



Infortrend EonStor DS 1016R 1,000 Mailbox Resiliency Exchange 2013 Storage Solution

Technical White Paper

Tested with: ESRP – Storage Version 4.0

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Overview

This document provides information on Infotrend® storage solution for Microsoft Exchange Server, based the Microsoft® Exchange Solution Reviewed Program (ESRP) *. For any questions or comments regarding the contents of this document, see [Contact for Additional Information](#).

*The ESRP was a program developed by Microsoft Corporation and provide a common storage testing framework for vendors to publish information on its storage solutions for Microsoft Exchange Server software. For more details on this program, please visit the web page:

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

Disclaimer

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The information contained in this document represents the current view of Infotrend on the issues discussed as of the date of publication. Due to changing market conditions, it should not be interpreted to be a commitment on the part of Infotrend, and Infotrend cannot guarantee the accuracy of any information presented after the date of publication.

Features

EonStor DS 1000 series storage systems deliver the best cost to performance ratios for SMB users among all entry-level RAID solutions. Models available in diverse form factors: 12-bay, 16-bay, and compact 24-bay. The EonStor DS 1000 series use redundant-controller design up to 32 GB of RAM and 3.2 TB SSD Cache per system with 8Gb/s or 16Gb/s Fibre Channel, 10Gb/s iSCSI, or 6Gb/s or 12Gb/s SAS host connectivity option for flexible hybrid interfaces. For EonStor DS 1016, the model supports daisy chaining up to 316 drives through compatible expansion enclosures.



Model name	DS 1016R DS 1016G	
Form factor	3U 16-bay LFF	
Storage controller	Single or Dual-redundant	
Host connectivity (per controller)	2 x 16Gb FC ports 4 x 8Gb FC ports 4 x 10Gb FCoE ports ⁵ 2 x 10Gb iSCSI ports (RJ-45) 2/4 x 10Gb iSCSI ports (SFP+)	4 x 1Gb iSCSI ports 2 x 6Gb SAS ports 2 x 12Gb SAS ports
Onboard iSCSI ports (per controller)	4	
Cache memory (per controller)	2GB, 4GB, 8GB, 16GB	
Max. drives (per system)	16	
Max. drives (via expansion enclosures)	316	
Expansion enclosure (JBOD)	JB 2016-1 JB 2048 JB 2060	
SAS expansion ports (per controller)	1 x 6Gb/ SAS port	
Cache backup techniques	<ul style="list-style-type: none"> • Super capacitor + Flash module or BBU (hot-swappable) 	
Supported drives	<ul style="list-style-type: none"> • 2.5" SATA/SAS SSD • 2.5" 10K/15K RPM SAS HDD • 3.5" 7200 RPM NL SAS HDD (DS1012/1016/1024 only) • 3.5" 7200 RPM SATA HDD (DS1012/1016/1024 only) 	

Table 1: Infortrend DS 1016 storage

List of Significant Features

- Sustained performance guaranteed:
Systems provide up to 550K IOPS. Throughput reaches transmission up to 5,500MB/s in reading and 1,900MB/s in writing.
- Hybrid host interconnect:
Host board slots of single modular are supported for each controller. Choose module host interface 8Gb/s or 16Gb/s Fibre Channel, 10Gb/s iSCSI, or 6Gb/s or 12Gb/s SAS.
- Expansion scalability:
Provide 6 Gb/s SAS ports for backend connectivity up to 5 JBOD expansion with 316 HDDs.
- Unified management:
Provide easy deployment and management via browser-based GUI Manager software suite - SANWatch.
- Data service:
Provide equipped Snapshot, local & remote replication for protecting data, automated Tiering, and SSD Cache for efficiency.
- Availability and reliability:
Support redundant, hot-swappable hardware modules, including controller, power supply unit and cooling fan. With high-availability hardware design, it prevents the "single-point-of-failure".
- Capacity efficiency:
Use thin provisioning to ensure the most efficient allocation of pooled capacity.
- Green design:
Support high-efficiency power supplies and intelligent multi-level drive spin-down technology.

For more detail information of this product, please check the product link:

<http://www.infortrend.com/global/Products/families/ESDS/1000>

Solution Description

In this solution we deployed 1,000 mailbox users with single exchange server per DAG on Infortrend DS 1016R storage. The host was configured to support up to 1,000 mailbox accounts with 5 GB mailbox capacity and 0.16 user profile (200 Messages sent and received per day, including 20% overhead).

The solution uses 8 disks for databases on storage array.

- 8 spindles in a RAID1 disk group
- 3 Exchange databases per disk group

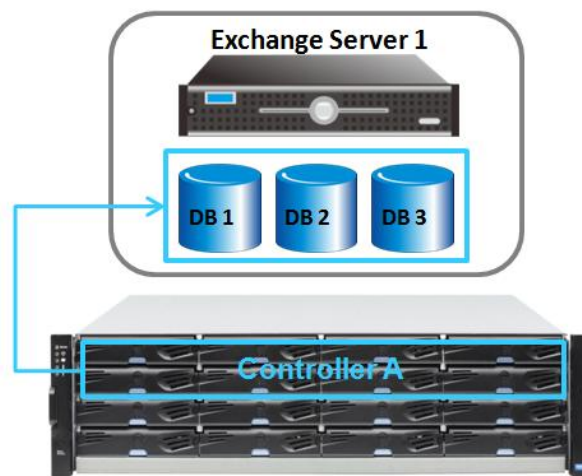


Figure 1: Solution configuration

A RAID1 disk group was created with 8 HDDs (8 x 3TB NL-SAS drives per group) in this solution, one RAID group was hosted by one controller of the EonStor DS 1016R. For the disk group, each includes one LUN for a total of 3 databases hosted by one active Exchange servers. Figure 1 shows the complete architecture of this solution.

