014 6:12:22 PM -- Instance3944.4 has 1.2 for I/O Log Writes Average Latency.
2/20/2014 6:12:22 PM -- Instance3944.4 has 1.2 for I/O Log Reads Average Latency.
2/20/2014 6:12:22 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.



2/20/2014 6:12:22 PM -- The test has 0 Database Page Fault Stalls/sec samples higher than 0.
2/20/2014 6:12:22 PM -- C:\Program Files\Exchange Jetstress\Performance_2014_2_20_15_44_50.xml has 587 samples queried.
2/20/2014 6:12:22 PM -- C:\Program Files\Exchange Jetstress\Performance_2014_2_20_15_44_50.html was saved.
2/20/2014 7:32:26 PM -- Performance logging started (interval: 2000 ms).
2/20/2014 7:32:26 PM -- Recovering databases ...
2/20/2014 7:48:37 PM -- Performance logging has ended.
2/20/2014 7:48:37 PM -- Instance3944.1 (963.2249232), Instance3944.2 (943.0693356), Instance3944.3 (933.7871571) and Instance3944.4 (971.1810762)
2/20/2014 7:48:37 PM -- C:\Program Files\Exchange Jetstress\SoftRecovery_2014_2_20_19_32_22.blg has 478 samples.
2/20/2014 7:48:37 PM -- Creating test report ...



D.5 Server 3 – JS14

Table 105 Soft Recovery statistics - All

Database Instance	Log files replayed	Elapsed seconds
Instance3088.1	503	911.5157716
Instance3088.2	507	910.1897376
Instance3088.3	501	911.5157716
Instance3088.4	505	918.6763552
Avg	504	912.974
Sum	2016	3651.897636

Table 106 Database configuration

Performance Counter	Value
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
Instance3088.3	Log path: C:\DB\DB3 Database: C:\DB\DB3\Jetstress003001.edb
Instance3088.4	Log path: C:\DB\DB4 Database: C:\DB\DB4\Jetstress004001.edb



Table 107 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	13.209	1.012	371.261	2.201	39935.267	32548.571	25.564	0.000	2.752	0.000	208158.708	0.000
Instance3088.2	13.210	1.050	368.183	2.224	39887.642	32548.081	25.648	0.000	2.780	0.000	207262.556	0.000
Instance3088.3	13.080	1.131	372.954	2.193	39921.381	32548.571	25.937	0.000	2.741	0.000	208448.849	0.000
Instance3088.4	13.236	0.946	373.384	2.191	39970.398	32041.437	24.916	0.000	2.739	0.000	204401.432	0.000

Table 108 Background Database Maintenance I/O performance

MSExchange Database ==> Instances	Database Maintenance IO Reads/sec	Database Maintenance IO Reads Average Bytes
Instance3088.1	7.869	261703.555
Instance3088.2	7.829	261313.967
Instance3088.3	7.841	261804.489
Instance3088.4	7.825	261668.880



Table 109 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	13.209	1.012	379.130	2.201	44537.960	32548.571	25.564	0.000	2.752	0.000	208158.708	0.000
Instance3088.2	13.210	1.050	376.012	2.224	44497.926	32548.081	25.648	0.000	2.780	0.000	207262.556	0.000
Instance3088.3	13.080	1.131	380.795	2.193	44490.286	32548.571	25.937	0.000	2.741	0.000	208448.849	0.000
Instance3088.4	13.236	0.946	381.209	2.191	44521.184	32041.437	24.916	0.000	2.739	0.000	204401.432	0.000

Table 110 Host system performance

Counter	Average	Minimum	Maximum
% Processor Time	2.350	0.000	21.107
Available MBytes	60546.338	60506.000	61521.000
Free System Page Table Entries	33555158.022	33555157.000	33555160.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	70438304.850	70430720.000	70483968.000
Pool Paged Bytes	221888521.062	221868032.000	222031872.000
Database Page Fault Stalls/sec	0.000	0.000	0.000



