



# Dell Storage Center SC4020 v6.5 with iSCSI - 7,000 Mailbox Exchange 2013 Resiliency Storage Solution

Microsoft ESRP 4.0

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# 1 Executive summary

This document provides information on a specific Dell Storage Center SC4020 solution for Microsoft Exchange Server, based on the Microsoft Exchange Solution Reviewed Program (ESRP) – Storage program.

The ESRP – Storage program was developed by Microsoft Corporation to provide a common storage testing framework for vendors for information on its storage solutions with Microsoft Exchange Server software. Details about the Microsoft ESRP – Storage program are available at <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 one Database Availability Group (DAG) and two copies of every database. The tested environment simulates all users in this DAG running on a single Storage Center array, or half of the solution. The number of users simulated was 7,000 across four servers, with 1,750 mailboxes per server. The mailbox size was 1.5GB per user. Each server has four 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 Storage Center (SC4020) v6.5, a redundant controller pair, with redundant front-end and back-end connections. The front-end connections are iSCSI-based, over redundant 10GbE fabrics, with 2 x 10GbE ports per server, and 2 x 10GbE ports per storage controller. One 24 bay 2.5" built-in drive enclosure was utilized with each Storage Center.

The disk connectivity was SAS 6Gbps and the disk drives used were SAS 10K 900GB. The spindle count was 23 disks/1 spares for database and logs, on a dedicated disk pool on each Storage Center. As a redundant solution, databases and logs were stored together on the same volumes using Microsoft best practices. All volumes are RAID 5.

Information about compatibility is available at <http://www.windowsservercatalog.com/item.aspx?itemId=467135f9-8f78-bfed-b511-f62d42b2d1cb&bCatID=1338>.



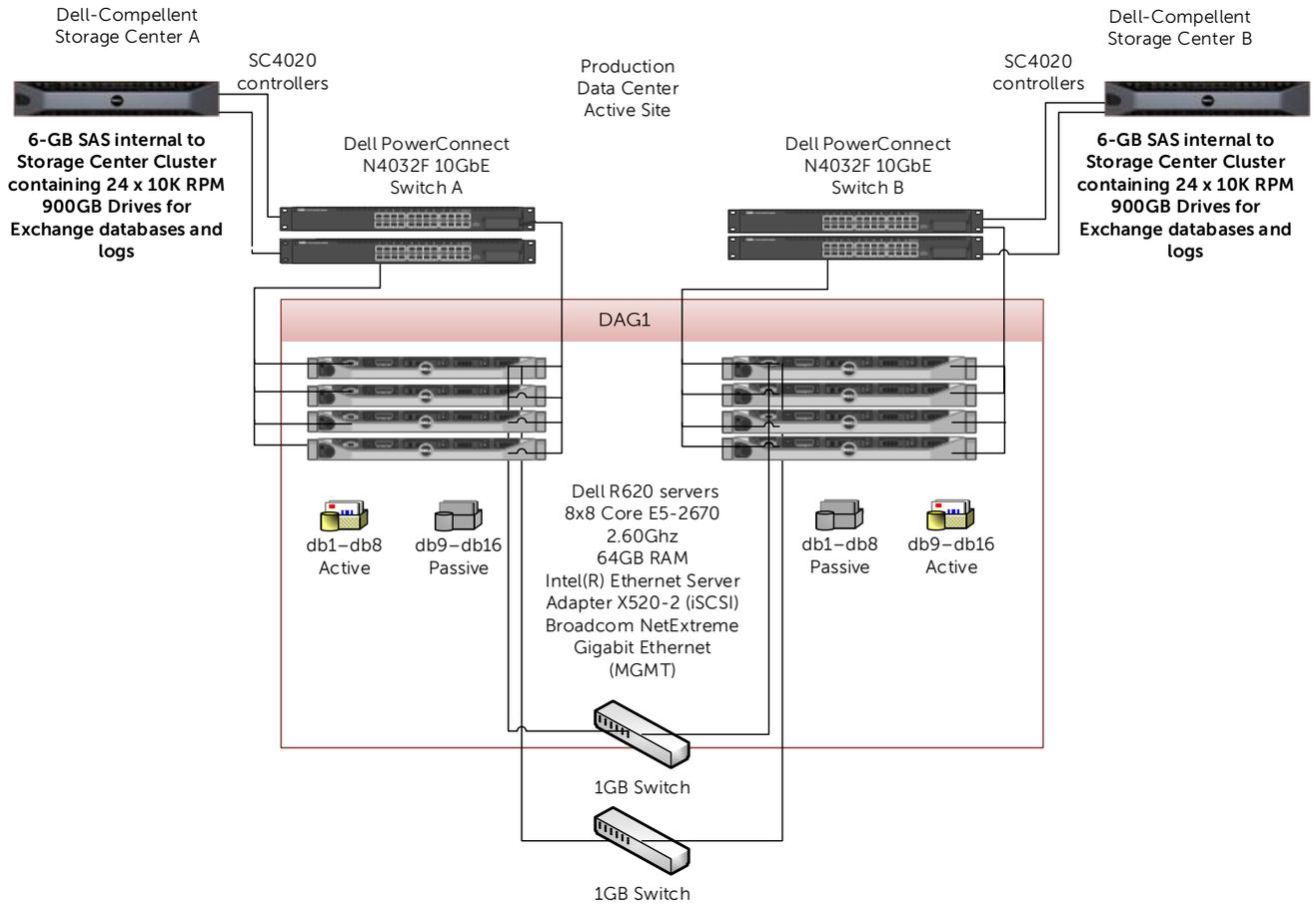


Figure 1 Highly available data center design

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.



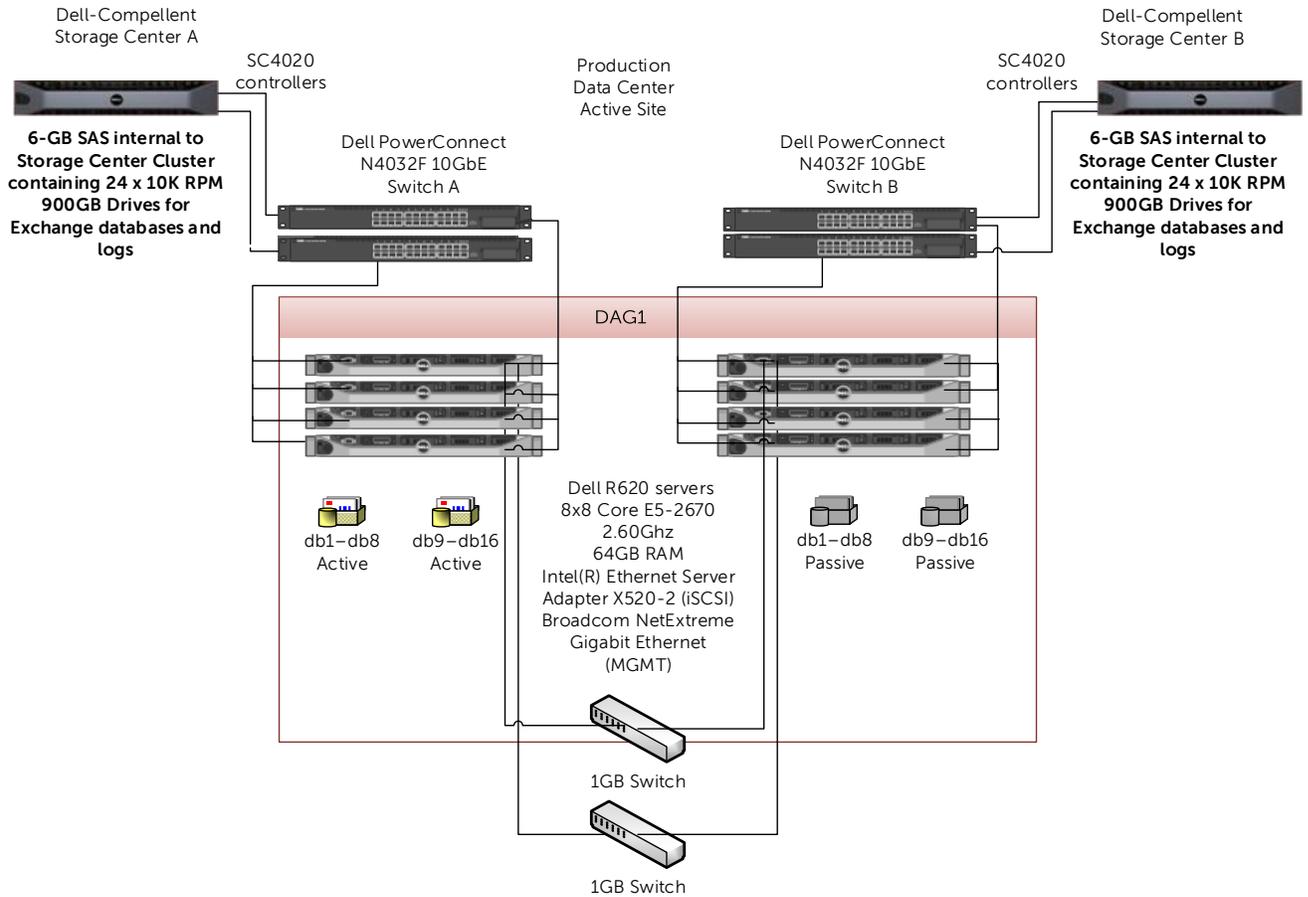


Figure 2 Tested configuration with Storage Center A with full user load and Storage Center B offline

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 I/O 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 Storage Center (SC4020) solution

### 2.1 A modular hardware design

The Dell SC4020 hardware design consists of a 24 x 2.5" drive system with dual controllers, providing automatic failover, combined in a single chassis. Dell SC4020 can seamlessly connect to any open-systems server without the need for server side agents. Organizations can utilize iSCSI or 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 Storage Center 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 Storage Enterprise Manager further simplifies storage management by providing comprehensive monitoring of all local and remote Storage Center environments.

Enterprise Manager better insight into Storage Center deployments and reduces planning and configuration time for remote replications.

### 2.4 About Microsoft ESRP-Storage program

The Microsoft 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>.

## 2.5 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 organization
2. Unlimited number of hosts can be attached via iSCSI connection
3. User I/O profile (.10 I/OPS per user, .12 tested, giving 20% headroom).
4. User mailbox size (1.5 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 RAID 10, RAID 5, and RAID 6 can be blended, with fully automated tiered storage providing the most efficient and best performing storage where needed.

## 2.6 Volume sizing

The volume size tested was just large enough to support the database size. Volumes on Dell SC4020 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 Storage 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 88% 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

Configuration Item	Detail
Number of Exchange mailboxes simulated	7,000
Number of Database Availability Groups (DAGs)	1
Number of servers/DAG	8
Number of active mailboxes/server	875
Number of databases/host	4
Number of copies/database	2
Number of mailboxes/database	437 or 438
Simulated profile: I/Os per second per mailbox (I/OPS, include 20% headroom)	.10 (.12 tested)
Database/Log LUN size	750 GB
Total database size for performance testing	10.5 TB
% storage capacity used by Exchange database*	88.28%

\* 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 no data, will consume no disk space.



## 3.2 Primary storage hardware

Table 2 Primary storage hardware

Configuration Item	Detail
Storage Connectivity (Fiber Channel, SAS, SATA, iSCSI)	iSCSI
Storage model and OS/firmware revision	Dell Storage Center (SC4020) v6.5 <a href="http://www.windowsservercatalog.com/item.aspx?idItem=467135f9-8f78-bfed-b511-f62d42b2d1cb&amp;bCatID=1338">http://www.windowsservercatalog.com/item.aspx?idItem=467135f9-8f78-bfed-b511-f62d42b2d1cb&amp;bCatID=1338</a>
Storage cache	16 GB
Number of storage controllers	2
Number of storage ports	2 active iSCSI ports per controller
Maximum bandwidth of storage connectivity to host	20 Gb/sec (2x10Gb GB HBA)
Switch type/model/firmware revision	Dell PowerConnect N4032F 10GbE Switches Firmware version 6.1.2.4
HBA model and firmware	Chelsio T320 Dual Port LP iSCSI Adapter, Firmware version: 7.8.0  Jumbo Frames utilized
Number of HBA's/host	1 x Chelsio T320 Dual Port LP iSCSI HBA
Host server type	2x8 Core E5-2670 2.60Ghz 64GB RAM
Total number of disks tested in solution	23 Active for DB and logs with 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	Intel(R) Ethernet Server Adapter X520-2 Driver Version: 3.9.58.9043
HBA Queue Depth Setting	65535
Multi-Pathing (MPI/O)	Microsoft Windows Server 2012 R2 MPI/O Round-Robin(In-Box DSM)
Host OS	Windows Server 2012 R2 Datacenter (6.2.9200.0)
ESE.dll file version	15.00.0995.021
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)	18.83 TB
Raid level	RAID 5
Total formatted capacity	11.64 TB
Storage capacity utilization	73.05 %
Database capacity utilization	88.28%



## 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 SC4020 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 SC4020 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 SC4020 provides increased storage performance, availability and utilization.

Dell SC4020 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 I/O with disk page boundaries. With Windows Server 2012 this is no longer required, as Windows 2012 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 when configured in a Database Availability Group (DAG); The Dell 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 Storage Center, visit the Dell TechCenter Exchange technical content collateral page:

<http://en.community.dell.com/techcenter/storage/w/wiki/5018.compellent-technical-content#Exchange>.

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.

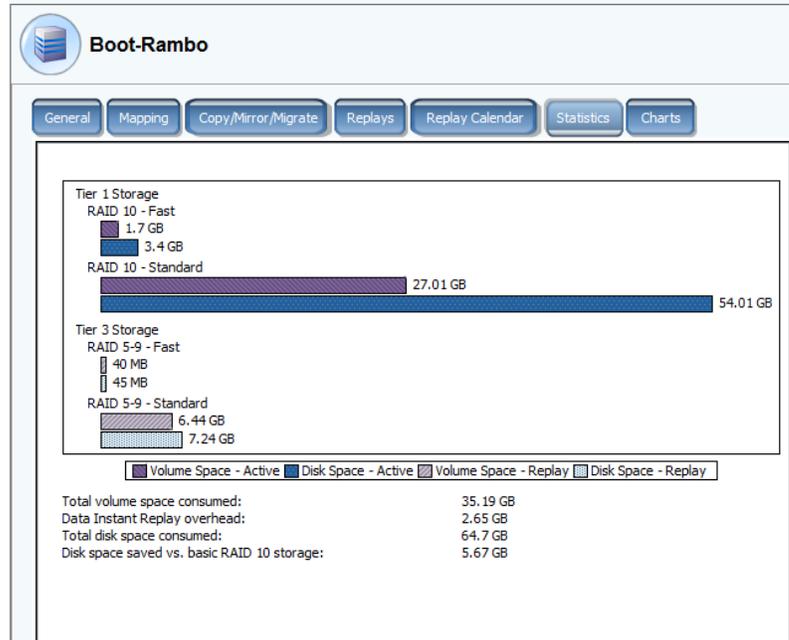
Each volume is configured by default with a recommended storage profile that manages the RAID configuration and provides optimal operation and performance for Exchange on the Dell Storage Center. With this configuration all data written to each volume is written at RAID10 providing the best possible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

Snapshots, known as Replays on the Dell 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.