Each database has 1 active at the local site and 1 passive at the remote site. The servers were configured in the same DAG for exchange 2013 built in database recovery high availability mailbox resiliency when encountered failure.

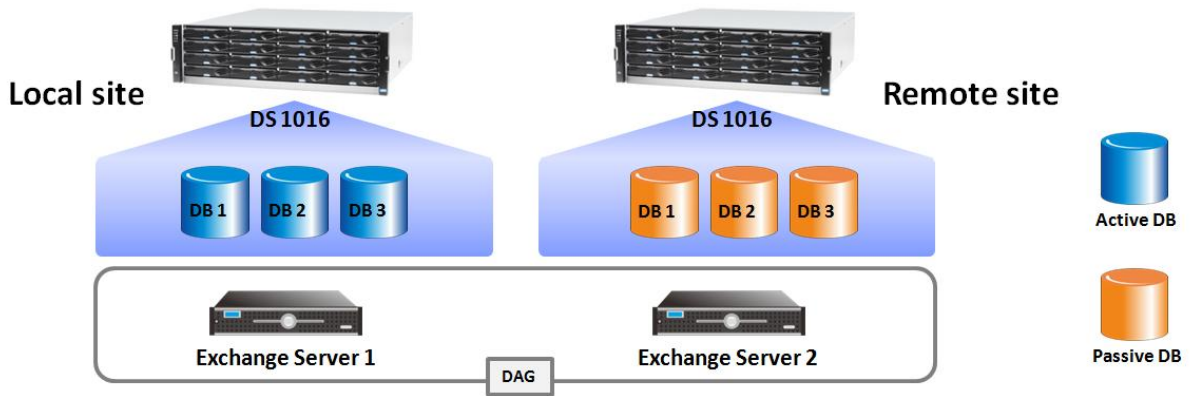


Figure 2: Database architecture

The proposed solution topology is connected with “No single point of failure” method. Three physical servers were deployed in this solution with multipath IO configured. Figure 3 below shows the complete diagram.

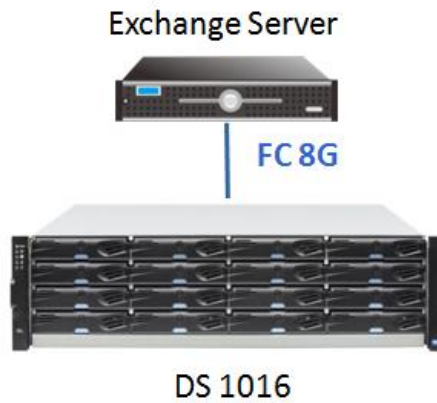


Figure 3: Solution connection topology

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

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

Target Customer Profile

This solution targets on a 1,000-user Exchange Server 2013 environment, suitable for small and medium size companies. The EonStor DS 1000 series provides excellent performance and price point through replication, backup and disaster recovery features. This EonStor DS 1000 series solution is also designed for easy deployment and maintenance without the help of IT professionals.

This solution has been tested with the following characteristics:

- 1,000 active mailboxes
- 5.0 GB capacity for each Mailbox
- 0.16 User Profile (200 messages sent and received per user per day, including 20% overhead)
- 1 Exchange servers per DAG, each supporting 1,000 users.
- 24 x 7 background database maintenance enabled
- Mailbox resiliency
- Two Infortrend EonStor DS 1016R storage (one tested)

Tested Deployment

The following tables summarize the testing environment:

Simulated Exchange Configuration

Number of Exchange mailboxes simulated	1,000
Number of Database Availability Groups (DAGs)	1
Number of servers/DAG	2 (1 tested)
Number of active mailboxes/server	1,000
Number of databases/host	3
Number of copies/database	2
Number of mailboxes/database	333
Simulated profile: I/O's per second per mailbox (IOPS, include 20% headroom)	0.16
Database/Log LUN size	2TB
Total database size for performance testing	4.77TB
% storage capacity used by Exchange database**	79.5%

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

Storage Hardware

Storage Connectivity (Fiber Channel, SAS, SATA, iSCSI)	Fibre Channel
Storage model and OS/firmware revision	EonStor DS 1016R Firmware version: 5.55C.08
Storage cache	16GB per controller
Number of storage controllers	1
Number of storage ports	2 per controller
Maximum bandwidth of storage connectivity to host	32 Gbps bandwidth (4 x 8Gb/s FC per controller)
Switch type/model/firmware revision	N/A
HBA model and firmware	Qlogic QLE2562 Firmware version: 4.6.02
Number of HBAs/host	1 per host
Host server type	Intel(R) Xeon(R) E5-2620 2.00Ghz 2.00Ghz x 32GB RAM
Total number of disks tested in solution	8
Maximum number of spindles can be hosted in the storage	316

Storage Software

HBA driver	Driver version: 9.1.8.6
HBA QueueTarget Setting	N/A
HBA QueueDepth Setting	N/A
Multi-Pathing	Microsoft MPIO
Host OS	Windows Server 2008 R2 64bit
ESE.dll file version	15.00.0516.026
Replication solution name/version	N/A

Storage Disk Configuration (Mailbox Store & Log Disks)

Disk type, speed and firmware revision	7.2k RPM NL SAS drive
Raw capacity per disk (GB)	2794.27GB
Number of physical disks in test	8
Total raw storage capacity (GB)	22354.16GB (21.83TB)
Disk slice size (GB)	N/A
RAID level	RAID 1
Total formatted capacity	6TB
Storage capacity utilization	27.49%
Database capacity utilization	21.85%

Best Practices

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

- Capacity and performance
 - Mailbox capacity
 - Performance requirements
 - Future growth

This solution includes the best practice of initial deployment of EonStor DS for Microsoft Exchange 2013, under consideration of both mailbox capacity and performance requirements. The type and amount of hard disk drives is the key factor in this solution when considering future growth in data size and usage. Please refer to the Microsoft Exchange 2013 best practices on storage design from Microsoft, and visit: [https://technet.microsoft.com/en-us/library/ee832792\(v=exchg.150\).aspx](https://technet.microsoft.com/en-us/library/ee832792(v=exchg.150).aspx)

- Layout
 - Number of database
 - Database size

Since larger database size and more number of databases may cause higher performance impact, it is recommended to follow this white paper for the best practice when configuring the number of database and database size when using EonStor DS for Exchange 2013 deployment. It has been tested that with the same total available capacity, deploying more databases will cause a higher impact than deploying larger databases.