D.6 Test log

2/20/2014 3:44:46 PM -- Preparing for testing ...
2/20/2014 3:44:51 PM -- Attaching databases ...
2/20/2014 3:44:51 PM -- Preparations for testing are complete.
2/20/2014 3:44:51 PM -- Starting transaction dispatch ..
2/20/2014 3:44:51 PM -- Database cache settings: (minimum: 128.0 MB, maximum: 1.0 GB)
2/20/2014 3:44:51 PM -- Database flush thresholds: (start: 10.2 MB, stop: 20.5 MB)
2/20/2014 3:44:55 PM -- Database read latency thresholds: (average: 20 msec/read, maximum: 100 msec/read).
2/20/2014 3:44:55 PM -- Log write latency thresholds: (average: 10 msec/write, maximum: 100 msec/write).
2/20/2014 3:44:59 PM -- Operation mix: Sessions 5, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
2/20/2014 3:44:59 PM -- Performance logging started (interval: 15000 ms).
2/20/2014 3:44:59 PM -- Generating log files ...
2/20/2014 6:05:41 PM -- C:\DB\DB1 (100.6% generated), C:\DB\DB2 (101.4% generated), C:\DB\DB3 (100.2% generated) and C:\DB\DB4 (100.8% generated)
2/20/2014 6:05:41 PM -- Performance logging has ended.
2/20/2014 6:05:41 PM -- JetInterop batch transaction stats: 17002, 17002, 17002 and 17002.
2/20/2014 6:05:41 PM -- Dispatching transactions ends.
2/20/2014 6:05:41 PM -- Shutting down databases ...
2/20/2014 6:05:42 PM -- Instance3088.1 (complete), Instance3088.2 (complete), Instance3088.3 (complete) and Instance3088.4 (complete)
2/20/2014 6:05:42 PM -- C:\Program Files\Exchange Jetstress\Performance_2014_2_20_15_44_55.blg has 561 samples.
2/20/2014 6:05:42 PM -- Creating test report ...
2/20/2014 6:05:44 PM -- Instance3088.1 has 14.2 for I/O Database Reads Average Latency.
2/20/2014 6:05:44 PM -- Instance3088.1 has 1.2 for I/O Log Writes Average Latency.
2/20/2014 6:05:44 PM -- Instance3088.1 has 1.2 for I/O Log Reads Average Latency.
2/20/2014 6:05:44 PM -- Instance3088.2 has 14.2 for I/O Database Reads Average Latency.
2/20/2014 6:05:44 PM -- Instance3088.2 has 1.3 for I/O Log Writes Average Latency.
2/20/2014 6:05:44 PM -- Instance3088.2 has 1.3 for I/O Log Reads Average Latency.
2/20/2014 6:05:44 PM -- Instance3088.3 has 14.2 for I/O Database Reads Average Latency.
2/20/2014 6:05:44 PM -- Instance3088.3 has 1.2 for I/O Log Writes Average Latency.
2/20/2014 6:05:44 PM -- Instance3088.3 has 1.2 for I/O Log Reads Average Latency.
2/20/2014 6:05:44 PM -- Instance3088.4 has 14.3 for I/O Database Reads Average Latency.
2/20/2014 6:05:44 PM -- Instance3088.4 has 1.2 for I/O Log Writes Average Latency.
2/20/2014 6:05:44 PM -- Instance3088.4 has 1.2 for I/O Log Reads Average Latency.
2/20/2014 6:05:44 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.



2/20/2014 6:05:44 PM -- The test has 0 Database Page Fault Stalls/sec samples higher than 0.
2/20/2014 6:05:44 PM -- C:\Program Files\Exchange Jetstress\Performance_2014_2_20_15_44_55.xml has 560 samples queried.
2/20/2014 6:05:44 PM -- C:\Program Files\Exchange Jetstress\Performance_2014_2_20_15_44_55.html was saved.
2/20/2014 7:32:19 PM -- Performance logging started (interval: 2000 ms).
2/20/2014 7:32:19 PM -- Recovering databases ...
2/20/2014 7:47:38 PM -- Performance logging has ended.
2/20/2014 7:47:38 PM -- Instance3088.1 (911.5157716), Instance3088.2 (910.1897376), Instance3088.3 (911.5157716) and Instance3088.4 (918.6763552)
2/20/2014 7:47:38 PM -- C:\Program Files\Exchange Jetstress\SoftRecovery_2014_2_20_19_32_16.blg has 452 samples.
2/20/2014 7:47:38 PM -- Creating test report ...
.