Figure 3 Volume Statistics showing Data Progression

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



## 4.1 Core storage

1. Storage Center volumes by nature do not need disk sector alignment to perform properly. Dell Storage Center virtualizes all disk reads and writes, and applies them across system managed data pages, so by nature isolates disk I/Os from sector boundaries. The page to sector alignment for all volumes and data pages is handled automatically by the system.
2. The Dell Storage Center method of I/O and disk capacity aggregation provides maximum I/O to all hosted applications. All the I/Os for all of the assigned drives can be applied to all applications hosted on a Storage Center. If I/Os need to be dedicated to an application, such as Exchange, a dedicated disk pool can be created for each I/O type, such as database or log files. As Exchange 2013 I/O 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 I/O constrained system. Using Dell Storage Center 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 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 I/OP requirement.

4. Fluid Data architecture uses an I/OPS and storage aggregation model. This means that the I/OPS 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 I/O 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 I/O across all the available spindles.
5. Latency and I/O load can be measured real-time, or logged historically for reporting purposes. This means if a volume is performing poorly, its I/O can be reported over time, and compared to I/O load on the server, for any length of time needing to be stored. If reporting on the last month of I/O history, a report can be generated showing the I/O graphically or as a summary chart. This provides the ability to trend and determine when I/O performance changed. Volumes can also be summarized as a group, to determine if I/O 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. 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. 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 I/O 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 I/O level requires a spindle count equal to or greater than the I/OP target. If the I/O load exceeds the capabilities of the spindles poor performance will result. Dell along with a business partner, will work with customers to determine the correct spindle count. As I/O load grows the spindle count must increase to maintain performance. Using Dell Storage Enterprise Manager, current I/O loads can be tracked, and thresholds can be set for alerting, to warn of I/O usage approaching or exceeding acceptable performance levels. Because I/O 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 no down time.



## 4.2 Backup strategy

1. The Dell 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 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 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 Storage Center Replays 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.

## 4.3 Additional information

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



## 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 [Appendix A](#) later in this whitepaper.

### 5.1 Reliability

Tests in this framework to check storage reliability are run over a 24 hour period. The goal of these “Stress tests” is to verify that the storage can handle high I/O load for a long period of time. Both log and database files were analyzed for integrity after the stress test to ensure no database/log corruption.

The following list provides an overview of reliability results:

- No errors were reported in either the application or system log
- No errors were reported during the database and log checksum process
- No errors were reported during either the backup or restore process

### 5.2 Storage performance results

The Primary Storage performance testing is designed to exercise the storage with maximum sustainable Exchange type I/O for 2 hours. The test is to show how long it takes for the storage to respond to a specific mailbox profile I/O load. The data below is the sum of all of the logical disk I/O and average of all the logical disks I/O latency in the 2-hour test duration. Each server is listed separately and the aggregate numbers across all servers is listed as well.

#### **Individual Server Metrics:**

The sum of all I/O across all mailbox databases and the average latency across all databases on a per server basis.



Table 5 Server 1 – JS10

<b>Database I/O</b>	<b>Value</b>
Database Disks Transfers/sec	251.868
Database Disks Reads/sec	178.82
Database Disks Writes/sec	73.048
Average Database Disk Read Latency (ms)	17.053
Average Database Disk Write Latency (ms)	4.974
<b>Transaction Log I/O</b>	
Log Disks Writes/sec	17.317
Average Log Disk Write Latency (ms)	2.909

Table 6 Server 2 – JS11

<b>Database I/O</b>	<b>Value</b>
Database Disks Transfers/sec	249.154
Database Disks Reads/sec	177.233
Database Disks Writes/sec	71.921
Average Database Disk Read Latency (ms)	16.896
Average Database Disk Write Latency (ms)	4.926
<b>Transaction Log I/O</b>	
Log Disks Writes/sec	17.001
Average Log Disk Write Latency (ms)	2.884



Table 7 Server 3 – JS12

<b>Database I/O</b>	<b>Value</b>
Database Disks Transfers/sec	251.279
Database Disks Reads/sec	178.222
Database Disks Writes/sec	73.057
Average Database Disk Read Latency (ms)	16.954
Average Database Disk Write Latency (ms)	4.951
<b>Transaction Log I/O</b>	
Log Disks Writes/sec	17.351
Average Log Disk Write Latency (ms)	2.896

Table 8 Server 4 – JS13

<b>Database I/O</b>	<b>Value</b>
Database Disks Transfers/sec	248.064
Database Disks Reads/sec	176.143
Database Disks Writes/sec	71.921
Average Database Disk Read Latency (ms)	17.427
Average Database Disk Write Latency (ms)	4.946
<b>Transaction Log I/O</b>	
Log Disks Writes/sec	16.984
Average Log Disk Write Latency (ms)	2.9215



### Aggregate Server Metrics:

The sum of all I/O across all server mailbox databases and the average latency across all databases aggregated.

Table 9 All server's I/O aggregated

Database I/O	Value
Database Disks Transfers/sec	1000.365
Database Disks Reads/sec	710.418
Database Disks Writes/sec	289.947
Average Database Disk Read Latency (ms)	17.083
Average Database Disk Write Latency (ms)	4.949
<b>Transaction Log I/O</b>	
Log Disks Writes/sec	68.653
Average Log Disk Write Latency (ms)	2.903



## 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.

Table 10

Performance item	Detail
MB read/sec per database	58.97
MB read/sec total per server	235.87

### 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)	4.474



## 6 Conclusion

The testing shows the scalability and performance of the Dell Storage Center SC4020 v6.5 using iSCSI front-end connectivity.

This document was 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 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

Microsoft ESRP Program Website: <http://technet.microsoft.com/en-us/exchange/ff182054.aspx>

Dell Storage Website: <http://www.dell.com/storage/>

Dell TechCenter storage page:  
<http://en.community.dell.com/techcenter/storage/>



## A Appendix - Performance testing details

### A.1 Server 1 – JS10

Table 11 Test Summary

Overall Test Result	Pass
Machine Name	JS10
Test Description	1750 Mailboxes (7000 total) .12 I/OPS Profile, SluggishSessions=2 8 Threads Mailbox size 1536MB (1.5GB) 4 Databases iSCSI Initiator - 2 x10GbE ports per server/controller SC4020 900GB 10K Drives
Test Start Time	12/12/2014 11:15:09 AM
Test End Time	12/12/2014 2:04:49 PM
Collection Start Time	12/12/2014 11:21:49 AM
Collection End Time	12/12/2014 1:21:36 PM
Jetstress Version	15.00.0995.000
ESE Version	15.00.0995.021
Operating System	Windows Server 2012 R2 Datacenter (6.2.9200.0)
Performance Log	C:\Program Files\Exchange Jetstress\Performance_2014_12_12_11_15_18.blg



Table 12 Database sizing and throughput

Performance counter	Value
Achieved Transactional I/O per Second	216.721
Target Transactional I/O per Second	210
Initial Database Size (bytes)	2832279273472
Final Database Size (bytes)	2833084579840
Database Files (Count)	4

Table 13 Jetstress system parameters

Performance counter	Value
Thread Count	8
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 14 Database configuration

Performance counter	Value
Instance3032.1	Log path: C:\DB\DB1 Database: C:\DB\DB1\Jetstress001001.edb
Instance3032.2	Log path: C:\DB\DB2 Database: C:\DB\DB2\Jetstress002001.edb
Instance3032.3	Log path: C:\DB\DB3 Database: C:\DB\DB3\Jetstress003001.edb
Instance3032.4	Log path: C:\DB\DB4 Database: C:\DB\DB4\Jetstress004001.edb

Table 15 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
Instance3032.1	17.066	4.922	35.777	18.120	33160.158	34957.269	0.000	2.901	0.000	4.322	0.000	20592.965
Instance3032.2	16.767	5.009	36.207	18.481	33169.393	34909.729	0.000	2.927	0.000	4.352	0.000	20188.559
Instance3032.3	16.720	5.047	35.884	18.186	33126.370	34969.223	0.000	2.917	0.000	4.302	0.000	20455.413
Instance3032.4	17.660	4.919	35.804	18.261	33151.072	34967.694	0.000	2.894	0.000	4.341	0.000	20427.341



Table 16 Background Database Maintenance I/O performance

MSExchange Database ==> Instances	Database Maintenance I/O Reads/sec	Database Maintenance I/O Reads Average Bytes
Instance3032.1	8.796	261469.394
Instance3032.2	8.852	261453.008
Instance3032.3	8.876	261471.669
Instance3032.4	8.623	261423.196

Table 17 Log replication I/O performance

MSExchange Database ==> Instances	I/O Log Reads/sec	I/O Log Reads Average Bytes
Instance3032.1	0.377	146986.036
Instance3032.2	0.375	146137.048
Instance3032.3	0.373	145662.079
Instance3032.4	0.376	146386.775

Table 18 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
Instance3032.1	17.066	4.922	44.573	18.120	78214.090	34957.269	8.334	2.901	0.377	4.322	146986.036	20592.965
Instance3032.2	16.767	5.009	45.060	18.481	78016.832	34909.729	6.980	2.927	0.375	4.352	146137.048	20188.559
Instance3032.3	16.720	5.047	44.760	18.186	78405.929	34969.223	7.331	2.917	0.373	4.302	145662.079	20455.413
Instance3032.4	17.660	4.919	44.427	18.261	77459.020	34967.694	9.772	2.894	0.376	4.341	146386.775	20427.341



Table 19 Host system performance

Counter	Average	Minimum	Maximum
% Processor Time	0.242	0.029	1.036
Available MBytes	60886.990	60861.000	60981.000
Free System Page Table Entries	16164068.864	16163644.000	16164344.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	2013668285.729	2013437952.000	2013949952.000
Pool Paged Bytes	114812299.491	114634752.000	115535872.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

## A.2 Test log

```

12/12/2014 11:15:09 AM -- Preparing for testing ...
12/12/2014 11:15:14 AM -- Attaching databases ...
12/12/2014 11:15:14 AM -- Preparations for testing are complete.
12/12/2014 11:15:14 AM -- Starting transaction dispatch ..
12/12/2014 11:15:14 AM -- Database cache settings: (minimum: 128.0 MB, maximum: 1.0 GB)
12/12/2014 11:15:14 AM -- Database flush thresholds: (start: 10.2 MB, stop: 20.5 MB)
12/12/2014 11:15:18 AM -- Database read latency thresholds: (average: 20 msec/read, maximum: 100 msec/read).
12/12/2014 11:15:18 AM -- Log write latency thresholds: (average: 10 msec/write, maximum: 100 msec/write).
12/12/2014 11:15:20 AM -- Operation mix: Sessions 8, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
12/12/2014 11:15:20 AM -- Performance logging started (interval: 15000 ms).
12/12/2014 11:15:20 AM -- Attaining prerequisites:
12/12/2014 11:21:49 AM -- \MSExchange Database(JetstressWin)\Database Cache Size, Last: 969125900.0 (lower bound: 966367600.0, upper bound: none)
12/12/2014 1:21:49 PM -- Performance logging has ended.

```



```
12/12/2014 2:04:10 PM -- JetInterop batch transaction stats: 14272, 14272, 14272 and 14271.
12/12/2014 2:04:10 PM -- Dispatching transactions ends.
12/12/2014 2:04:11 PM -- Shutting down databases ...
12/12/2014 2:04:49 PM -- Instance3032.1 (complete), Instance3032.2 (complete), Instance3032.3 (complete) and Instance3032.4 (complete)
12/12/2014 2:04:49 PM -- C:\Program Files\Exchange Jetstress\Performance_2014_12_12_11_15_18.blg has 504 samples.
12/12/2014 2:04:49 PM -- Creating test report ...
12/12/2014 2:04:53 PM -- Instance3032.1 has 17.1 for I/O Database Reads Average Latency.
12/12/2014 2:04:53 PM -- Instance3032.1 has 2.9 for I/O Log Writes Average Latency.
12/12/2014 2:04:53 PM -- Instance3032.1 has 2.9 for I/O Log Reads Average Latency.
12/12/2014 2:04:53 PM -- Instance3032.2 has 16.8 for I/O Database Reads Average Latency.
12/12/2014 2:04:53 PM -- Instance3032.2 has 2.9 for I/O Log Writes Average Latency.
12/12/2014 2:04:53 PM -- Instance3032.2 has 2.9 for I/O Log Reads Average Latency.
12/12/2014 2:04:53 PM -- Instance3032.3 has 16.7 for I/O Database Reads Average Latency.
12/12/2014 2:04:53 PM -- Instance3032.3 has 2.9 for I/O Log Writes Average Latency.
12/12/2014 2:04:53 PM -- Instance3032.3 has 2.9 for I/O Log Reads Average Latency.
12/12/2014 2:04:53 PM -- Instance3032.4 has 17.7 for I/O Database Reads Average Latency.
12/12/2014 2:04:53 PM -- Instance3032.4 has 2.9 for I/O Log Writes Average Latency.
12/12/2014 2:04:53 PM -- Instance3032.4 has 2.9 for I/O Log Reads Average Latency.
12/12/2014 2:04:53 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.
12/12/2014 2:04:53 PM -- The test has 0 Database Page Fault Stalls/sec samples higher than 0.
12/12/2014 2:04:53 PM -- C:\Program Files\Exchange Jetstress\Performance\_2014\_12\_12\_11\_15\_18.xml has 478 samples queried.
```



## A.3 Server 2 – JS11

Table 20 Test summary

Overall Test Result	Pass
Machine Name	JS11
Test Description	1750 Mailboxes (7000 total) .12 I/OPS Profile, SluggishSessions=2 8 Threads Mailbox size 1536MB (1.5GB) 4 Databases iSCSI Initiator - 2 x10GbE ports per server/controller SC4020 900GB 10K Drives
Test Start Time	12/12/2014 11:15:11 AM
Test End Time	12/12/2014 2:04:49 PM
Collection Start Time	12/12/2014 11:21:54 AM
Collection End Time	12/12/2014 1:21:54 PM
Jetstress Version	15.00.0995.000
ESE Version	15.00.0995.021
Operating System	Windows Server 2012 R2 Datacenter (6.2.9200.0)
Performance Log	C:\Program Files\Exchange Jetstress\Performance_2014_12_12_11_15_21.blg



Table 21 Database sizing and throughput

Performance counter	Value
Achieved Transactional I/O per Second	213.631
Target Transactional I/O per Second	210
Initial Database Size (bytes)	2832077946880
Final Database Size (bytes)	2832858087424
Database Files (Count)	4

Table 22 Jetstress system parameters

Performance counter	Value
Thread Count	8
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 23 Database configuration