- Windows server 2008 R2 no longer require to use DiskPart for partitioning and aligning sector boundary. For windows server 2003, use DiskPart to align the sectors to 64k.
- It is not recommended to share Exchange 2013 disks with other IO intensive applications it may cause performance impact.
- Database and Log I/O is no longer needed to be isolated in Exchange 2013 solution.
- It is best practice to format the database and log LUN as 64k allocation size.
- It is best practice to minimize the number of database and increase the database size.
- It is best practice to minimize the number of disk groups and multiple disk groups hosted by a single server may carry lower performance than single disk groups.
- It is recommended to use identical drives for better performance optimization and capacity utilization.
- It is best practice to optimize performance by balancing the load of both controllers with even disk groups.

Backup Strategy

This solution has reserved capacity for Infortrend snapshot technology for Exchange server data protection. For database backup, deployment of capacity expansion will be required in addition to this solution.

Contact for Additional Information

To find out more detail information about the EonStor DS 1000 series, please visit the product solution webpage: <http://www.infortrend.com/global/Products/families/ESDS/1000>

For more information about Infortrend storage solution, we recommend you consult with Infortrend directly to assist with the related information about products and services. Or visit Infortrend website: <http://www.infortrend.com>

Test Result Summary

This section provides a high level summary of the test data from ESRP and the link to the detailed html reports which are generated by ESRP testing framework. Please check the [Appendix](#) for all detailed information about test results.

Reliability

A number of tests in the framework are to check Reliability tests runs for 24 hours. The goal is to verify the storage can handle high IO load for a long period of time. Both log and database files will be analyzed for integrity after the stress test to ensure no database/log corruption. Please check the [Appendix A: Stress Test](#) for detailed results.

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

- [No errors reported in the saved event log file.](#)
- [No errors reported in during the database and log checksum process.](#)

Storage Performance Results

The Primary Storage performance testing is designed to exercise the storage with maximum sustainable Exchange type of IO for 2 hours. The test is to show how long it takes for the storage to respond to an IO under load. The data below is the sum of all of the logical disk I/O's and average of all the logical disks I/O latency in the 2 hours test duration. Each server is listed separately and the aggregate numbers across all servers is listed as well. Please check the [Appendix B: Performance Test](#) for detailed results.

Individual Server Metrics:

The sum of I/O's across Storage Groups and the average latency across all Storage Groups on a per server basis.

Server 1

Database I/O	
Database Disks Transfers/sec	1212.281
Database Disks Reads/sec	831.723
Database Disks Writes/sec	380.559
Average Database Disk Read Latency (ms)	17.60
Average Database Disk Write Latency (ms)	2.118
Transaction Log I/O	
Log Disks Writes/sec	183.386
Average Log Disk Write Latency (ms)	1.304

Aggregate Performance across all servers Metrics:

The sum of I/O's across servers in solution and the average latency across all servers in solution.

Database I/O	
Database Disks Transfers/sec	1212.281
Database Disks Reads/sec	831.723
Database Disks Writes/sec	380.559
Average Database Disk Read Latency (ms)	17.60
Average Database Disk Write Latency (ms)	2.118
Transaction Log I/O	
Log Disks Writes/sec	183.386
Average Log Disk Write Latency (ms)	1.304

Database Backup/Recovery Performance

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

Database Read-only Performance

The test is to measure the maximum rate at which databases could be backed up via VSS. The following table shows the average rate for a single database file. Please check the [Appendix C: Database Backup Test](#) for detailed results.

MB read/sec per database	58.61
MB read/sec total per server	175.83

Transaction Log Recovery/Replay Performance

The test is to measure the maximum rate at which the log files can be played against the databases. The following table shows the average rate for 500 log files played in a single storage group. Each log file is 1 MB in size. Please check the [Appendix D: Soft Recovery](#) for detailed results.

Average time to play one Log file (sec)	2.279
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Conclusion

The information discussed in this report describes the best practices and test report for EonStor DS 1016R supporting up to 1,000 users. The test was conducted under the environment listed in the [Tested Deployment](#) section. The test result shows that the EonStor DS 1016R system is capable of handling the specified number of users without using up its performance resources.

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

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

Appendix: Test Report

This appendix contains Microsoft Exchange Jetstress 2013 test results for one of the servers used in testing this storage solution. These test results are representative of the results obtained for all of the servers tested.