D.7 Server 4 – JS15

Table 111 Soft Recovery statistics - All

Database Instance	Log files replayed	Elapsed seconds
Instance2528.1	510	939.8868744
Instance2528.2	501	883.9285983
Instance2528.3	506	895.3324176
Instance2528.4	501	923.9745684
Avg	504	910.781
Sum	2018	3643.1224587

Table 112 Database configuration

Performance Counter	Value
Instance2528.1	Log path: C:\DB\DB1 Database: C:\DB\DB1\Jetstress001001.edb
Instance2528.2	Log path: C:\DB\DB2 Database: C:\DB\DB2\Jetstress002001.edb
Instance2528.3	Log path: C:\DB\DB3 Database: C:\DB\DB3\Jetstress003001.edb
Instance2528.4	Log path: C:\DB\DB4 Database: C:\DB\DB4\Jetstress004001.edb



Table 113 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
Instance2528.1	13.565	1.138	361.311	2.165	39878.626	32555.221	25.609	0.000	2.706	0.000	207674.796	0.000
Instance2528.2	12.773	1.036	384.551	2.263	39927.898	32768.000	26.293	0.000	2.829	0.000	209161.727	0.000
Instance2528.3	12.821	1.004	381.385	2.255	39835.127	32544.582	25.529	0.000	2.819	0.000	208469.821	0.000
Instance2528.4	13.540	1.012	361.548	2.164	39931.820	32407.119	25.810	0.000	2.704	0.000	207128.943	0.000

Table 114 Background Database Maintenance I/O performance

MSExchange Database ==> Instances	Database Maintenance IO Reads/sec	Database Maintenance IO Reads Average Bytes
Instance2528.1	7.945	261843.138
Instance2528.2	7.903	261399.386
Instance2528.3	7.868	261530.075
Instance2528.4	7.881	261764.633



Table 115 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
Instance2528.1	13.565	1.138	369.256	2.165	44654.536	32555.221	25.609	0.000	2.706	0.000	207674.796	0.000
Instance2528.2	12.773	1.036	392.454	2.263	44387.896	32768.000	26.293	0.000	2.829	0.000	209161.727	0.000
Instance2528.3	12.821	1.004	389.253	2.255	44316.447	32544.582	25.529	0.000	2.819	0.000	208469.821	0.000
Instance2528.4	13.540	1.012	369.429	2.164	44664.122	32407.119	25.810	0.000	2.704	0.000	207128.943	0.000

Table 116 Host system performance

Counter	Average	Minimum	Maximum
% Processor Time	2.165	0.000	16.732
Available MBytes	60710.037	60680.000	61694.000
Free System Page Table Entries	33555159.281	33555157.000	33555160.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	67445567.585	67440640.000	67469312.000
Pool Paged Bytes	154538585.572	154529792.000	154664960.000
Database Page Fault Stalls/sec	0.000	0.000	0.000