Performance counter	Value
Instance3728.1	Log path: C:\DB\DB1 Database: C:\DB\DB1\Jetstress001001.edb
Instance3728.2	Log path: C:\DB\DB2 Database: C:\DB\DB2\Jetstress002001.edb
Instance3728.3	Log path: C:\DB\DB3 Database: C:\DB\DB3\Jetstress003001.edb
Instance3728.4	Log path: C:\DB\DB4 Database: C:\DB\DB4\Jetstress004001.edb

Table 24 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
Instance3728.1	16.267	4.824	35.312	17.872	33211.839	34973.579	0.000	2.883	0.000	4.232	0.000	20717.529
Instance3728.2	16.523	4.943	35.462	18.031	33168.564	34954.780	0.000	2.875	0.000	4.226	0.000	20627.847
Instance3728.3	17.345	4.983	35.426	17.981	33186.283	34968.543	0.000	2.876	0.000	4.285	0.000	20426.797
Instance3728.4	17.452	4.954	35.511	18.037	33194.523	34968.148	0.000	2.902	0.000	4.258	0.000	20545.109



Table 25 Background Database Maintenance I/O performance

MSEExchange Database ==> Instances	Database Maintenance I/O Reads/sec	Database Maintenance I/O Reads Average Bytes
Instance3728.1	8.969	261496.277
Instance3728.2	9.009	261493.099
Instance3728.3	8.779	261568.301
Instance3728.4	8.764	261502.708

Table 26 Log Replication I/O performance

MSEExchange Database ==> Instances	I/O Log Reads/sec	I/O Log Reads Average Bytes
Instance3728.1	0.372	145811.983
Instance3728.2	0.371	144351.084
Instance3728.3	0.371	145125.392
Instance3728.4	0.373	145458.129

Table 27 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
Instance3728.1	16.267	4.824	44.281	17.872	79450.131	34973.579	9.114	2.883	0.372	4.232	145811.983	20717.529
Instance3728.2	16.523	4.943	44.471	18.031	79424.927	34954.780	7.302	2.875	0.371	4.226	144351.084	20627.847
Instance3728.3	17.345	4.983	44.206	17.981	78543.013	34968.543	7.258	2.876	0.371	4.285	145125.392	20426.797
Instance3728.4	17.452	4.954	44.275	18.037	78384.790	34968.148	7.300	2.902	0.373	4.258	145458.129	20545.109



Table 28 Host system performance

Counter	Average	Minimum	Maximum
% Processor Time	0.233	0.005	0.525
Available MBytes	60995.415	60964.000	61065.000
Free System Page Table Entries	16166711.704	16166329.000	16166954.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	2019527686.413	2019311616.000	2019799040.000
Pool Paged Bytes	114456717.094	114245632.000	115089408.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

## A.4 Test log

```

12/12/2014 11:15:11 AM -- Preparing for testing ...
12/12/2014 11:15:16 AM -- Attaching databases ...
12/12/2014 11:15:16 AM -- Preparations for testing are complete.
12/12/2014 11:15:16 AM -- Starting transaction dispatch ..
12/12/2014 11:15:16 AM -- Database cache settings: (minimum: 128.0 MB, maximum: 1.0 GB)
12/12/2014 11:15:16 AM -- Database flush thresholds: (start: 10.2 MB, stop: 20.5 MB)
12/12/2014 11:15:21 AM -- Database read latency thresholds: (average: 20 msec/read, maximum: 100 msec/read).
12/12/2014 11:15:21 AM -- Log write latency thresholds: (average: 10 msec/write, maximum: 100 msec/write).
12/12/2014 11:15:22 AM -- Operation mix: Sessions 8, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
12/12/2014 11:15:22 AM -- Performance logging started (interval: 15000 ms).
12/12/2014 11:15:22 AM -- Attaining prerequisites:
12/12/2014 11:21:54 AM -- \MSExchange Database(JetstressWin)\Database Cache Size, Last: 967557100.0 (lower bound: 966367600.0, upper
bound: none)

```



12/12/2014 1:21:55 PM -- Performance logging has ended.  
12/12/2014 2:04:07 PM -- JetInterop batch transaction stats: 14057, 14057, 14056 and 14056.  
12/12/2014 2:04:07 PM -- Dispatching transactions ends.  
12/12/2014 2:04:11 PM -- Shutting down databases ...  
12/12/2014 2:04:49 PM -- Instance3728.1 (complete), Instance3728.2 (complete), Instance3728.3 (complete) and Instance3728.4 (complete)  
12/12/2014 2:04:49 PM -- C:\Program Files\Exchange Jetstress\Performance\_2014\_12\_12\_11\_15\_21.blg has 505 samples.  
12/12/2014 2:04:49 PM -- Creating test report ...  
12/12/2014 2:04:53 PM -- Instance3728.1 has 16.3 for I/O Database Reads Average Latency.  
12/12/2014 2:04:53 PM -- Instance3728.1 has 2.9 for I/O Log Writes Average Latency.  
12/12/2014 2:04:53 PM -- Instance3728.1 has 2.9 for I/O Log Reads Average Latency.  
12/12/2014 2:04:53 PM -- Instance3728.2 has 16.5 for I/O Database Reads Average Latency.  
12/12/2014 2:04:53 PM -- Instance3728.2 has 2.9 for I/O Log Writes Average Latency.  
12/12/2014 2:04:53 PM -- Instance3728.2 has 2.9 for I/O Log Reads Average Latency.  
12/12/2014 2:04:53 PM -- Instance3728.3 has 17.3 for I/O Database Reads Average Latency.  
12/12/2014 2:04:53 PM -- Instance3728.3 has 2.9 for I/O Log Writes Average Latency.  
12/12/2014 2:04:53 PM -- Instance3728.3 has 2.9 for I/O Log Reads Average Latency.  
12/12/2014 2:04:53 PM -- Instance3728.4 has 17.5 for I/O Database Reads Average Latency.  
12/12/2014 2:04:53 PM -- Instance3728.4 has 2.9 for I/O Log Writes Average Latency.  
12/12/2014 2:04:53 PM -- Instance3728.4 has 2.9 for I/O Log Reads Average Latency.  
12/12/2014 2:04:53 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.  
12/12/2014 2:04:53 PM -- The test has 0 Database Page Fault Stalls/sec samples higher than 0.  
12/12/2014 2:04:53 PM -- C:\Program Files\Exchange Jetstress\Performance\_2014\_12\_12\_11\_15\_21.xml has 478 samples queried.



## A.5 Server 3 – JS12

Table 29 Test summary

Overall Test Result	Pass
Machine Name	JS12
Test Description	1750 Mailboxes (7000 total) .12 I/OPS Profile, SluggishSessions=2 8 Threads Mailbox size 1536MB (1.5GB) 4 Databases iSCSI Initiator - 2 x10GbE ports per server/controller SC4020 900GB 10K Drives
Test Start Time	12/12/2014 11:15:13 AM
Test End Time	12/12/2014 2:04:45 PM
Collection Start Time	12/12/2014 11:21:50 AM
Collection End Time	12/12/2014 1:21:40 PM
Jetstress Version	15.00.0995.000
ESE Version	15.00.0995.021
Operating System	Windows Server 2012 R2 Datacenter (6.2.9200.0)
Performance Log	C:\Program Files\Exchange Jetstress\Performance_2014_12_12_11_15_23.blg



Table 30 Database sizing and throughput

Performance counter	Value
Achieved Transactional I/O per Second	215.958
Target Transactional I/O per Second	210
Initial Database Size (bytes)	2832228941824
Final Database Size (bytes)	2833042636800
Database Files (Count)	4

Table 31 Jetstress system parameters

Performance counter	Value
Thread Count	8
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 32 Database configuration

Performance counter	Value
nstance3312.1	Log path: C:\DB\DB1 Database: C:\DB\DB1\Jetstress001001.edb
Instance3312.2	Log path: C:\DB\DB2 Database: C:\DB\DB2\Jetstress002001.edb
Instance3312.3	Log path: C:\DB\DB3 Database: C:\DB\DB3\Jetstress003001.edb
Instance3312.4	Log path: C:\DB\DB4 Database: C:\DB\DB4\Jetstress004001.edb

Table 33 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
Instance3312.1	16.375	4.827	35.660	18.230	33167.723	34960.024	0.000	2.861	0.000	4.328	0.000	20358.953
Instance3312.2	16.420	5.199	35.923	18.406	33183.460	34892.442	0.000	2.807	0.000	4.365	0.000	20133.652
Instance3312.3	18.057	5.021	35.680	18.133	33155.846	34959.972	0.000	2.956	0.000	4.309	0.000	20261.120
Instance3312.4	16.966	4.759	35.638	18.288	33138.265	34950.945	0.000	2.961	0.000	4.349	0.000	20507.624



Table 34 Background Database Maintenance I/O performance

MSEExchange Database ==> Instances	Database Maintenance I/O Reads/sec	Database Maintenance I/O Reads Average Bytes
Instance3312.1	8.954	261437.313
Instance3312.2	8.987	261315.459
Instance3312.3	8.533	261362.619
Instance3312.4	8.847	261455.990

Table 35 Log Replication I/O performance

MSEExchange Database ==> Instances	I/O Log Reads/sec	I/O Log Reads Average Bytes
Instance3312.1	0.375	147609.508
Instance3312.2	0.372	145555.034
Instance3312.3	0.371	144351.084
Instance3312.4	0.380	147959.098

Table 36 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
Instance3312.1	16.375	4.827	44.614	18.230	78981.417	34960.024	9.007	2.861	0.375	4.328	147609.508	20358.953
Instance3312.2	16.420	5.199	44.910	18.406	78835.149	34892.442	7.300	2.807	0.372	4.365	145555.034	20133.652
Instance3312.3	18.057	5.021	44.213	18.133	77199.951	34959.972	7.758	2.956	0.371	4.309	144351.084	20261.120
Instance3312.4	16.966	4.759	44.485	18.288	78545.530	34950.945	6.852	2.961	0.380	4.349	147959.098	20507.624



Table 37 Host system performance

Counter	Average	Minimum	Maximum
% Processor Time	0.232	0.102	0.615
Available MBytes	61021.305	60993.000	61103.000
Free System Page Table Entries	16170344.718	16170020.000	16170562.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	2011892152.384	2011648000.000	2012110848.000
Pool Paged Bytes	111689266.238	111460352.000	111955968.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

## A.6 Test log

```

12/12/2014 11:15:13 AM -- Preparing for testing ...
12/12/2014 11:15:18 AM -- Attaching databases ...
12/12/2014 11:15:18 AM -- Preparations for testing are complete.
12/12/2014 11:15:18 AM -- Starting transaction dispatch ..
12/12/2014 11:15:18 AM -- Database cache settings: (minimum: 128.0 MB, maximum: 1.0 GB)
12/12/2014 11:15:18 AM -- Database flush thresholds: (start: 10.2 MB, stop: 20.5 MB)
12/12/2014 11:15:23 AM -- Database read latency thresholds: (average: 20 msec/read, maximum: 100 msec/read).
12/12/2014 11:15:23 AM -- Log write latency thresholds: (average: 10 msec/write, maximum: 100 msec/write).
12/12/2014 11:15:24 AM -- Operation mix: Sessions 8, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
12/12/2014 11:15:24 AM -- Performance logging started (interval: 15000 ms).
12/12/2014 11:15:24 AM -- Attaining prerequisites:
12/12/2014 11:21:50 AM -- \MSExchange Database(JetstressWin)\Database Cache Size, Last: 966869000.0 (lower bound: 966367600.0, upper bound: none)
12/12/2014 1:21:51 PM -- Performance logging has ended.

```



```
12/12/2014 2:04:04 PM -- JetInterop batch transaction stats: 14170, 14170, 14169 and 14169.
12/12/2014 2:04:04 PM -- Dispatching transactions ends.
12/12/2014 2:04:07 PM -- Shutting down databases ...
12/12/2014 2:04:45 PM -- Instance3312.1 (complete), Instance3312.2 (complete), Instance3312.3 (complete) and Instance3312.4 (complete)
12/12/2014 2:04:45 PM -- C:\Program Files\Exchange Jetstress\Performance_2014_12_12_11_15_23.blg has 504 samples.
12/12/2014 2:04:45 PM -- Creating test report ...
12/12/2014 2:04:49 PM -- Instance3312.1 has 16.4 for I/O Database Reads Average Latency.
12/12/2014 2:04:49 PM -- Instance3312.1 has 2.9 for I/O Log Writes Average Latency.
12/12/2014 2:04:49 PM -- Instance3312.1 has 2.9 for I/O Log Reads Average Latency.
12/12/2014 2:04:49 PM -- Instance3312.2 has 16.4 for I/O Database Reads Average Latency.
12/12/2014 2:04:49 PM -- Instance3312.2 has 2.8 for I/O Log Writes Average Latency.
12/12/2014 2:04:49 PM -- Instance3312.2 has 2.8 for I/O Log Reads Average Latency.
12/12/2014 2:04:49 PM -- Instance3312.3 has 18.1 for I/O Database Reads Average Latency.
12/12/2014 2:04:49 PM -- Instance3312.3 has 3.0 for I/O Log Writes Average Latency.
12/12/2014 2:04:49 PM -- Instance3312.3 has 3.0 for I/O Log Reads Average Latency.
12/12/2014 2:04:49 PM -- Instance3312.4 has 17.0 for I/O Database Reads Average Latency.
12/12/2014 2:04:49 PM -- Instance3312.4 has 3.0 for I/O Log Writes Average Latency.
12/12/2014 2:04:49 PM -- Instance3312.4 has 3.0 for I/O Log Reads Average Latency.
12/12/2014 2:04:49 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.
12/12/2014 2:04:49 PM -- The test has 0 Database Page Fault Stalls/sec samples higher than 0.
12/12/2014 2:04:50 PM -- C:\Program Files\Exchange Jetstress\Performance_2014_12_12_11_15_23.xml has 478 samples queried.
```



## A.7 Server 4 – JS13

Table 38 Test summary

Overall Test Result	Pass
Machine Name	JS13
Test Description	1750 Mailboxes (7000 total) .12 I/OPS Profile, SluggishSessions=2 8 Threads Mailbox size 1536MB (1.5GB) 4 Databases iSCSI Initiator - 2 x10GbE ports per server/controller SC4020 900GB 10K Drives
Test Start Time	12/12/2014 11:15:15 AM
Test End Time	12/12/2014 2:04:03 PM
Collection Start Time	12/12/2014 11:21:59 AM
Collection End Time	12/12/2014 1:21:58 PM
Jetstress Version	15.00.0995.000
ESE Version	15.00.0995.021
Operating System	Windows Server 2012 R2 Datacenter (6.2.9200.0)
Performance Log	C:\Program Files\Exchange Jetstress\Performance_2014_12_12_11_15_25.blg