Appendix A: Stress Test

Microsoft Exchange **Jetstress 2013**

24hr Stress Test Result Report (Server 1)

Test Summary

Overall Test Result **Pass**

Machine Name WIN-HI0BI2E59BK

Test Description

Test Start Time 5/25/2016 12:43:33 AM

Test End Time 5/26/2016 12:44:42 AM

Collection Start Time 5/25/2016 12:44:38 AM

Collection End Time 5/26/2016 12:44:30 AM

Jetstress Version 15.01.0466.019

ESE Version 15.00.0516.026

Operating System Windows Server 2008 R2 Standard (6.1.7600.0)

Performance Log [C:\Program Files\Exchange Jetstress\20160524-2_R1_TC=26_10005G\(Stress\)\Stress_2016_5_25_0_43_40.blg](#)

Database Sizing and Throughput

Achieved Transactional I/O per Second 1064.777

Target Transactional I/O per Second 160

Initial Database Size (bytes) 5249390804992

Final Database Size (bytes) 5275672313856

Database Files (Count) 3

Jetstress System Parameters

Thread Count 26

Minimum Database Cache 96.0 MB

Maximum Database Cache 768.0 MB

Insert Operations 40%

Delete Operations 20%

Replace Operations 5%

Read Operations 35%

Lazy Commits 70%

Run Background Database Maintenance True

Number of Copies per Database 2

Database Configuration

Instance4656.1 Log path: E:\DB1
Database: E:\DB1\Jetstress001001.edb

Instance4656.2 Log path: E:\DB2
Database: E:\DB2\Jetstress002001.edb

Instance4656.3 Log path: E:\DB3
Database: E:\DB3\Jetstress003001.edb

Transactional I/O Performance

MSExchange Database ==> Instances	I/O Database Reads Average Latency (msec)	I/O Database Writes Average Latency (msec)	I/O Database Reads/sec	I/O Database Writes/sec	I/O Database Reads Average Bytes	I/O Database Writes Average Bytes	I/O Log Reads Average Latency (msec)	I/O Log Writes Average Latency (msec)	I/O Log Reads/sec	I/O Log Writes/sec	I/O Log Reads Average Bytes	I/O Log Writes Average Bytes
Instance4656.1	19.016	0.999	247.026	108.131	32879.949	34887.549	0.000	0.378	0.000	67.233	0.000	7742.258
Instance4656.2	18.597	0.995	247.281	108.303	32880.698	34883.435	0.000	0.378	0.000	67.237	0.000	7740.695
Instance4656.3	17.646	0.993	246.334	107.702	32877.524	34882.668	0.000	0.378	0.000	67.163	0.000	7741.204

Background Database Maintenance I/O Performance

MSEExchange Database ==> Instances	Database Maintenance IO Reads/sec	Database Maintenance IO Reads Average Bytes
Instance4656.1	7.041	261900.240
Instance4656.2	7.461	261907.519
Instance4656.3	7.227	261910.780

Log Replication I/O Performance

MSEExchange Database ==> Instances	I/O Log Reads/sec	I/O Log Reads Average Bytes
Instance4656.1	1.515	232561.813
Instance4656.2	1.514	232555.967
Instance4656.3	1.514	232560.762

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
Instance4656.1	19.016	0.999	254.067	108.131	39226.924	34887.549	0.555	0.378	1.515	67.233	232561.813	7742.258
Instance4656.2	18.597	0.995	254.742	108.303	39588.748	34883.435	0.558	0.378	1.514	67.237	232555.967	7740.695
Instance4656.3	17.646	0.993	253.562	107.702	39405.776	34882.668	0.557	0.378	1.514	67.163	232560.762	7741.204

Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	0.944	0.000	14.986
Available MBytes	28884.874	28558.000	28932.000
Free System Page Table Entries	33555283.881	33555134.000	33555660.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	53041024.868	52887552.000	53764096.000
Pool Paged Bytes	140523793.138	139669504.000	144027648.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log

5/25/2016 12:43:33 AM -- Preparing for testing ...
 5/25/2016 12:43:36 AM -- Attaching databases ...
 5/25/2016 12:43:36 AM -- Preparations for testing are complete.
 5/25/2016 12:43:36 AM -- Starting transaction dispatch ..
 5/25/2016 12:43:36 AM -- Database cache settings: (minimum: 96.0 MB, maximum: 768.0 MB)
 5/25/2016 12:43:36 AM -- Database flush thresholds: (start: 7.7 MB, stop: 15.3 MB)
 5/25/2016 12:43:40 AM -- Database read latency thresholds: (average: 20 msec/read, maximum: 200 msec/read).
 5/25/2016 12:43:40 AM -- Log write latency thresholds: (average: 10 msec/write, maximum: 200 msec/write).
 5/25/2016 12:43:46 AM -- Operation mix: Sessions 26, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
 5/25/2016 12:43:46 AM -- Performance logging started (interval: 15000 ms).
 5/25/2016 12:43:46 AM -- Attaining prerequisites:
 5/25/2016 12:44:38 AM -- \MSEExchange Database(JetstressWin)\Database Cache Size, Last: 730701800.0 (lower bound: 724775700.0, upper bound: none)
 5/26/2016 12:44:39 AM -- Performance logging has ended.
 5/26/2016 12:44:39 AM -- JetInterop batch transaction stats: 626234, 626234 and 626233.
 5/26/2016 12:44:39 AM -- Dispatching transactions ends.
 5/26/2016 12:44:39 AM -- Shutting down databases ...
 5/26/2016 12:44:42 AM -- Instance4656.1 (complete), Instance4656.2 (complete) and Instance4656.3 (complete)
 5/26/2016 12:44:42 AM -- C:\Program Files\Exchange Jetstress\20160524-2_R1_TC=26_10005G(Stress)\Stress_2016_5_25_0_43_40.blg has 5754 samples.
 5/26/2016 12:44:43 AM -- Creating test report ...
 5/26/2016 12:45:19 AM -- Instance4656.1 has 19.0 for I/O Database Reads Average Latency.
 5/26/2016 12:45:19 AM -- Instance4656.1 has 0.4 for I/O Log Writes Average Latency.
 5/26/2016 12:45:19 AM -- Instance4656.1 has 0.4 for I/O Log Reads Average Latency.
 5/26/2016 12:45:19 AM -- Instance4656.2 has 18.6 for I/O Database Reads Average Latency.
 5/26/2016 12:45:19 AM -- Instance4656.2 has 0.4 for I/O Log Writes Average Latency.
 5/26/2016 12:45:19 AM -- Instance4656.2 has 0.4 for I/O Log Reads Average Latency.
 5/26/2016 12:45:19 AM -- Instance4656.3 has 17.6 for I/O Database Reads Average Latency.
 5/26/2016 12:45:19 AM -- Instance4656.3 has 0.4 for I/O Log Writes Average Latency.
 5/26/2016 12:45:19 AM -- Instance4656.3 has 0.4 for I/O Log Reads Average Latency.
 5/26/2016 12:45:19 AM -- Test has 0 Maximum Database Page Fault Stalls/sec.
 5/26/2016 12:45:19 AM -- The test has 0 Database Page Fault Stalls/sec samples higher than 0.
 5/26/2016 12:45:19 AM -- C:\Program Files\Exchange Jetstress\20160524-2_R1_TC=26_10005G(Stress)\Stress_2016_5_25_0_43_40.xml has 5750 samples queried.