D.8 Test log

2/20/2014 3:44:51 PM -- Preparing for testing ...
2/20/2014 3:44:55 PM -- Attaching databases ...
2/20/2014 3:44:55 PM -- Preparations for testing are complete.
2/20/2014 3:44:55 PM -- Starting transaction dispatch ..
2/20/2014 3:44:55 PM -- Database cache settings: (minimum: 128.0 MB, maximum: 1.0 GB)
2/20/2014 3:44:55 PM -- Database flush thresholds: (start: 10.2 MB, stop: 20.5 MB)
2/20/2014 3:45:00 PM -- Database read latency thresholds: (average: 20 msec/read, maximum: 100 msec/read).
2/20/2014 3:45:00 PM -- Log write latency thresholds: (average: 10 msec/write, maximum: 100 msec/write).
2/20/2014 3:45:03 PM -- Operation mix: Sessions 5, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
2/20/2014 3:45:03 PM -- Performance logging started (interval: 15000 ms).
2/20/2014 3:45:03 PM -- Generating log files ...
2/20/2014 6:09:18 PM -- C:\DB\DB1 (102.0% generated), C:\DB\DB2 (100.2% generated), C:\DB\DB3 (101.2% generated) and C:\DB\DB4 (100.2% generated)
2/20/2014 6:09:18 PM -- Performance logging has ended.
2/20/2014 6:09:18 PM -- JetInterop batch transaction stats: 17006, 17006, 17005 and 17005.
2/20/2014 6:09:18 PM -- Dispatching transactions ends.
2/20/2014 6:09:18 PM -- Shutting down databases ...
2/20/2014 6:09:19 PM -- Instance2528.1 (complete), Instance2528.2 (complete), Instance2528.3 (complete) and Instance2528.4 (complete)
2/20/2014 6:09:19 PM -- C:\Program Files\Exchange Jetstress\Performance_2014_2_20_15_45_0.blg has 576 samples.
2/20/2014 6:09:19 PM -- Creating test report ...
2/20/2014 6:09:22 PM -- Instance2528.1 has 14.9 for I/O Database Reads Average Latency.
2/20/2014 6:09:22 PM -- Instance2528.1 has 1.2 for I/O Log Writes Average Latency.
2/20/2014 6:09:22 PM -- Instance2528.1 has 1.2 for I/O Log Reads Average Latency.
2/20/2014 6:09:22 PM -- Instance2528.2 has 14.2 for I/O Database Reads Average Latency.
2/20/2014 6:09:22 PM -- Instance2528.2 has 1.2 for I/O Log Writes Average Latency.
2/20/2014 6:09:22 PM -- Instance2528.2 has 1.2 for I/O Log Reads Average Latency.
2/20/2014 6:09:22 PM -- Instance2528.3 has 14.2 for I/O Database Reads Average Latency.
2/20/2014 6:09:22 PM -- Instance2528.3 has 1.2 for I/O Log Writes Average Latency.
2/20/2014 6:09:22 PM -- Instance2528.3 has 1.2 for I/O Log Reads Average Latency.
2/20/2014 6:09:22 PM -- Instance2528.4 has 14.9 for I/O Database Reads Average Latency.
2/20/2014 6:09:22 PM -- Instance2528.4 has 1.2 for I/O Log Writes Average Latency.
2/20/2014 6:09:22 PM -- Instance2528.4 has 1.2 for I/O Log Reads Average Latency.
2/20/2014 6:09:22 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.



2/20/2014 6:09:22 PM -- The test has 0 Database Page Fault Stalls/sec samples higher than 0.
2/20/2014 6:09:22 PM -- C:\Program Files\Exchange Jetstress\Performance_2014_2_20_15_45_0.xml has 575 samples queried.
2/20/2014 6:09:22 PM -- C:\Program Files\Exchange Jetstress\Performance_2014_2_20_15_45_0.html was saved.
2/20/2014 7:32:13 PM -- Performance logging started (interval: 2000 ms).
2/20/2014 7:32:13 PM -- Recovering databases ...
2/20/2014 7:47:53 PM -- Performance logging has ended.
2/20/2014 7:47:53 PM -- Instance2528.1 (939.8868744), Instance2528.2 (883.9285983), Instance2528.3 (895.3324176) and Instance2528.4 (923.9745684)
2/20/2014 7:47:53 PM -- C:\Program Files\Exchange Jetstress\SoftRecovery_2014_2_20_19_32_10.blg has 463 samples.
2/20/2014 7:47:53 PM -- Creating test report ...