Table 39 Database sizing and throughput

Performance counter	Value
Achieved Transactional I/O per Second	213.079
Target Transactional I/O per Second	210
Initial Database Size (bytes)	2832036003840
Final Database Size (bytes)	2832816144384
Database Files (Count)	4

Table 40 Jetstress system parameters

Performance counter	Value
Thread Count	8
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 41 Database configuration

Performance counter	Value
Instance1644.1	Log path: C:\DB\DB1 Database: C:\DB\DB1\Jetstress001001.edb
Instance1644.2	Log path: C:\DB\DB2 Database: C:\DB\DB2\Jetstress002001.edb
Instance1644.3	Log path: C:\DB\DB3 Database: C:\DB\DB3\Jetstress003001.edb
Instance1644.4	Log path: C:\DB\DB4 Database: C:\DB\DB4\Jetstress004001.edb

Table 42 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
Instance1644.1	18.466	4.833	35.469	18.055	33229.766	34936.754	0.000	2.898	0.000	4.272	0.000	20228.479
Instance1644.2	16.597	5.063	35.205	18.035	33245.069	34977.014	0.000	2.997	0.000	4.219	0.000	20480.227
Instance1644.3	16.924	4.996	35.237	17.870	33169.033	34930.604	0.000	2.940	0.000	4.191	0.000	20510.255
Instance1644.4	17.724	4.892	35.246	17.961	33242.563	34933.089	0.000	2.851	0.000	4.302	0.000	20094.093



Table 43 Background Database Maintenance I/O performance

MSEExchange Database ==> Instances	Database Maintenance I/O Reads/sec	Database Maintenance I/O Reads Average Bytes
Instance1644.1	8.392	261492.792
Instance1644.2	9.002	261587.667
Instance1644.3	8.918	261357.378
Instance1644.4	8.672	261501.778

Table 44 Log Replication I/O performance

MSEExchange Database ==> Instances	I/O Log Reads/sec	I/O Log Reads Average Bytes
Instance1644.1	0.367	143229.424
Instance1644.2	0.367	143452.974
Instance1644.3	0.364	142076.311
Instance1644.4	0.367	142404.960

Table 45 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
Instance1644.1	18.466	4.833	43.862	18.055	76905.134	34936.754	8.799	2.898	0.367	4.272	143229.424	20228.479
Instance1644.2	16.597	5.063	44.206	18.035	79741.274	34977.014	6.142	2.997	0.367	4.219	143452.974	20480.227
Instance1644.3	16.924	4.996	44.156	17.870	79258.057	34930.604	7.974	2.940	0.364	4.191	142076.311	20510.255
Instance1644.4	17.724	4.892	43.919	17.961	78315.758	34933.089	7.651	2.851	0.367	4.302	142404.960	20094.093



Table 46 Host system performance

Counter	Average	Minimum	Maximum
% Processor Time	0.223	0.032	0.627
Available MBytes	61020.152	60987.000	61088.000
Free System Page Table Entries	16168425.601	16167954.000	16168696.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	2011787922.438	2011566080.000	2012053504.000
Pool Paged Bytes	110308170.288	110161920.000	110727168.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

## A.8 Test log

```

12/12/2014 11:15:15 AM -- Preparing for testing ...
12/12/2014 11:15:20 AM -- Attaching databases ...
12/12/2014 11:15:20 AM -- Preparations for testing are complete.
12/12/2014 11:15:20 AM -- Starting transaction dispatch ..
12/12/2014 11:15:20 AM -- Database cache settings: (minimum: 128.0 MB, maximum: 1.0 GB)
12/12/2014 11:15:20 AM -- Database flush thresholds: (start: 10.2 MB, stop: 20.5 MB)
12/12/2014 11:15:25 AM -- Database read latency thresholds: (average: 20 msec/read, maximum: 100 msec/read).
12/12/2014 11:15:25 AM -- Log write latency thresholds: (average: 10 msec/write, maximum: 100 msec/write).
12/12/2014 11:15:26 AM -- Operation mix: Sessions 8, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
12/12/2014 11:15:26 AM -- Performance logging started (interval: 15000 ms).
12/12/2014 11:15:26 AM -- Attaining prerequisites:
12/12/2014 11:21:59 AM -- \MSExchange Database(JetstressWin)\Database Cache Size, Last: 967319600.0 (lower bound: 966367600.0, upper
bound: none)
12/12/2014 1:22:00 PM -- Performance logging has ended.
12/12/2014 2:04:01 PM -- JetInterop batch transaction stats: 13949, 13949, 13949 and 13948.

```



```
12/12/2014 2:04:01 PM -- Dispatching transactions ends.
12/12/2014 2:04:01 PM -- Shutting down databases ...
12/12/2014 2:04:03 PM -- Instance1644.1 (complete), Instance1644.2 (complete), Instance1644.3 (complete) and Instance1644.4 (complete)
12/12/2014 2:04:03 PM -- C:\Program Files\Exchange Jetstress\Performance_2014_12_12_11_15_25.blg has 505 samples.
12/12/2014 2:04:03 PM -- Creating test report ...
12/12/2014 2:04:07 PM -- Instance1644.1 has 18.5 for I/O Database Reads Average Latency.
12/12/2014 2:04:07 PM -- Instance1644.1 has 2.9 for I/O Log Writes Average Latency.
12/12/2014 2:04:07 PM -- Instance1644.1 has 2.9 for I/O Log Reads Average Latency.
12/12/2014 2:04:07 PM -- Instance1644.2 has 16.6 for I/O Database Reads Average Latency.
12/12/2014 2:04:07 PM -- Instance1644.2 has 3.0 for I/O Log Writes Average Latency.
12/12/2014 2:04:07 PM -- Instance1644.2 has 3.0 for I/O Log Reads Average Latency.
12/12/2014 2:04:07 PM -- Instance1644.3 has 16.9 for I/O Database Reads Average Latency.
12/12/2014 2:04:07 PM -- Instance1644.3 has 2.9 for I/O Log Writes Average Latency.
12/12/2014 2:04:07 PM -- Instance1644.3 has 2.9 for I/O Log Reads Average Latency.
12/12/2014 2:04:07 PM -- Instance1644.4 has 17.7 for I/O Database Reads Average Latency.
12/12/2014 2:04:07 PM -- Instance1644.4 has 2.9 for I/O Log Writes Average Latency.
12/12/2014 2:04:07 PM -- Instance1644.4 has 2.9 for I/O Log Reads Average Latency.
12/12/2014 2:04:07 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.
12/12/2014 2:04:07 PM -- The test has 0 Database Page Fault Stalls/sec samples higher than 0.
12/12/2014 2:04:07 PM -- C:\Program Files\Exchange Jetstress\Performance_2014_12_12_11_15_25.xml has 478 samples queried.
```



## B Stress testing

### B.1 Server 1 – JS10

Table 47 Test summary

<b>Overall Test Result</b>	<b>Pass</b>
Machine Name	JS10
Test Description	1750 Mailboxes (7000 total) .12 I/OPS Profile, SluggishSessions=2 8 Threads Mailbox size 1536MB (1.5GB) 4 Databases iSCSI Initiator - 2 x10GbE ports per server/controller SC4020 900GB 10K Drives
Test Start Time	12/16/2014 11:18:51 AM
Test End Time	12/17/2014 11:25:51 AM
Collection Start Time	12/16/2014 11:25:22 AM
Collection End Time	12/17/2014 11:25:20 AM
Jetstress Version	15.00.0995.000
ESE Version	15.00.0995.021
Operating System	Windows Server 2012 R2 Datacenter (6.2.9200.0)
Performance Log	C:\Program Files\Exchange Jetstress\Stress_2014_12_16_11_19_1.blg



Table 48 Database sizing and throughput

Performance Counter	Value
Achieved Transactional I/O per Second	215.169
Target Transactional I/O per Second	210
Initial Database Size (bytes)	2833722114048
Final Database Size (bytes)	2840516886528
Database Files (Count)	4

Table 49 Jetstress system parameters

Performance Counter	Value
Thread Count	8
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
Instance3508.1	Log path: C:\DB\DB1 Database: C:\DB\DB1\Jetstress001001.edb
Instance3508.2	Log path: C:\DB\DB2 Database: C:\DB\DB2\Jetstress002001.edb
Instance3508.3	Log path: C:\DB\DB3 Database: C:\DB\DB3\Jetstress003001.edb
Instance3508.4	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
Instance3508.1	18.169	5.089	35.600	18.118	33068.749	34778.933	0.000	3.055	0.000	4.261	0.000	20368.519
Instance3508.2	17.312	5.174	35.635	18.146	33074.765	34773.657	0.000	3.099	0.000	4.252	0.000	20456.302
Instance3508.3	16.820	5.108	35.634	18.175	33099.125	34779.179	0.000	2.967	0.000	4.270	0.000	20408.111
Instance3508.4	16.725	5.023	35.642	18.220	33103.612	34778.142	0.000	2.988	0.000	4.271	0.000	20453.836



Table 52 Background Database Maintenance I/O performance

MSExchange Database ==> Instances	Database Maintenance I/O Reads/sec	Database Maintenance I/O Reads Average Bytes
Instance3508.1	8.683	261570.846
Instance3508.2	8.689	261572.188
Instance3508.3	8.792	261534.244
Instance3508.4	8.823	261545.228

Table 53 Log replication I/O performance

MSExchange Database ==> Instances	I/O Log Reads/sec	I/O Log Reads Average Bytes
Instance3508.1	0.369	144175.902
Instance3508.2	0.369	144154.397
Instance3508.3	0.370	144803.127
Instance3508.4	0.371	145328.800

Table 54 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
Instance3508.1	18.169	5.089	44.283	18.118	77872.670	34778.933	9.262	3.055	0.369	4.261	144175.902	20368.519
Instance3508.2	17.312	5.174	44.323	18.146	77866.494	34773.657	7.980	3.099	0.369	4.252	144154.397	20456.302
Instance3508.3	16.820	5.108	44.426	18.175	78309.029	34779.179	7.969	2.967	0.370	4.270	144803.127	20408.111
Instance3508.4	16.725	5.023	44.464	18.220	78431.888	34778.142	10.335	2.988	0.371	4.271	145328.800	20453.836



Table 55 Host system performance

Counter	Average	Minimum	Maximum
% Processor Time	0.224	0.082	1.486
Available MBytes	61105.936	60962.000	61222.000
Free System Page Table Entries	16181613.378	16181158.000	16181906.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	1903846628.743	1902661632.000	1908113408.000
Pool Paged Bytes	106740082.550	105197568.000	108564480.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

## B.2 Test log

```

12/16/2014 11:18:51 AM -- Preparing for testing ...
12/16/2014 11:18:56 AM -- Attaching databases ...
12/16/2014 11:18:56 AM -- Preparations for testing are complete.
12/16/2014 11:18:56 AM -- Starting transaction dispatch ..
12/16/2014 11:18:56 AM -- Database cache settings: (minimum: 128.0 MB, maximum: 1.0 GB)
12/16/2014 11:18:56 AM -- Database flush thresholds: (start: 10.2 MB, stop: 20.5 MB)
12/16/2014 11:19:01 AM -- Database read latency thresholds: (average: 20 msec/read, maximum: 200 msec/read).
12/16/2014 11:19:01 AM -- Log write latency thresholds: (average: 10 msec/write, maximum: 200 msec/write).
12/16/2014 11:19:02 AM -- Operation mix: Sessions 8, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
12/16/2014 11:19:02 AM -- Performance logging started (interval: 15000 ms).
12/16/2014 11:19:02 AM -- Attaining prerequisites:
12/16/2014 11:25:22 AM -- \MSExchange Database(JetstressWin)\Database Cache Size, Last: 968785900.0 (lower bound: 966367600.0, upper
bound: none)

```



```
12/17/2014 11:25:23 AM -- Performance logging has ended.
12/17/2014 11:25:49 AM -- JetInterop batch transaction stats: 120373, 120372, 120372 and 120372.
12/17/2014 11:25:49 AM -- Dispatching transactions ends.
12/17/2014 11:25:50 AM -- Shutting down databases ...
12/17/2014 11:25:51 AM -- Instance3508.1 (complete), Instance3508.2 (complete), Instance3508.3 (complete) and Instance3508.4
(complete)
12/17/2014 11:25:51 AM -- C:\Program Files\Exchange Jetstress\Stress_2014_12_16_11_19_1.blg has 5773 samples.
12/17/2014 11:25:52 AM -- Creating test report ...
12/17/2014 11:26:20 AM -- Instance3508.1 has 18.2 for I/O Database Reads Average Latency.
12/17/2014 11:26:20 AM -- Instance3508.1 has 3.1 for I/O Log Writes Average Latency.
12/17/2014 11:26:20 AM -- Instance3508.1 has 3.1 for I/O Log Reads Average Latency.
12/17/2014 11:26:20 AM -- Instance3508.2 has 17.3 for I/O Database Reads Average Latency.
12/17/2014 11:26:20 AM -- Instance3508.2 has 3.1 for I/O Log Writes Average Latency.
12/17/2014 11:26:20 AM -- Instance3508.2 has 3.1 for I/O Log Reads Average Latency.
12/17/2014 11:26:20 AM -- Instance3508.3 has 16.8 for I/O Database Reads Average Latency.
12/17/2014 11:26:20 AM -- Instance3508.3 has 3.0 for I/O Log Writes Average Latency.
12/17/2014 11:26:20 AM -- Instance3508.3 has 3.0 for I/O Log Reads Average Latency.
12/17/2014 11:26:20 AM -- Instance3508.4 has 16.7 for I/O Database Reads Average Latency.
12/17/2014 11:26:20 AM -- Instance3508.4 has 3.0 for I/O Log Writes Average Latency.
12/17/2014 11:26:20 AM -- Instance3508.4 has 3.0 for I/O Log Reads Average Latency.
12/17/2014 11:26:20 AM -- Test has 0 Maximum Database Page Fault Stalls/sec.
12/17/2014 11:26:20 AM -- The test has 0 Database Page Fault Stalls/sec samples higher than 0.
12/17/2014 11:26:20 AM -- C:\Program Files\Exchange Jetstress\Stress_2014_12_16_11_19_1.xml has 5747 samples queried.
```



## B.3 Server 2 – JS11

Table 56 Test Summary

Overall Test Result	Pass
Machine Name	JS11
Test Description	1750 Mailboxes (7000 total) .12 I/OPS Profile, SluggishSessions=2 8 Threads Mailbox size 1536MB (1.5GB) 4 Databases iSCSI Initiator - 2 x10GbE ports per server/controller SC4020 900GB 10K Drives
Test Start Time	12/16/2014 11:18:53 AM
Test End Time	12/17/2014 11:26:42 AM
Collection Start Time	12/16/2014 11:25:30 AM
Collection End Time	12/17/2014 11:25:29 AM
Jetstress Version	15.00.0995.000
ESE Version	15.00.0995.021
Operating System	Windows Server 2012 R2 Datacenter (6.2.9200.0)
Performance Log	C:\Program Files\Exchange Jetstress\Stress_2014_12_16_11_19_3.blg