Stress Test Database Checksum (Server 1)

Checksum Statistics - All

Database	Seen pages	Bad pages	Correctable pages	Wrong page-number pages	File length / seconds taken
E:\DB1\Jetstress001001.edb	53666914	0	0	0	1677091 MB/4118 sec
E:\DB2\Jetstress002001.edb	53666658	0	0	0	1677083 MB/3877 sec
E:\DB3\Jetstress003001.edb	53667170	0	0	0	1677099 MB/3739 sec
(Sum)	161000742	0	0	0	5031273 MB/11736 sec

Disk Subsystem Performance (of checksum)

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec	Avg. Disk Bytes/Read
E:	0.037	0.000	6860.440	0.000	65536.000

Memory System Performance (of checksum)

Counter	Average	Minimum	Maximum
---------	---------	---------	---------

% Processor Time	1.962	0.000	3.963
Available MBytes	29558.517	29544.000	29568.000
Free System Page Table Entries	33555375.304	33555142.000	33555656.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	54124826.844	54067200.000	54288384.000
Pool Paged Bytes	144327787.376	144105472.000	144683008.000

Test Log

5/25/2016 12:43:33 AM -- Preparing for testing ...
 5/25/2016 12:43:36 AM -- Attaching databases ...
 5/25/2016 12:43:36 AM -- Preparations for testing are complete.
 5/25/2016 12:43:36 AM -- Starting transaction dispatch ..
 5/25/2016 12:43:36 AM -- Database cache settings: (minimum: 96.0 MB, maximum: 768.0 MB)
 5/25/2016 12:43:36 AM -- Database flush thresholds: (start: 7.7 MB, stop: 15.3 MB)
 5/25/2016 12:43:40 AM -- Database read latency thresholds: (average: 20 msec/read, maximum: 200 msec/read).
 5/25/2016 12:43:40 AM -- Log write latency thresholds: (average: 10 msec/write, maximum: 200 msec/write).
 5/25/2016 12:43:46 AM -- Operation mix: Sessions 26, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
 5/25/2016 12:43:46 AM -- Performance logging started (interval: 15000 ms).
 5/25/2016 12:43:46 AM -- Attaining prerequisites:
 5/25/2016 12:44:38 AM -- \\MSEXchange Database(JetstressWin)\Database Cache Size, Last: 730701800.0 (lower bound: 724775700.0, upper bound: none)
 5/26/2016 12:44:39 AM -- Performance logging has ended.
 5/26/2016 12:44:39 AM -- JetInterop batch transaction stats: 626234, 626234 and 626233.
 5/26/2016 12:44:39 AM -- Dispatching transactions ends.
 5/26/2016 12:44:39 AM -- Shutting down databases ...
 5/26/2016 12:44:42 AM -- Instance4656.1 (complete), Instance4656.2 (complete) and Instance4656.3 (complete)
 5/26/2016 12:44:42 AM -- [C:\Program Files\Exchange Jetstress\20160524-2_R1_TC=26_10005G\(Stress\)\Stress_2016_5_25_0_43_40.blg](#) has 5754 samples.
 5/26/2016 12:44:43 AM -- Creating test report ...
 5/26/2016 12:45:19 AM -- Instance4656.1 has 19.0 for I/O Database Reads Average Latency.
 5/26/2016 12:45:19 AM -- Instance4656.1 has 0.4 for I/O Log Writes Average Latency.
 5/26/2016 12:45:19 AM -- Instance4656.1 has 0.4 for I/O Log Reads Average Latency.
 5/26/2016 12:45:19 AM -- Instance4656.2 has 18.6 for I/O Database Reads Average Latency.
 5/26/2016 12:45:19 AM -- Instance4656.2 has 0.4 for I/O Log Writes Average Latency.
 5/26/2016 12:45:19 AM -- Instance4656.2 has 0.4 for I/O Log Reads Average Latency.
 5/26/2016 12:45:19 AM -- Instance4656.3 has 17.6 for I/O Database Reads Average Latency.
 5/26/2016 12:45:19 AM -- Instance4656.3 has 0.4 for I/O Log Writes Average Latency.
 5/26/2016 12:45:19 AM -- Instance4656.3 has 0.4 for I/O Log Reads Average Latency.
 5/26/2016 12:45:19 AM -- Test has 0 Maximum Database Page Fault Stalls/sec.
 5/26/2016 12:45:19 AM -- The test has 0 Database Page Fault Stalls/sec samples higher than 0.
 5/26/2016 12:45:19 AM -- [C:\Program Files\Exchange Jetstress\20160524-2_R1_TC=26_10005G\(Stress\)\Stress_2016_5_25_0_43_40.xml](#) has 5750 samples queried.
 5/26/2016 12:45:19 AM -- [C:\Program Files\Exchange Jetstress\20160524-2_R1_TC=26_10005G\(Stress\)\Stress_2016_5_25_0_43_40.html](#) was saved.
 5/26/2016 12:45:20 AM -- Performance logging started (interval: 30000 ms).
 5/26/2016 12:45:20 AM -- Verifying database checksums ...
 5/26/2016 4:00:56 AM -- E: (100% processed)
 5/26/2016 4:00:56 AM -- Performance logging has ended.
 5/26/2016 4:00:56 AM -- [C:\Program Files\Exchange Jetstress\20160524-2_R1_TC=26_10005G\(Stress\)\DBChecksum_2016_5_26_0_45_19.blg](#) has 391 samples.