Table 57 Database Sizing and Throughput

Performance Counter	Value
Achieved Transactional I/O per Second	213.71
Target Transactional I/O per Second	210
Initial Database Size (bytes)	2833487233024
Final Database Size (bytes)	2840189730816
Database Files (Count)	4

Table 58 Jetstress System Parameters

Performance Counter	Value
Thread Count	8
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 59 Table 1 Database configuration

Performance Counter	Value
Instance2624.1	Log path: C:\DB\DB1 Database: C:\DB\DB1\Jetstress001001.edb
Instance2624.2	Log path: C:\DB\DB2 Database: C:\DB\DB2\Jetstress002001.edb
Instance2624.3	Log path: C:\DB\DB3 Database: C:\DB\DB3\Jetstress003001.edb
Instance2624.4	Log path: C:\DB\DB4 Database: C:\DB\DB4\Jetstress004001.edb

Table 60 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
Instance2624.1	18.104	5.124	35.364	18.031	33073.722	34770.188	0.000	3.039	0.000	4.229	0.000	20331.753
Instance2624.2	17.517	5.152	35.405	18.109	33090.219	34757.632	0.000	3.071	0.000	4.230	0.000	20375.533
Instance2624.3	17.307	5.086	35.366	18.012	33091.505	34770.564	0.000	3.033	0.000	4.201	0.000	20423.861
Instance2624.4	17.509	5.048	35.366	18.057	33087.531	34762.778	0.000	3.012	0.000	4.223	0.000	20394.083



Table 61 Background Database Maintenance I/O performance

MSEExchange Database ==> Instances	Database Maintenance I/O Reads/sec	Database Maintenance I/O Reads Average Bytes
Instance2624.1	8.675	261533.704
Instance2624.2	8.678	261517.502
Instance2624.3	8.708	261526.143
Instance2624.4	8.656	261550.583

Table 62 Log Replication I/O performance

MSEExchange Database ==> Instances	I/O Log Reads/sec	I/O Log Reads Average Bytes
Instance2624.1	0.365	142836.368
Instance2624.2	0.366	142573.160
Instance2624.3	0.364	142069.372
Instance2624.4	0.366	143069.815

Table 63 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
Instance2624.1	18.104	5.124	44.038	18.031	78075.979	34770.188	10.160	3.039	0.365	4.229	142836.368	20331.753
Instance2624.2	17.517	5.152	44.082	18.109	78055.906	34757.632	7.764	3.071	0.366	4.230	142573.160	20375.533
Instance2624.3	17.307	5.086	44.074	18.012	78225.000	34770.564	7.788	3.033	0.364	4.201	142069.372	20423.861
Instance2624.4	17.509	5.048	44.022	18.057	78009.808	34762.778	7.654	3.012	0.366	4.223	143069.815	20394.083



Table 64 Host system performance

Counter	Average	Minimum	Maximum
% Processor Time	0.226	0.000	1.110
Available MBytes	61010.371	60869.000	61131.000
Free System Page Table Entries	16183772.368	16183322.000	16184070.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	1922750664.239	1922359296.000	1926852608.000
Pool Paged Bytes	116266981.634	115851264.000	116686848.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

## B.4 Test log

```

12/16/2014 11:18:53 AM -- Preparing for testing ...
12/16/2014 11:18:58 AM -- Attaching databases ...
12/16/2014 11:18:58 AM -- Preparations for testing are complete.
12/16/2014 11:18:58 AM -- Starting transaction dispatch ..
12/16/2014 11:18:58 AM -- Database cache settings: (minimum: 128.0 MB, maximum: 1.0 GB)
12/16/2014 11:18:58 AM -- Database flush thresholds: (start: 10.2 MB, stop: 20.5 MB)
12/16/2014 11:19:03 AM -- Database read latency thresholds: (average: 20 msec/read, maximum: 200 msec/read).
12/16/2014 11:19:03 AM -- Log write latency thresholds: (average: 10 msec/write, maximum: 200 msec/write).
12/16/2014 11:19:04 AM -- Operation mix: Sessions 8, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
12/16/2014 11:19:04 AM -- Performance logging started (interval: 15000 ms).
12/16/2014 11:19:04 AM -- Attaining prerequisites:
12/16/2014 11:25:30 AM -- \MSExchange Database(JetstressWin)\Database Cache Size, Last: 969347100.0 (lower bound: 966367600.0, upper
bound: none)
12/17/2014 11:25:31 AM -- Performance logging has ended.

```



```
12/17/2014 11:25:52 AM -- JetInterop batch transaction stats: 119488, 119488, 119488 and 119488.
12/17/2014 11:25:52 AM -- Dispatching transactions ends.
12/17/2014 11:25:54 AM -- Shutting down databases ...
12/17/2014 11:26:42 AM -- Instance2624.1 (complete), Instance2624.2 (complete), Instance2624.3 (complete) and Instance2624.4
(complete)
12/17/2014 11:26:42 AM -- C:\Program Files\Exchange Jetstress\Stress_2014_12_16_11_19_3.blg has 5773 samples.
12/17/2014 11:26:43 AM -- Creating test report ...
12/17/2014 11:27:17 AM -- Instance2624.1 has 18.1 for I/O Database Reads Average Latency.
12/17/2014 11:27:17 AM -- Instance2624.1 has 3.0 for I/O Log Writes Average Latency.
12/17/2014 11:27:17 AM -- Instance2624.1 has 3.0 for I/O Log Reads Average Latency.
12/17/2014 11:27:17 AM -- Instance2624.2 has 17.5 for I/O Database Reads Average Latency.
12/17/2014 11:27:17 AM -- Instance2624.2 has 3.1 for I/O Log Writes Average Latency.
12/17/2014 11:27:17 AM -- Instance2624.2 has 3.1 for I/O Log Reads Average Latency.
12/17/2014 11:27:17 AM -- Instance2624.3 has 17.3 for I/O Database Reads Average Latency.
12/17/2014 11:27:17 AM -- Instance2624.3 has 3.0 for I/O Log Writes Average Latency.
12/17/2014 11:27:17 AM -- Instance2624.3 has 3.0 for I/O Log Reads Average Latency.
12/17/2014 11:27:17 AM -- Instance2624.4 has 17.5 for I/O Database Reads Average Latency.
12/17/2014 11:27:17 AM -- Instance2624.4 has 3.0 for I/O Log Writes Average Latency.
12/17/2014 11:27:17 AM -- Instance2624.4 has 3.0 for I/O Log Reads Average Latency.
12/17/2014 11:27:17 AM -- Test has 0 Maximum Database Page Fault Stalls/sec.
12/17/2014 11:27:17 AM -- The test has 0 Database Page Fault Stalls/sec samples higher than 0.
12/17/2014 11:27:17 AM -- C:\Program Files\Exchange Jetstress\Stress_2014_12_16_11_19_3.xml has 5747 samples queried.
```



## B.5 Server 3 – JS12

Table 65 Test Summary

Overall Test Result	Pass
Machine Name	JS12
Test Description	1750 Mailboxes (7000 total) .12 I/OPS Profile, SluggishSessions=2 8 Threads Mailbox size 1536MB (1.5GB) 4 Databases iSCSI Initiator - 2 x10GbE ports per server/controller SC4020 900GB 10K Drives
Test Start Time	12/16/2014 11:18:57 AM
Test End Time	12/17/2014 11:26:44 AM
Collection Start Time	12/16/2014 11:25:34 AM
Collection End Time	12/17/2014 11:25:26 AM
Jetstress Version	15.00.0995.000
ESE Version	15.00.0995.021
Operating System	Windows Server 2012 R2 Datacenter (6.2.9200.0)
Performance Log	C:\Program Files\Exchange Jetstress\Stress_2014_12_16_11_19_6.blg



Table 66 Database sizing and throughput

Performance Counter	Value
Achieved Transactional I/O per Second	215.354
Target Transactional I/O per Second	210
Initial Database Size (bytes)	2833663393792
Final Database Size (bytes)	2840474943488
Database Files (Count)	4

Table 67 Jetstress system parameters

Performance Counter	Value
Thread Count	8
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 68 Database configuration

Performance Counter	Value
Instance2940.1	Log path: C:\DB\DB1 Database: C:\DB\DB1\Jetstress001001.edb
Instance2940.2	Log path: C:\DB\DB2 Database: C:\DB\DB2\Jetstress002001.edb
Instance2940.3	Log path: C:\DB\DB3 Database: C:\DB\DB3\Jetstress003001.edb
Instance2940.4	Log path: C:\DB\DB4 Database: C:\DB\DB4\Jetstress004001.edb

Table 69 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
Instance2940.1	18.127	4.973	35.595	18.115	33067.668	34770.607	0.000	2.975	0.000	4.246	0.000	20445.304
Instance2940.2	16.622	5.109	35.590	18.171	33106.587	34773.642	0.000	3.045	0.000	4.286	0.000	20385.944
Instance2940.3	16.821	5.037	35.696	18.256	33102.167	34776.556	0.000	3.010	0.000	4.275	0.000	20380.610
Instance2940.4	17.129	5.065	35.676	18.256	33088.791	34773.439	0.000	2.963	0.000	4.286	0.000	20371.546



Table 70 Background Database Maintenance I/O performance

MSEExchange Database ==> Instances	Database Maintenance I/O Reads/sec	Database Maintenance I/O Reads Average Bytes
Instance2940.1	8.657	261548.515
Instance2940.2	8.885	261527.333
Instance2940.3	8.816	261493.036
Instance2940.4	8.721	261510.841

Table 71 Log Replication I/O performance

MSEExchange Database ==> Instances	I/O Log Reads/sec	I/O Log Reads Average Bytes
Instance2940.1	0.369	144292.479
Instance2940.2	0.371	145093.702
Instance2940.3	0.370	144553.545
Instance2940.4	0.371	144956.498

Table 72 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
Instance2940.1	18.127	4.973	44.252	18.115	77766.208	34770.607	10.204	2.975	0.369	4.246	144292.479	20445.304
Instance2940.2	16.622	5.109	44.475	18.171	78739.697	34773.642	7.806	3.045	0.371	4.286	145093.702	20385.944
Instance2940.3	16.821	5.037	44.512	18.256	78335.641	34776.556	7.866	3.010	0.370	4.275	144553.545	20380.610
Instance2940.4	17.129	5.065	44.397	18.256	77960.045	34773.439	8.063	2.963	0.371	4.286	144956.498	20371.546



Table 73 Host system performance

Counter	Average	Minimum	Maximum
% Processor Time	0.226	0.053	1.528
Available MBytes	61058.364	60908.000	61184.000
Free System Page Table Entries	16187399.134	16186855.000	16187701.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	1929730595.986	1929404416.000	1934098432.000
Pool Paged Bytes	112753844.999	112345088.000	113147904.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

## B.6 Test log

```

12/16/2014 11:18:57 AM -- Preparing for testing ...
12/16/2014 11:19:01 AM -- Attaching databases ...
12/16/2014 11:19:01 AM -- Preparations for testing are complete.
12/16/2014 11:19:01 AM -- Starting transaction dispatch ..
12/16/2014 11:19:01 AM -- Database cache settings: (minimum: 128.0 MB, maximum: 1.0 GB)
12/16/2014 11:19:01 AM -- Database flush thresholds: (start: 10.2 MB, stop: 20.5 MB)
12/16/2014 11:19:06 AM -- Database read latency thresholds: (average: 20 msec/read, maximum: 200 msec/read).
12/16/2014 11:19:06 AM -- Log write latency thresholds: (average: 10 msec/write, maximum: 200 msec/write).
12/16/2014 11:19:08 AM -- Operation mix: Sessions 8, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
12/16/2014 11:19:08 AM -- Performance logging started (interval: 15000 ms).
12/16/2014 11:19:08 AM -- Attaining prerequisites:
12/16/2014 11:25:34 AM -- \MSExchange Database(JetstressWin)\Database Cache Size, Last: 968806400.0 (lower bound: 966367600.0, upper
bound: none)
12/17/2014 11:25:36 AM -- Performance logging has ended.
12/17/2014 11:25:55 AM -- JetInterop batch transaction stats: 120523, 120522, 120522 and 120522.

```



```
12/17/2014 11:25:55 AM -- Dispatching transactions ends.
12/17/2014 11:25:59 AM -- Shutting down databases ...
12/17/2014 11:26:44 AM -- Instance2940.1 (complete), Instance2940.2 (complete), Instance2940.3 (complete) and Instance2940.4
(complete)
12/17/2014 11:26:44 AM -- C:\Program Files\Exchange Jetstress\Stress_2014_12_16_11_19_6.blg has 5773 samples.
12/17/2014 11:26:44 AM -- Creating test report ...
12/17/2014 11:27:18 AM -- Instance2940.1 has 18.1 for I/O Database Reads Average Latency.
12/17/2014 11:27:18 AM -- Instance2940.1 has 3.0 for I/O Log Writes Average Latency.
12/17/2014 11:27:18 AM -- Instance2940.1 has 3.0 for I/O Log Reads Average Latency.
12/17/2014 11:27:18 AM -- Instance2940.2 has 16.6 for I/O Database Reads Average Latency.
12/17/2014 11:27:18 AM -- Instance2940.2 has 3.0 for I/O Log Writes Average Latency.
12/17/2014 11:27:18 AM -- Instance2940.2 has 3.0 for I/O Log Reads Average Latency.
12/17/2014 11:27:18 AM -- Instance2940.3 has 16.8 for I/O Database Reads Average Latency.
12/17/2014 11:27:18 AM -- Instance2940.3 has 3.0 for I/O Log Writes Average Latency.
12/17/2014 11:27:18 AM -- Instance2940.3 has 3.0 for I/O Log Reads Average Latency.
12/17/2014 11:27:18 AM -- Instance2940.4 has 17.1 for I/O Database Reads Average Latency.
12/17/2014 11:27:18 AM -- Instance2940.4 has 3.0 for I/O Log Writes Average Latency.
12/17/2014 11:27:18 AM -- Instance2940.4 has 3.0 for I/O Log Reads Average Latency.
12/17/2014 11:27:18 AM -- Test has 0 Maximum Database Page Fault Stalls/sec.
12/17/2014 11:27:18 AM -- The test has 0 Database Page Fault Stalls/sec samples higher than 0.
12/17/2014 11:27:18 AM -- C:\Program Files\Exchange Jetstress\Stress_2014_12_16_11_19_6.xml has 5747 samples queried.
```

.