Appendix B: Performance Test

Microsoft Exchange Jetstress 2013

2 hr Performance Test Result Report (Server 1)

Test Summary

Overall Test Result **Pass**
Machine Name WIN-HI0BI2E59BK
Test Description
Test Start Time 5/24/2016 2:07:08 PM
Test End Time 5/24/2016 4:08:18 PM
Collection Start Time 5/24/2016 2:08:15 PM
Collection End Time 5/24/2016 4:08:02 PM
Jetstress Version 15.01.0466.019
ESE Version 15.00.0516.026
Operating System Windows Server 2008 R2 Standard (6.1.7600.0)
Performance Log C:\Program Files\Exchange Jetstress\20160524-1_R1_TC=26_10005G\Performance_2016_5_24_14_7_16.blg

Database Sizing and Throughput

Achieved Transactional I/O per Second 1212.281
Target Transactional I/O per Second 160
Initial Database Size (bytes) 5247293652992
Final Database Size (bytes) 5249390804992
Database Files (Count) 3

Jetstress System Parameters

Thread Count 26
Minimum Database Cache 96.0 MB
Maximum Database Cache 768.0 MB
Insert Operations 40%
Delete Operations 20%
Replace Operations 5%
Read Operations 35%
Lazy Commits 70%
Run Background Database Maintenance True
Number of Copies per Database 2

Database Configuration

Instance564.1 Log path: E:\DB1
 Database: E:\DB1\Jetstress001001.edb
Instance564.2 Log path: E:\DB2
 Database: E:\DB2\Jetstress002001.edb
Instance564.3 Log path: E:\DB3
 Database: E:\DB3\Jetstress003001.edb

Transactional I/O Performance

MSEExchange Database ==> Instances	I/O Database Reads Average Latency (msec)	I/O Database Writes Average Latency (msec)	I/O Database Reads/sec	I/O Database Writes/sec	I/O Database Reads Average Bytes	I/O Database Writes Average Bytes	I/O Log Reads Average Latency (msec)	I/O Log Writes Average Latency (msec)	I/O Log Reads/sec	I/O Log Writes/sec	I/O Log Reads Average Bytes	I/O Log Writes Average Bytes
Instance564.1	18.040	2.120	277.159	126.295	32918.787	35029.948	0.000	1.301	0.000	60.841	0.000	7929.753
Instance564.2	17.922	2.109	277.693	127.110	32924.119	35052.453	0.000	1.308	0.000	61.059	0.000	7925.048
Instance564.3	16.839	2.124	276.871	127.154	32921.095	35030.203	0.000	1.303	0.000	61.486	0.000	7902.866

Background Database Maintenance I/O Performance

MSEExchange Database ==> Instances	Database Maintenance IO Reads/sec	Database Maintenance IO Reads Average Bytes
Instance564.1	6.631	261870.274
Instance564.2	7.020	261939.432
Instance564.3	6.809	261828.684

Log Replication I/O Performance

MSEExchange Database ==> Instances	I/O Log Reads/sec	I/O Log Reads Average Bytes
Instance564.1	1.449	232556.059
Instance564.2	1.454	232561.778
Instance564.3	1.460	232562.832

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
Instance564.1	18.040	2.120	283.789	126.295	38268.282	35029.948	1.601	1.301	1.449	60.841	232556.059	7929.753
Instance564.2	17.922	2.109	284.713	127.110	38570.844	35052.453	1.258	1.308	1.454	61.059	232561.778	7925.048
Instance564.3	16.839	2.124	283.680	127.154	38415.140	35030.203	1.218	1.303	1.460	61.486	232562.832	7902.866

Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	0.837	0.000	4.076
Available MBytes	28959.359	28943.000	28976.000
Free System Page Table Entries	33555163.307	33555145.000	33555660.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	52986702.564	52891648.000	53186560.000
Pool Paged Bytes	138483656.418	138391552.000	141619200.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log