## B.7 Server 4 – JS13

Table 74 Test summary

Overall Test Result	Pass
Machine Name	JS13
Test Description	1750 Mailboxes (7000 total) .12 I/OPS Profile, SluggishSessions=2 8 Threads Mailbox size 1536MB (1.5GB) 4 Databases iSCSI Initiator - 2 x10GbE ports per server/controller SC4020 900GB 10K Drives
Test Start Time	12/16/2014 11:18:59 AM
Test End Time	12/17/2014 11:26:44 AM
Collection Start Time	12/16/2014 11:25:43 AM
Collection End Time	12/17/2014 11:25:35 AM
Jetstress Version	15.00.0995.000
ESE Version	15.00.0995.021
Operating System	Windows Server 2012 R2 Datacenter (6.2.9200.0)
Performance Log	C:\Program Files\Exchange Jetstress\Stress_2014_12_16_11_19_9.blg



Table 75 Database sizing and throughput

Performance Counter	Value
Achieved Transactional I/O per Second	214.254
Target Transactional I/O per Second	210
Initial Database Size (bytes)	2833445289984
Final Database Size (bytes)	2840181342208
Database Files (Count)	4

Table 76 Jetstress system parameters

Performance Counter	Value
Thread Count	8
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 77 Database configuration

Performance Counter	Value
Instance4048.1	Log path: C:\DB\DB1 Database: C:\DB\DB1\Jetstress001001.edb
Instance4048.2	Log path: C:\DB\DB2 Database: C:\DB\DB2\Jetstress002001.edb
Instance4048.3	Log path: C:\DB\DB3 Database: C:\DB\DB3\Jetstress003001.edb
Instance4048.4	Log path: C:\DB\DB4 Database: C:\DB\DB4\Jetstress004001.edb

Table 78 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
Instance4048.1	17.687	5.117	35.466	18.110	33085.628	34773.234	0.000	3.023	0.000	4.240	0.000	20386.378
Instance4048.2	17.250	5.124	35.445	18.058	33096.474	34767.476	0.000	3.053	0.000	4.231	0.000	20329.306
Instance4048.3	17.214	5.012	35.442	18.107	33094.174	34780.503	0.000	3.010	0.000	4.228	0.000	20475.442
Instance4048.4	16.961	5.034	35.486	18.139	33097.729	34768.048	0.000	2.990	0.000	4.246	0.000	20360.635



Table 79 Background Database Maintenance I/O performance

MSExchange Database ==> Instances	Database Maintenance I/O Reads/sec	Database Maintenance I/O Reads Average Bytes
Instance4048.1	8.771	261512.268
Instance4048.2	8.741	261545.602
Instance4048.3	8.721	261537.640
Instance4048.4	8.796	261558.008

Table 80 Log Replication I/O performance

MSExchange Database ==> Instances	I/O Log Reads/sec	I/O Log Reads Average Bytes
Instance4048.1	0.368	143705.574
Instance4048.2	0.366	142820.263
Instance4048.3	0.368	143532.956
Instance4048.4	0.367	143589.845

Table 81 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
Instance4048.1	17.687	5.117	44.237	18.110	78377.886	34773.234	10.180	3.023	0.368	4.240	143705.574	20386.378
Instance4048.2	17.250	5.124	44.186	18.058	78289.684	34767.476	7.774	3.053	0.366	4.231	142820.263	20329.306
Instance4048.3	17.214	5.012	44.163	18.107	78205.342	34780.503	9.134	3.010	0.368	4.228	143532.956	20475.442
Instance4048.4	16.961	5.034	44.282	18.139	78478.333	34768.048	8.337	2.990	0.367	4.246	143589.845	20360.635



Table 82 Host system performance

Counter	Average	Minimum	Maximum
% Processor Time	0.239	0.016	1.247
Available MBytes	61027.248	60875.000	61134.000
Free System Page Table Entries	16181637.903	16180986.000	16181993.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	1901943838.469	1900625920.000	1906376704.000
Pool Paged Bytes	103402306.951	102383616.000	105611264.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

## B.8 Test log

```

12/16/2014 11:19:00 AM -- Preparing for testing ...
12/16/2014 11:19:04 AM -- Attaching databases ...
12/16/2014 11:19:04 AM -- Preparations for testing are complete.
12/16/2014 11:19:04 AM -- Starting transaction dispatch ..
12/16/2014 11:19:04 AM -- Database cache settings: (minimum: 128.0 MB, maximum: 1.0 GB)
12/16/2014 11:19:04 AM -- Database flush thresholds: (start: 10.2 MB, stop: 20.5 MB)
12/16/2014 11:19:09 AM -- Database read latency thresholds: (average: 20 msec/read, maximum: 200 msec/read).
12/16/2014 11:19:09 AM -- Log write latency thresholds: (average: 10 msec/write, maximum: 200 msec/write).
12/16/2014 11:19:11 AM -- Operation mix: Sessions 8, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
12/16/2014 11:19:11 AM -- Performance logging started (interval: 15000 ms).
12/16/2014 11:19:11 AM -- Attaining prerequisites:
12/16/2014 11:25:43 AM -- \MSExchange Database(JetstressWin)\Database Cache Size, Last: 967884800.0 (lower bound: 966367600.0, upper
bound: none)
12/17/2014 11:25:44 AM -- Performance logging has ended.

```



```
12/17/2014 11:25:57 AM -- JetInterop batch transaction stats: 119833, 119832, 119832 and 119832.
12/17/2014 11:25:57 AM -- Dispatching transactions ends.
12/17/2014 11:26:03 AM -- Shutting down databases ...
12/17/2014 11:26:44 AM -- Instance4048.1 (complete), Instance4048.2 (complete), Instance4048.3 (complete) and Instance4048.4
(complete)
12/17/2014 11:26:44 AM -- C:\Program Files\Exchange Jetstress\Stress_2014_12_16_11_19_9.blg has 5773 samples.
12/17/2014 11:26:44 AM -- Creating test report ...
12/17/2014 11:27:19 AM -- Instance4048.1 has 17.7 for I/O Database Reads Average Latency.
12/17/2014 11:27:19 AM -- Instance4048.1 has 3.0 for I/O Log Writes Average Latency.
12/17/2014 11:27:19 AM -- Instance4048.1 has 3.0 for I/O Log Reads Average Latency.
12/17/2014 11:27:19 AM -- Instance4048.2 has 17.2 for I/O Database Reads Average Latency.
12/17/2014 11:27:19 AM -- Instance4048.2 has 3.1 for I/O Log Writes Average Latency.
12/17/2014 11:27:19 AM -- Instance4048.2 has 3.1 for I/O Log Reads Average Latency.
12/17/2014 11:27:19 AM -- Instance4048.3 has 17.2 for I/O Database Reads Average Latency.
12/17/2014 11:27:19 AM -- Instance4048.3 has 3.0 for I/O Log Writes Average Latency.
12/17/2014 11:27:19 AM -- Instance4048.3 has 3.0 for I/O Log Reads Average Latency.
12/17/2014 11:27:19 AM -- Instance4048.4 has 17.0 for I/O Database Reads Average Latency.
12/17/2014 11:27:19 AM -- Instance4048.4 has 3.0 for I/O Log Writes Average Latency.
12/17/2014 11:27:19 AM -- Instance4048.4 has 3.0 for I/O Log Reads Average Latency.
12/17/2014 11:27:19 AM -- Test has 0 Maximum Database Page Fault Stalls/sec.
12/17/2014 11:27:19 AM -- The test has 0 Database Page Fault Stalls/sec samples higher than 0.
12/17/2014 11:27:19 AM -- C:\Program Files\Exchange Jetstress\Stress_2014_12_16_11_19_9.xml has 5746 samples queried.
```



## C Backup testing

### C.1 Server 1 – JS10

Table 83 Database backup statistics - All

Database Instance	Database Size (MBytes)	Elapsed Backup Time	MBytes Transferred/sec
Instance3732.1	677216.03	03:30:40	53.58
Instance3732.2	677224.03	03:19:28	56.59
Instance3732.3	677224.03	03:30:07	53.72
Instance3732.4	677232.03	03:26:20	54.70
Avg			54.65
Sum			218.58

Table 84 Jetstress system parameters

Performance Counter	Value
Thread Count	8
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
Instance3732.1	Log path: C:\DB\DB1 Database: C:\DB\DB1\Jetstress001001.edb
Instance3732.2	Log path: C:\DB\DB2 Database: C:\DB\DB2\Jetstress002001.edb
Instance3732.3	Log path: C:\DB\DB3 Database: C:\DB\DB3\Jetstress003001.edb
Instance3732.4	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
Instance3732.1	8.307	0.000	212.147	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance3732.2	6.624	0.000	226.187	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance3732.3	7.433	0.000	213.218	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance3732.4	6.863	0.000	218.789	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	1.364	0.983	2.732
Available MBytes	62027.395	62014.000	62034.000
Free System Page Table Entries	16181543.160	16181224.000	16181789.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	1908225891.962	1908060160.000	1908350976.000
Pool Paged Bytes	114394004.724	114118656.000	114712576.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

## C.2 Test log

```

12/18/2014 7:56:12 AM -- Preparing for testing ...
12/18/2014 7:56:17 AM -- Attaching databases ...
12/18/2014 7:56:17 AM -- Preparations for testing are complete.
12/18/2014 7:56:22 AM -- Performance logging started (interval: 30000 ms).
12/18/2014 7:56:22 AM -- Backing up databases ...
12/18/2014 11:27:03 AM -- Performance logging has ended.
12/18/2014 11:27:03 AM -- Instance3732.1 (100% processed), Instance3732.2 (100% processed), Instance3732.3 (100% processed) and
Instance3732.4 (100% processed)
12/18/2014 11:27:03 AM -- C:\Program Files\Exchange Jetstress\DatabaseBackup_2014_12_18_7_56_17.blg has 420 samples.
12/18/2014 11:27:03 AM -- Creating test report ...

```



## C.3 Server 2 – JS11

Table 88 Database backup statistics - All

Database Instance	Database Size (MBytes)	Elapsed Backup Time	MBytes Transferred/sec
Instance36.1	677144.03	03:10:14	59.32
Instance36.2	677160.03	02:48:26	67.00
Instance36.3	677136.03	03:07:43	60.12
Instance36.4	677144.03	03:07:21	60.24
Avg			61.67
Sum			246.68

Table 89 Jetstress system parameters

Performance Counter	Value
Thread Count	8
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
Instance36.1	Log path: C:\DB\DB1 Database: C:\DB\DB1\Jetstress001001.edb
Instance36.2	Log path: C:\DB\DB2 Database: C:\DB\DB2\Jetstress002001.edb
Instance36.3	Log path: C:\DB\DB3 Database: C:\DB\DB3\Jetstress003001.edb
Instance36.4	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
Instance36.1	6.862	0.000	237.304	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance36.2	5.559	0.000	268.201	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance36.3	6.250	0.000	240.475	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance36.4	6.233	0.000	240.981	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	1.447	0.753	1.727



Available MBytes	61949.295	61938.000	61955.000
Free System Page Table Entries	16183864.958	16183593.000	16184116.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	1924884803.368	1924689920.000	1925099520.000
Pool Paged Bytes	119855028.547	119689216.000	120107008.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

## C.4 Test log

```

Test Log 12/18/2014 7:56:09 AM -- Preparing for testing ...
12/18/2014 7:56:13 AM -- Attaching databases ...
12/18/2014 7:56:13 AM -- Preparations for testing are complete.
12/18/2014 7:56:19 AM -- Performance logging started (interval: 30000 ms).
12/18/2014 7:56:19 AM -- Backing up databases ...
12/18/2014 11:06:34 AM -- Performance logging has ended.
12/18/2014 11:06:34 AM -- Instance36.1 (100% processed), Instance36.2 (100% processed), Instance36.3 (100% processed) and Instance36.4
(100% processed)
12/18/2014 11:06:34 AM -- C:\Program Files\Exchange Jetstress\DatabaseBackup_2014_12_18_7_56_13.blg has 380 samples.
12/18/2014 11:06:34 AM -- Creating test report ...

```



## C.5 Server 3 – JS12

Table 93 Database backup statistics - All

Database Instance	Database Size (MBytes)	Elapsed Backup Time	MBytes Transferred/sec
Instance1816.1	677208.03	03:11:08	59.05
Instance1816.2	677224.03	02:48:38	66.93
Instance1816.3	677208.03	03:27:48	54.31
Instance1816.4	677216.03	03:22:41	55.69
Avg			59.00
Sum			235.98

Table 94 Jetstress system parameters

Performance Counter	Value
Thread Count	8
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 95 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 96 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
Instance1816.1	6.975	0.000	235.114	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance1816.2	5.576	0.000	268.066	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance1816.3	7.153	0.000	217.100	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance1816.4	6.760	0.000	222.645	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000



Table 97 Host system performance

Counter	Average	Minimum	Maximum
% Processor Time	1.352	0.730	1.788
Available MBytes	61951.284	61939.000	61963.000
Free System Page Table Entries	16187439.301	16187164.000	16187669.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	1929562126.805	1929408512.000	1929707520.000
Pool Paged Bytes	116603486.998	116400128.000	116736000.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

## C.6 Test log

```

2Test Log 12/18/2014 7:56:06 AM -- Preparing for testing ...
12/18/2014 7:56:11 AM -- Attaching databases ...
12/18/2014 7:56:11 AM -- Preparations for testing are complete.
12/18/2014 7:56:17 AM -- Performance logging started (interval: 30000 ms).
12/18/2014 7:56:17 AM -- Backing up databases ...
12/18/2014 11:24:05 AM -- Performance logging has ended.
12/18/2014 11:24:05 AM -- Instance1816.1 (100% processed), Instance1816.2 (100% processed), Instance1816.3 (100% processed) and
Instance1816.4 (100% processed)
12/18/2014 11:24:05 AM -- C:\Program Files\Exchange Jetstress\DatabaseBackup_2014_12_18_7_56_11.blg has 415 samples.
12/18/2014 11:24:05 AM -- Creating test report ...

```



## C.7 Server 4 – JS13

Table 98 Database backup statistics - All

Database Instance	Database Size (MBytes)	Elapsed Backup Time	MBytes Transferred/sec
Instance1652.1	677136.03	03:30:38	53.58
Instance1652.2	677144.03	03:17:52	57.03
Instance1652.3	677144.03	02:52:00	65.61
Instance1652.4	677152.03	02:50:56	66.02
Avg			60.56
Sum			242.24

Table 99 Jetstress system parameters

Performance Counter	Value
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%
Minimum Database Cache	128.0 MB



Table 100 Database configuration

Performance Counter	Value
Instance1652.1	Log path: C:\DB\DB1 Database: C:\DB\DB1\Jetstress001001.edb
Instance1652.2	Log path: C:\DB\DB2 Database: C:\DB\DB2\Jetstress002001.edb
Instance1652.3	Log path: C:\DB\DB3 Database: C:\DB\DB3\Jetstress003001.edb
Instance1652.4	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
Instance1652.1	8.416	0.000	212.298	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance1652.2	6.579	0.000	227.898	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance1652.3	5.702	0.000	262.334	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance1652.4	5.669	0.000	264.189	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000



Table 102 Host system performance

Counter	Average	Minimum	Maximum
% Processor Time	1.323	0.555	1.898
Available MBytes	61905.655	61887.000	61912.000
Free System Page Table Entries	16181668.529	16181248.000	16181922.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	1906989982.476	1906831360.000	1907142656.000
Pool Paged Bytes	110815641.600	110632960.000	111267840.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

## C.8 Test log

```

12/18/2014 7:56:05 AM -- Preparing for testing ...
12/18/2014 7:56:09 AM -- Attaching databases ...
12/18/2014 7:56:09 AM -- Preparations for testing are complete.
12/18/2014 7:56:15 AM -- Performance logging started (interval: 30000 ms).
12/18/2014 7:56:15 AM -- Backing up databases ...
12/18/2014 11:26:53 AM -- Performance logging has ended.
12/18/2014 11:26:53 AM -- Instance1652.1 (100% processed), Instance1652.2 (100% processed), Instance1652.3 (100% processed) and
Instance1652.4 (100% processed)
12/18/2014 11:26:53 AM -- C:\Program Files\Exchange Jetstress\DatabaseBackup_2014_12_18_7_56_9.blg has 420 samples.
12/18/2014 11:26:53 AM -- Creating test report ...