5/24/2016 2:07:08 PM -- Preparing for testing ...
 5/24/2016 2:07:11 PM -- Attaching databases ...
 5/24/2016 2:07:11 PM -- Preparations for testing are complete.
 5/24/2016 2:07:11 PM -- Starting transaction dispatch ..
 5/24/2016 2:07:11 PM -- Database cache settings: (minimum: 96.0 MB, maximum: 768.0 MB)
 5/24/2016 2:07:11 PM -- Database flush thresholds: (start: 7.7 MB, stop: 15.3 MB)
 5/24/2016 2:07:16 PM -- Database read latency thresholds: (average: 20 msec/read, maximum: 100 msec/read).
 5/24/2016 2:07:16 PM -- Log write latency thresholds: (average: 10 msec/write, maximum: 100 msec/write).
 5/24/2016 2:07:21 PM -- Operation mix: Sessions 26, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
 5/24/2016 2:07:21 PM -- Performance logging started (interval: 15000 ms).
 5/24/2016 2:07:21 PM -- Attaining prerequisites:
 5/24/2016 2:08:15 PM -- \MSEXchange Database(JetstressWin)\Database Cache Size, Last: 743075800.0 (lower bound: 724775700.0, upper bound: none)
 5/24/2016 4:08:16 PM -- Performance logging has ended.
 5/24/2016 4:08:16 PM -- JetInterop batch transaction stats: 49951, 49951 and 49951.
 5/24/2016 4:08:16 PM -- Dispatching transactions ends.
 5/24/2016 4:08:16 PM -- Shutting down databases ...
 5/24/2016 4:08:18 PM -- Instance564.1 (complete), Instance564.2 (complete) and Instance564.3 (complete)
 5/24/2016 4:08:18 PM -- C:\Program Files\Exchange Jetstress\20160524-1_R1_TC=26_10005G\Performance_2016_5_24_14_7_16.blg has 482 samples.
 5/24/2016 4:08:18 PM -- Creating test report ...
 5/24/2016 4:08:22 PM -- Instance564.1 has 18.0 for I/O Database Reads Average Latency.
 5/24/2016 4:08:22 PM -- Instance564.1 has 1.3 for I/O Log Writes Average Latency.
 5/24/2016 4:08:22 PM -- Instance564.1 has 1.3 for I/O Log Reads Average Latency.
 5/24/2016 4:08:22 PM -- Instance564.2 has 17.9 for I/O Database Reads Average Latency.
 5/24/2016 4:08:22 PM -- Instance564.2 has 1.3 for I/O Log Writes Average Latency.
 5/24/2016 4:08:22 PM -- Instance564.2 has 1.3 for I/O Log Reads Average Latency.
 5/24/2016 4:08:22 PM -- Instance564.3 has 16.8 for I/O Database Reads Average Latency.
 5/24/2016 4:08:22 PM -- Instance564.3 has 1.3 for I/O Log Writes Average Latency.
 5/24/2016 4:08:22 PM -- Instance564.3 has 1.3 for I/O Log Reads Average Latency.
 5/24/2016 4:08:22 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.
 5/24/2016 4:08:22 PM -- The test has 0 Database Page Fault Stalls/sec samples higher than 0.
 5/24/2016 4:08:22 PM -- C:\Program Files\Exchange Jetstress\20160524-1_R1_TC=26_10005G\Performance_2016_5_24_14_7_16.xml has 478 samples queried.

Performance Test Database Checksum (Server 1)

Checksum Statistics - All

Database	Seen pages	Bad pages	Correctable pages	Wrong page-number pages	File length / seconds taken
E:\DB1\Jetstress001001.edb	53399394	0	0	0	1668731 MB/4141 sec
E:\DB2\Jetstress002001.edb	53399394	0	0	0	1668731 MB/3835 sec
E:\DB3\Jetstress003001.edb	53399906	0	0	0	1668747 MB/3693 sec
(Sum)	160198694	0	0	0	5006209 MB/11670 sec

Disk Subsystem Performance (of checksum)

LogicalDisk	Avg. Disk sec/Read	Avg. Disk sec/Write	Disk Reads/sec	Disk Writes/sec	Avg. Disk Bytes/Read
E:	0.037	0.000	6873.909	0.000	65536.000

Memory System Performance (of checksum)

Counter	Average	Minimum	Maximum
% Processor Time	2.030	0.000	4.506
Available MBytes	29755.392	29728.000	29771.000
Free System Page Table Entries	33555305.466	33555142.000	33555658.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	53281982.021	53235712.000	53399552.000
Pool Paged Bytes	139556388.948	138600448.000	141946880.000

Test Log

5/24/2016 2:07:08 PM -- Preparing for testing ...
 5/24/2016 2:07:11 PM -- Attaching databases ...
 5/24/2016 2:07:11 PM -- Preparations for testing are complete.
 5/24/2016 2:07:11 PM -- Starting transaction dispatch ..
 5/24/2016 2:07:11 PM -- Database cache settings: (minimum: 96.0 MB, maximum: 768.0 MB)

Infotrend EonStor DS 1016R 1,000 Mailbox Resiliency Exchange 2013 Storage Solution

5/24/2016 2:07:11 PM -- Database flush thresholds: (start: 7.7 MB, stop: 15.3 MB)
5/24/2016 2:07:16 PM -- Database read latency thresholds: (average: 20 msec/read, maximum: 100 msec/read).
5/24/2016 2:07:16 PM -- Log write latency thresholds: (average: 10 msec/write, maximum: 100 msec/write).
5/24/2016 2:07:21 PM -- Operation mix: Sessions 26, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
5/24/2016 2:07:21 PM -- Performance logging started (interval: 15000 ms).
5/24/2016 2:07:21 PM -- Attaining prerequisites:
5/24/2016 2:08:15 PM -- \\MSEExchange Database(JetstressWin)\Database Cache Size, Last: 743075800.0 (lower bound: 724775700.0, upper bound: none)
5/24/2016 4:08:16 PM -- Performance logging has ended.
5/24/2016 4:08:16 PM -- JetInterop batch transaction stats: 49951, 49951 and 49951.
5/24/2016 4:08:16 PM -- Dispatching transactions ends.
5/24/2016 4:08:16 PM -- Shutting down databases ...
5/24/2016 4:08:18 PM -- Instance564.1 (complete), Instance564.2 (complete) and Instance564.3 (complete)
5/24/2016 4:08:18 PM -- C:\Program Files\Exchange Jetstress\20160524-1_R1_TC=26_10005G\Performance_2016_5_24_14_7_16.blg has 482 samples.
5/24/2016 4:08:18 PM -- Creating test report ...
5/24/2016 4:08:22 PM -- Instance564.1 has 18.0 for I/O Database Reads Average Latency.
5/24/2016 4:08:22 PM -- Instance564.1 has 1.3 for I/O Log Writes Average Latency.
5/24/2016 4:08:22 PM -- Instance564.1 has 1.3 for I/O Log Reads Average Latency.
5/24/2016 4:08:22 PM -- Instance564.2 has 17.9 for I/O Database Reads Average Latency.
5/24/2016 4:08:22 PM -- Instance564.2 has 1.3 for I/O Log Writes Average Latency.
5/24/2016 4:08:22 PM -- Instance564.2 has 1.3 for I/O Log Reads Average Latency.
5/24/2016 4:08:22 PM -- Instance564.3 has 16.8 for I/O Database Reads Average Latency.
5/24/2016 4:08:22 PM -- Instance564.3 has 1.3 for I/O Log Writes Average Latency.
5/24/2016 4:08:22 PM -- Instance564.3 has 1.3 for I/O Log Reads Average Latency.
5/24/2016 4:08:22 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.
5/24/2016 4:08:22 PM -- The test has 0 Database Page Fault Stalls/sec samples higher than 0.
5/24/2016 4:08:22 PM -- C:\Program Files\Exchange Jetstress\20160524-1_R1_TC=26_10005G\Performance_2016_5_24_14_7_16.xml has 478 samples queried.
5/24/2016 4:08:22 PM -- C:\Program Files\Exchange Jetstress\20160524-1_R1_TC=26_10005G\Performance_2016_5_24_14_7_16.html was saved.
5/24/2016 4:08:23 PM -- Performance logging started (interval: 30000 ms).
5/24/2016 4:08:23 PM -- Verifying database checksums ...
5/24/2016 7:22:54 PM -- E: (100% processed)
5/24/2016 7:22:54 PM -- Performance logging has ended.
5/24/2016 7:22:54 PM -- C:\Program Files\Exchange Jetstress\20160524-1_R1_TC=26_10005G\DBChecksum_2016_5_24_16_8_22.blg has 388 samples.