```



## D Recovery testing

### D.1 Server 1 – JS10

Table 103 Soft Recovery statistics - All

Database Instance	Log files replayed	Elapsed seconds
Instance3732.1	501	2253.6684361
Instance3732.2	502	2234.9330984
Instance3732.3	504	2243.7357484
Instance3732.4	509	2277.9722649
Avg	504	2252.577
Sum	2016	9010.3095478

Table 104 Database configuration

Performance Counter	Value
Instance3732.1	Log path: C:\DB\DB1 Database: C:\DB\DB1\Jetstress001001.edb
Instance3732.2	Log path: C:\DB\DB2 Database: C:\DB\DB2\Jetstress002001.edb
Instance3732.3	Log path: C:\DB\DB3 Database: C:\DB\DB3\Jetstress003001.edb
Instance3732.4	Log path: C:\DB\DB4 Database: C:\DB\DB4\Jetstress004001.edb



Table 105 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
Instance3732.1	14.121	2.286	95.702	0.886	38288.219	15291.733	5.394	0.000	1.112	0.000	95445.973	0.000
Instance3732.2	12.437	2.274	96.950	0.896	38293.675	15460.538	5.784	0.000	1.120	0.000	96497.230	0.000
Instance3732.3	12.638	2.297	95.794	0.896	37985.294	15509.198	5.846	0.000	1.124	0.000	97654.889	0.000
Instance3732.4	13.824	2.362	94.588	0.891	38155.544	15478.645	5.900	0.000	1.118	0.000	96938.554	0.000

Table 106 Background Database Maintenance I/O performance

MSExchange Database ==> Instances	Database Maintenance I/O Reads/sec	Database Maintenance I/O Reads Average Bytes
Instance3732.1	0.000	0.000
Instance3732.2	0.000	0.000
Instance3732.3	0.000	0.000
Instance3732.4	0.000	0.000



Table 107 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
Instance3732.1	14.121	2.286	95.702	0.886	38288.219	15291.733	5.394	0.000	1.112	0.000	95445.973	0.000
Instance3732.2	12.437	2.274	96.950	0.896	38293.675	15460.538	5.784	0.000	1.120	0.000	96497.230	0.000
Instance3732.3	12.638	2.297	95.794	0.896	37985.294	15509.198	5.846	0.000	1.124	0.000	97654.889	0.000
Instance3732.4	13.824	2.362	94.588	0.891	38155.544	15478.645	5.900	0.000	1.118	0.000	96938.554	0.000

Table 108 Host system performance

Counter	Average	Minimum	Maximum
% Processor Time	0.277	0.000	3.444
Available MBytes	61035.967	60975.000	62014.000
Free System Page Table Entries	16181560.990	16180663.000	16181851.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	1909266058.144	1909198848.000	1909481472.000
Pool Paged Bytes	114977685.314	114860032.000	115089408.000
Database Page Fault Stalls/sec	0.000	0.000	0.000



## D.2 Test log

```
12/18/2014 12:18:36 PM -- Preparing for testing ...
12/18/2014 12:18:41 PM -- Attaching databases ...
12/18/2014 12:18:41 PM -- Preparations for testing are complete.
12/18/2014 12:18:41 PM -- Starting transaction dispatch ..
12/18/2014 12:18:41 PM -- Database cache settings: (minimum: 128.0 MB, maximum: 1.0 GB)
12/18/2014 12:18:41 PM -- Database flush thresholds: (start: 10.2 MB, stop: 20.5 MB)
12/18/2014 12:18:46 PM -- Database read latency thresholds: (average: 20 msec/read, maximum: 100 msec/read).
12/18/2014 12:18:46 PM -- Log write latency thresholds: (average: 10 msec/write, maximum: 100 msec/write).
12/18/2014 12:18:47 PM -- Operation mix: Sessions 8, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
12/18/2014 12:18:47 PM -- Performance logging started (interval: 15000 ms).
12/18/2014 12:18:47 PM -- Generating log files ...
12/18/2014 3:34:06 PM -- C:\DB\DB1 (100.2% generated), C:\DB\DB2 (100.4% generated), C:\DB\DB3 (100.8% generated) and C:\DB\DB4
(101.8% generated)
12/18/2014 3:34:06 PM -- Performance logging has ended.
12/18/2014 3:34:06 PM -- JetInterop batch transaction stats: 17072, 17072, 17072 and 17072.
12/18/2014 3:34:06 PM -- Dispatching transactions ends.
12/18/2014 3:34:06 PM -- Shutting down databases ...
12/18/2014 3:34:09 PM -- Instance3732.1 (complete), Instance3732.2 (complete), Instance3732.3 (complete) and Instance3732.4 (complete)
12/18/2014 3:34:09 PM -- C:\Program Files\Exchange Jetstress\Performance_2014_12_18_12_18_46.blg has 779 samples.
12/18/2014 3:34:09 PM -- Creating test report ...
12/18/2014 3:34:12 PM -- Instance3732.1 has 18.5 for I/O Database Reads Average Latency.
12/18/2014 3:34:12 PM -- Instance3732.1 has 3.0 for I/O Log Writes Average Latency.
12/18/2014 3:34:12 PM -- Instance3732.1 has 3.0 for I/O Log Reads Average Latency.
12/18/2014 3:34:12 PM -- Instance3732.2 has 18.4 for I/O Database Reads Average Latency.
12/18/2014 3:34:12 PM -- Instance3732.2 has 3.0 for I/O Log Writes Average Latency.
12/18/2014 3:34:12 PM -- Instance3732.2 has 3.0 for I/O Log Reads Average Latency.
12/18/2014 3:34:12 PM -- Instance3732.3 has 18.3 for I/O Database Reads Average Latency.
12/18/2014 3:34:12 PM -- Instance3732.3 has 3.0 for I/O Log Writes Average Latency.
12/18/2014 3:34:12 PM -- Instance3732.3 has 3.0 for I/O Log Reads Average Latency.
12/18/2014 3:34:12 PM -- Instance3732.4 has 18.2 for I/O Database Reads Average Latency.
12/18/2014 3:34:12 PM -- Instance3732.4 has 3.0 for I/O Log Writes Average Latency.
12/18/2014 3:34:12 PM -- Instance3732.4 has 3.0 for I/O Log Reads Average Latency.
12/18/2014 3:34:12 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.
```



12/18/2014 3:34:12 PM -- The test has 0 Database Page Fault Stalls/sec samples higher than 0.  
12/18/2014 3:34:12 PM -- C:\Program Files\Exchange Jetstress\Performance\_2014\_12\_18\_12\_18\_46.xml has 778 samples queried.  
12/18/2014 3:34:12 PM -- C:\Program Files\Exchange Jetstress\Performance\_2014\_12\_18\_12\_18\_46.html was saved.  
12/19/2014 6:33:39 AM -- Performance logging started (interval: 2000 ms).  
12/19/2014 6:33:39 AM -- Recovering databases ...  
12/19/2014 7:11:37 AM -- Performance logging has ended.  
12/19/2014 7:11:37 AM -- Instance3732.1 (2253.6684361), Instance3732.2 (2234.9330984), Instance3732.3 (2243.7357484) and Instance3732.4 (2277.9722649)  
12/19/2014 7:11:37 AM -- C:\Program Files\Exchange Jetstress\SoftRecovery\_2014\_12\_19\_6\_33\_37.blg has 1123 samples.  
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 – JS11

Table 109 Soft Recovery statistics - All

Database Instance	Log files replayed	Elapsed seconds
Instance36.1	510	2284.1237244
Instance36.2	505	2251.9970749
Instance36.3	509	2275.4377093
Instance36.4	501	2248.1197462
Avg	506	2264.92
Sum	2025	9059.6782548

Table 110 Database configuration

Performance Counter	Value
Instance36.1	Log path: C:\DB\DB1 Database: C:\DB\DB1\Jetstress001001.edb
Instance36.2	Log path: C:\DB\DB2 Database: C:\DB\DB2\Jetstress002001.edb
Instance36.3	Log path: C:\DB\DB3 Database: C:\DB\DB3\Jetstress003001.edb
Instance36.4	Log path: C:\DB\DB4 Database: C:\DB\DB4\Jetstress004001.edb



Table 111 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
Instance36.1	13.784	2.266	95.571	0.889	38176.988	15334.491	5.568	0.000	1.112	0.000	96235.471	0.000
Instance36.2	12.787	2.300	95.394	0.895	38029.334	15496.780	5.937	0.000	1.119	0.000	97027.019	0.000
Instance36.3	14.039	2.323	95.226	0.891	38252.549	15594.057	5.825	0.000	1.113	0.000	96773.425	0.000
Instance36.4	12.676	2.265	95.799	0.889	38130.496	15510.779	5.803	0.000	1.114	0.000	96639.750	0.000

Table 112 Background Database Maintenance I/O performance

MSExchange Database ==> Instances	Database Maintenance I/O Reads/sec	Database Maintenance I/O Reads Average Bytes
Instance36.1	0.000	0.000
Instance36.2	0.000	0.000
Instance36.3	0.000	0.000
Instance36.4	0.000	0.000



Table 113 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
Instance36.1	13.784	2.266	95.571	0.889	38176.988	15334.491	5.568	0.000	1.112	0.000	96235.471	0.000
Instance36.2	12.787	2.300	95.394	0.895	38029.334	15496.780	5.937	0.000	1.119	0.000	97027.019	0.000
Instance36.3	14.039	2.323	95.226	0.891	38252.549	15594.057	5.825	0.000	1.113	0.000	96773.425	0.000
Instance36.4	12.676	2.265	95.799	0.889	38130.496	15510.779	5.803	0.000	1.114	0.000	96639.750	0.000

Table 114 Host system performance

Counter	Average	Minimum	Maximum
% Processor Time	0.272	0.000	1.700
Available MBytes	60947.428	60863.000	61933.000
Free System Page Table Entries	16183776.879	16183166.000	16183962.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	1924770820.551	1924739072.000	1925083136.000
Pool Paged Bytes	120706797.113	120606720.000	121094144.000
Database Page Fault Stalls/sec	0.000	0.000	0.000



## D.4 Test log

```
12/18/2014 12:18:39 PM -- Preparing for testing ...
12/18/2014 12:18:44 PM -- Attaching databases ...
12/18/2014 12:18:44 PM -- Preparations for testing are complete.
12/18/2014 12:18:44 PM -- Starting transaction dispatch ..
12/18/2014 12:18:44 PM -- Database cache settings: (minimum: 128.0 MB, maximum: 1.0 GB)
12/18/2014 12:18:44 PM -- Database flush thresholds: (start: 10.2 MB, stop: 20.5 MB)
12/18/2014 12:18:49 PM -- Database read latency thresholds: (average: 20 msec/read, maximum: 100 msec/read).
12/18/2014 12:18:49 PM -- Log write latency thresholds: (average: 10 msec/write, maximum: 100 msec/write).
12/18/2014 12:18:50 PM -- Operation mix: Sessions 8, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
12/18/2014 12:18:50 PM -- Performance logging started (interval: 15000 ms).
12/18/2014 12:18:50 PM -- Generating log files ...
12/18/2014 3:36:37 PM -- C:\DB\DB1 (102.0% generated), C:\DB\DB2 (101.0% generated), C:\DB\DB3 (101.8% generated) and C:\DB\DB4
(100.2% generated)
12/18/2014 3:36:37 PM -- Performance logging has ended.
12/18/2014 3:36:37 PM -- JetInterop batch transaction stats: 17132, 17131, 17131 and 17131.
12/18/2014 3:36:37 PM -- Dispatching transactions ends.
12/18/2014 3:36:37 PM -- Shutting down databases ...
12/18/2014 3:36:39 PM -- Instance36.1 (complete), Instance36.2 (complete), Instance36.3 (complete) and Instance36.4 (complete)
12/18/2014 3:36:39 PM -- C:\Program Files\Exchange Jetstress\Performance_2014_12_18_12_18_49.blg has 789 samples.
12/18/2014 3:36:39 PM -- Creating test report ...
12/18/2014 3:36:42 PM -- Instance36.1 has 18.4 for I/O Database Reads Average Latency.
12/18/2014 3:36:42 PM -- Instance36.1 has 3.0 for I/O Log Writes Average Latency.
12/18/2014 3:36:42 PM -- Instance36.1 has 3.0 for I/O Log Reads Average Latency.
12/18/2014 3:36:42 PM -- Instance36.2 has 18.7 for I/O Database Reads Average Latency.
12/18/2014 3:36:42 PM -- Instance36.2 has 3.0 for I/O Log Writes Average Latency.
12/18/2014 3:36:42 PM -- Instance36.2 has 3.0 for I/O Log Reads Average Latency.
12/18/2014 3:36:42 PM -- Instance36.3 has 18.6 for I/O Database Reads Average Latency.
12/18/2014 3:36:42 PM -- Instance36.3 has 3.0 for I/O Log Writes Average Latency.
12/18/2014 3:36:42 PM -- Instance36.3 has 3.0 for I/O Log Reads Average Latency.
12/18/2014 3:36:42 PM -- Instance36.4 has 18.7 for I/O Database Reads Average Latency.
12/18/2014 3:36:42 PM -- Instance36.4 has 3.0 for I/O Log Writes Average Latency.
12/18/2014 3:36:42 PM -- Instance36.4 has 3.0 for I/O Log Reads Average Latency.
12/18/2014 3:36:42 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.
```



```
12/18/2014 3:36:42 PM -- The test has 0 Database Page Fault Stalls/sec samples higher than 0.
12/18/2014 3:36:42 PM -- C:\Program Files\Exchange Jetstress\Performance_2014_12_18_12_18_49.xml has 788 samples queried.
12/18/2014 3:36:42 PM -- C:\Program Files\Exchange Jetstress\Performance_2014_12_18_12_18_49.html was saved.
12/19/2014 6:33:43 AM -- Performance logging started (interval: 2000 ms).
12/19/2014 6:33:43 AM -- Recovering databases ...
12/19/2014 7:11:47 AM -- Performance logging has ended.
12/19/2014 7:11:47 AM -- Instance36.1 (2284.1237244), Instance36.2 (2251.9970749), Instance36.3 (2275.4377093) and Instance36.4
(2248.1197462)
12/19/2014 7:11:47 AM -- C:\Program Files\Exchange Jetstress\SoftRecovery_2014_12_19_6_33_41.blg has 1125 samples.
```



## D.5 Server 3 – JS12

Table 115 Soft Recovery statistics - All

Database Instance	Log files replayed	Elapsed seconds
Instance1816.1	510	2273.8158445
Instance1816.2	507	2279.3252887
Instance1816.3	501	2256.8711082
Instance1816.4	501	2253.2484762
Avg	504	2265.815
Sum	2019	9063.2607176

Table 116 Database configuration

Performance Counter	Value
Instance1816.1	Log path: C:\DB\DB1 Database: C:\DB\DB1\Jetstress001001.edb
Instance1816.2	Log path: C:\DB\DB2 Database: C:\DB\DB2\Jetstress002001.edb
Instance1816.3	Log path: C:\DB\DB3 Database: C:\DB\DB3\Jetstress003001.edb
Instance1816.4	Log path: C:\DB\DB4 Database: C:\DB\DB4\Jetstress004001.edb



Table 117 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
Instance1816.1	12.583	2.344	94.655	0.895	38037.336	15549.426	5.790	0.000	1.119	0.000	97393.717	0.000
Instance1816.2	13.790	2.307	94.586	0.887	38128.039	15303.415	5.895	0.000	1.109	0.000	96284.475	0.000
Instance1816.3	14.064	2.245	94.427	0.886	38133.483	15336.958	5.852	0.000	1.107	0.000	96049.664	0.000
Instance1816.4	12.581	2.171	95.081	0.886	38078.618	15246.427	5.788	0.000	1.107	0.000	95883.642	0.000

Table 118 Background Database Maintenance I/O performance

MSExchange Database ==> Instances	Database Maintenance I/O Reads/sec	Database Maintenance I/O Reads Average Bytes
Instance1816.1	0.000	0.000
Instance1816.2	0.000	0.000
Instance1816.3	0.000	0.000
Instance1816.4	0.000	0.000



Table 119 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
Instance1816.1	12.583	2.344	94.655	0.895	38037.336	15549.426	5.790	0.000	1.119	0.000	97393.717	0.000
Instance1816.2	13.790	2.307	94.586	0.887	38128.039	15303.415	5.895	0.000	1.109	0.000	96284.475	0.000
Instance1816.3	14.064	2.245	94.427	0.886	38133.483	15336.958	5.852	0.000	1.107	0.000	96049.664	0.000
Instance1816.4	12.581	2.171	95.081	0.886	38078.618	15246.427	5.788	0.000	1.107	0.000	95883.642	0.000

Table 120 Host system performance

Counter	Average	Minimum	Maximum
% Processor Time	0.271	0.000	2.950
Available MBytes	60980.073	60916.000	61952.000
Free System Page Table Entries	16187485.313	16186756.000	16187737.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	1929566738.693	1929478144.000	1929854976.000
Pool Paged Bytes	117406062.561	117260288.000	117661696.000
Database Page Fault Stalls/sec	0.000	0.000	0.000



## D.6 Test log

```
12/18/2014 12:18:42 PM -- Preparing for testing ...
12/18/2014 12:18:47 PM -- Attaching databases ...
12/18/2014 12:18:47 PM -- Preparations for testing are complete.
12/18/2014 12:18:47 PM -- Starting transaction dispatch ..
12/18/2014 12:18:47 PM -- Database cache settings: (minimum: 128.0 MB, maximum: 1.0 GB)
12/18/2014 12:18:47 PM -- Database flush thresholds: (start: 10.2 MB, stop: 20.5 MB)
12/18/2014 12:18:52 PM -- Database read latency thresholds: (average: 20 msec/read, maximum: 100 msec/read).
12/18/2014 12:18:52 PM -- Log write latency thresholds: (average: 10 msec/write, maximum: 100 msec/write).
12/18/2014 12:18:53 PM -- Operation mix: Sessions 8, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
12/18/2014 12:18:53 PM -- Performance logging started (interval: 15000 ms).
12/18/2014 12:18:53 PM -- Generating log files ...
12/18/2014 3:33:27 PM -- C:\DB\DB1 (102.0% generated), C:\DB\DB2 (101.4% generated), C:\DB\DB3 (100.2% generated) and C:\DB\DB4
(100.2% generated)
12/18/2014 3:33:27 PM -- Performance logging has ended.
12/18/2014 3:33:27 PM -- JetInterop batch transaction stats: 16998, 16998, 16998 and 16997.
12/18/2014 3:33:27 PM -- Dispatching transactions ends.
12/18/2014 3:33:27 PM -- Shutting down databases ...
12/18/2014 3:33:29 PM -- Instance1816.1 (complete), Instance1816.2 (complete), Instance1816.3 (complete) and Instance1816.4 (complete)
12/18/2014 3:33:29 PM -- C:\Program Files\Exchange Jetstress\Performance_2014_12_18_12_18_52.blg has 776 samples.
12/18/2014 3:33:29 PM -- Creating test report ...
12/18/2014 3:33:32 PM -- Instance1816.1 has 18.4 for I/O Database Reads Average Latency.
12/18/2014 3:33:32 PM -- Instance1816.1 has 3.0 for I/O Log Writes Average Latency.
12/18/2014 3:33:32 PM -- Instance1816.1 has 3.0 for I/O Log Reads Average Latency.
12/18/2014 3:33:32 PM -- Instance1816.2 has 18.3 for I/O Database Reads Average Latency.
12/18/2014 3:33:32 PM -- Instance1816.2 has 3.0 for I/O Log Writes Average Latency.
12/18/2014 3:33:32 PM -- Instance1816.2 has 3.0 for I/O Log Reads Average Latency.
12/18/2014 3:33:32 PM -- Instance1816.3 has 18.3 for I/O Database Reads Average Latency.
12/18/2014 3:33:32 PM -- Instance1816.3 has 3.0 for I/O Log Writes Average Latency.
12/18/2014 3:33:32 PM -- Instance1816.3 has 3.0 for I/O Log Reads Average Latency.
12/18/2014 3:33:32 PM -- Instance1816.4 has 18.3 for I/O Database Reads Average Latency.
12/18/2014 3:33:32 PM -- Instance1816.4 has 3.0 for I/O Log Writes Average Latency.
12/18/2014 3:33:32 PM -- Instance1816.4 has 3.0 for I/O Log Reads Average Latency.
12/18/2014 3:33:32 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.
```



```
12/18/2014 3:33:32 PM -- The test has 0 Database Page Fault Stalls/sec samples higher than 0.
12/18/2014 3:33:32 PM -- C:\Program Files\Exchange Jetstress\Performance_2014_12_18_12_18_52.xml has 775 samples queried.
12/18/2014 3:33:32 PM -- C:\Program Files\Exchange Jetstress\Performance_2014_12_18_12_18_52.html was saved.
12/19/2014 6:33:46 AM -- Performance logging started (interval: 2000 ms).
12/19/2014 6:33:46 AM -- Recovering databases ...
12/19/2014 7:11:46 AM -- Performance logging has ended.
12/19/2014 7:11:46 AM -- Instance1816.1 (2273.8158445), Instance1816.2 (2279.3252887), Instance1816.3 (2256.8711082) and
Instance1816.4 (2253.2484762)
12/19/2014 7:11:46 AM -- C:\Program Files\Exchange Jetstress\SoftRecovery_2014_12_19_6_33_45.blg has 1123 samples.
12/19/2014 7:11:46 AM -- Creating test report ...
```

.



## D.7 Server 4 – JS13

Table 121 Soft Recovery statistics - All

Database Instance	Log files replayed	Elapsed seconds
Instance1652.1	506	2254.9532995
Instance1652.2	508	2281.4362367
Instance1652.3	508	2266.1626214
Instance1652.4	501	2230.9733855
Avg	505	2258.381
Sum	2023	9033.5255431

Table 122 Database configuration

Performance Counter	Value
Instance1652.1	Log path: C:\DB\DB1 Database: C:\DB\DB1\Jetstress001001.edb
Instance1652.2	Log path: C:\DB\DB2 Database: C:\DB\DB2\Jetstress002001.edb
Instance1652.3	Log path: C:\DB\DB3 Database: C:\DB\DB3\Jetstress003001.edb
Instance1652.4	Log path: C:\DB\DB4 Database: C:\DB\DB4\Jetstress004001.edb



Table 123 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
Instance1652.1	12.409	2.343	95.456	0.895	37989.003	15616.461	5.555	0.000	1.119	0.000	96948.937	0.000
Instance1652.2	14.105	2.285	93.552	0.889	38115.596	15435.683	5.975	0.000	1.111	0.000	97259.028	0.000
Instance1652.3	13.903	2.391	95.086	0.894	38092.592	15620.588	5.820	0.000	1.118	0.000	97072.141	0.000
Instance1652.4	12.814	2.364	96.885	0.896	38146.875	15355.341	6.006	0.000	1.123	0.000	96722.251	0.000

Table 124 Background Database Maintenance I/O performance

MSExchange Database ==> Instances	Database Maintenance I/O Reads/sec	Database Maintenance I/O Reads Average Bytes
Instance1652.1	0.000	0.000
Instance1652.2	0.000	0.000
Instance1652.3	0.000	0.000
Instance1652.4	0.000	0.000



Table 125 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
Instance1652.1	12.409	2.343	95.456	0.895	37989.003	15616.461	5.555	0.000	1.119	0.000	96948.937	0.000
Instance1652.2	14.105	2.285	93.552	0.889	38115.596	15435.683	5.975	0.000	1.111	0.000	97259.028	0.000
Instance1652.3	13.903	2.391	95.086	0.894	38092.592	15620.588	5.820	0.000	1.118	0.000	97072.141	0.000
Instance1652.4	12.814	2.364	96.885	0.896	38146.875	15355.341	6.006	0.000	1.123	0.000	96722.251	0.000

Table 126 Host system performance

Counter	Average	Minimum	Maximum
% Processor Time	0.294	0.000	4.307
Available MBytes	60925.081	60847.000	61906.000
Free System Page Table Entries	16181640.879	16181051.000	16181950.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	1907877939.018	1907781632.000	1908318208.000
Pool Paged Bytes	111700696.826	111616000.000	112361472.000
Database Page Fault Stalls/sec	0.000	0.000	0.000



## D.8 Test log

```
12/18/2014 12:18:45 PM -- Preparing for testing ...
12/18/2014 12:18:50 PM -- Attaching databases ...
12/18/2014 12:18:50 PM -- Preparations for testing are complete.
12/18/2014 12:18:50 PM -- Starting transaction dispatch ..
12/18/2014 12:18:50 PM -- Database cache settings: (minimum: 128.0 MB, maximum: 1.0 GB)
12/18/2014 12:18:50 PM -- Database flush thresholds: (start: 10.2 MB, stop: 20.5 MB)
12/18/2014 12:18:55 PM -- Database read latency thresholds: (average: 20 msec/read, maximum: 100 msec/read).
12/18/2014 12:18:55 PM -- Log write latency thresholds: (average: 10 msec/write, maximum: 100 msec/write).
12/18/2014 12:18:56 PM -- Operation mix: Sessions 8, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
12/18/2014 12:18:56 PM -- Performance logging started (interval: 15000 ms).
12/18/2014 12:18:56 PM -- Generating log files ...
12/18/2014 3:36:11 PM -- C:\DB\DB1 (101.2% generated), C:\DB\DB2 (101.6% generated), C:\DB\DB3 (101.6% generated) and C:\DB\DB4
(100.2% generated)
12/18/2014 3:36:12 PM -- Performance logging has ended.
12/18/2014 3:36:12 PM -- JetInterop batch transaction stats: 17150, 17150, 17150 and 17149.
12/18/2014 3:36:12 PM -- Dispatching transactions ends.
12/18/2014 3:36:12 PM -- Shutting down databases ...
12/18/2014 3:36:13 PM -- Instancel652.1 (complete), Instancel652.2 (complete), Instancel652.3 (complete) and Instancel652.4 (complete)
12/18/2014 3:36:13 PM -- C:\Program Files\Exchange Jetstress\Performance_2014_12_18_12_18_55.blg has 787 samples.
12/18/2014 3:36:13 PM -- Creating test report ...
12/18/2014 3:36:17 PM -- Instancel652.1 has 18.5 for I/O Database Reads Average Latency.
12/18/2014 3:36:17 PM -- Instancel652.1 has 3.0 for I/O Log Writes Average Latency.
12/18/2014 3:36:17 PM -- Instancel652.1 has 3.0 for I/O Log Reads Average Latency.
12/18/2014 3:36:17 PM -- Instancel652.2 has 18.8 for I/O Database Reads Average Latency.
12/18/2014 3:36:17 PM -- Instancel652.2 has 3.0 for I/O Log Writes Average Latency.
12/18/2014 3:36:17 PM -- Instancel652.2 has 3.0 for I/O Log Reads Average Latency.
12/18/2014 3:36:17 PM -- Instancel652.3 has 18.7 for I/O Database Reads Average Latency.
12/18/2014 3:36:17 PM -- Instancel652.3 has 3.0 for I/O Log Writes Average Latency.
12/18/2014 3:36:17 PM -- Instancel652.3 has 3.0 for I/O Log Reads Average Latency.
12/18/2014 3:36:17 PM -- Instancel652.4 has 18.8 for I/O Database Reads Average Latency.
12/18/2014 3:36:17 PM -- Instancel652.4 has 3.0 for I/O Log Writes Average Latency.
12/18/2014 3:36:17 PM -- Instancel652.4 has 3.0 for I/O Log Reads Average Latency.
12/18/2014 3:36:17 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.
```



```
12/18/2014 3:36:17 PM -- The test has 0 Database Page Fault Stalls/sec samples higher than 0.
12/18/2014 3:36:17 PM -- C:\Program Files\Exchange Jetstress\Performance_2014_12_18_12_18_55.xml has 786 samples queried.
12/18/2014 3:36:17 PM -- C:\Program Files\Exchange Jetstress\Performance_2014_12_18_12_18_55.html was saved.
12/19/2014 6:33:50 AM -- Performance logging started (interval: 2000 ms).
12/19/2014 6:33:50 AM -- Recovering databases ...
12/19/2014 7:11:52 AM -- Performance logging has ended.
12/19/2014 7:11:52 AM -- Instance1652.1 (2254.9532995), Instance1652.2 (2281.4362367), Instance1652.3 (2266.1626214) and
Instance1652.4 (2230.9733855)
12/19/2014 7:11:52 AM -- C:\Program Files\Exchange Jetstress\SoftRecovery_2014_12_19_6_33_49.blg has 1124 samples.
12/19/2014 7:11:52 AM -- Creating test report ...
```