Appendix C: Database Backup Test

Microsoft Exchange Jetstress 2013

Database Backup Test Result Report (Server 1)

Database Backup Statistics - All

Database Instance	Database Size (MBytes)	Elapsed Backup Time	MBytes Transferred/sec
Instance4240.1	1677083.09	08:03:55	57.76
Instance4240.2	1677075.09	08:07:03	57.39
Instance4240.3	1677091.09	07:40:36	60.68
Avg			58.61
Sum			175.83

Jetstress System Parameters

Thread Count	26
Minimum Database Cache	96.0 MB
Maximum Database Cache	768.0 MB
Insert Operations	40%
Delete Operations	20%
Replace Operations	5%
Read Operations	35%
Lazy Commits	70%

Database Configuration

Instance4240.1	Log path: E:\DB1 Database: E:\DB1\Jetstress001001.edb
Instance4240.2	Log path: E:\DB2 Database: E:\DB2\Jetstress002001.edb
Instance4240.3	Log path: E:\DB3 Database: E:\DB3\Jetstress003001.edb

Transactional I/O Performance

MSEXchange Database ==> Instances	I/O Database Reads Average Latency (msec)	I/O Database Writes Average Latency (msec)	I/O Database Reads/sec	I/O Database Writes/sec	I/O Database Reads Average Bytes	I/O Database Writes Average Bytes	I/O Log Reads Average Latency (msec)	I/O Log Writes Average Latency (msec)	I/O Log Reads/sec	I/O Log Writes/sec	I/O Log Reads Average Bytes	I/O Log Writes Average Bytes
Instance4240.1	6.721	0.000	231.059	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance4240.2	7.232	0.000	229.345	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance4240.3	6.459	0.000	242.771	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	0.630	0.000	2.786
Available MBytes	29735.921	29711.000	29751.000
Free System Page Table Entries	33555357.308	33555142.000	33555656.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	53872187.461	53846016.000	53923840.000
Pool Paged Bytes	144136728.732	142913536.000	147759104.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log

5/26/2016 9:11:51 AM -- Preparing for testing ...
 5/26/2016 9:11:55 AM -- Attaching databases ...
 5/26/2016 9:11:55 AM -- Preparations for testing are complete.
 5/26/2016 9:12:01 AM -- Performance logging started (interval: 30000 ms).
 5/26/2016 9:12:01 AM -- Backing up databases ...
 5/26/2016 5:19:05 PM -- Performance logging has ended.
 5/26/2016 5:19:05 PM -- Instance4240.1 (100% processed), Instance4240.2 (100% processed) and Instance4240.3 (100% processed)
 5/26/2016 5:19:05 PM -- C:\Program Files\Exchange Jetstress\20160526-1_R1_TC=26_10005G(Backup)\DatabaseBackup_2016_5_26_9_11_55.blg has 973 samples.
 5/26/2016 5:19:05 PM -- Creating test report ...

Appendix D: Soft Recovery

Microsoft Exchange Jetstress 2013

Soft Recovery Test Result Report (Server 1)

Soft-Recovery Statistics - All

Database Instance	Log files replayed	Elapsed seconds
Instance3272.1	510	1132.7537899
Instance3272.2	508	1106.7493025
Instance3272.3	501	1059.4945997
Avg	506	1099.666
Sum	1519	3298.9976921

Database Configuration

Instance3272.1 Log path: E:\DB1
Database: E:\DB1\Jetstress001001.edb

Instance3272.2 Log path: E:\DB2
Database: E:\DB2\Jetstress002001.edb

Instance3272.3 Log path: E:\DB3
Database: E:\DB3\Jetstress003001.edb

Transactional I/O Performance

MSEExchange Database ==> Instances	I/O Database Reads Average Latency (msec)	I/O Database Writes Average Latency (msec)	I/O Database Reads/sec	I/O Database Writes/sec	I/O Database Reads Average Bytes	I/O Database Writes Average Bytes	I/O Log Reads Average Latency (msec)	I/O Log Writes Average Latency (msec)	I/O Log Reads/sec	I/O Log Writes/sec	I/O Log Reads Average Bytes	I/O Log Writes Average Bytes
Instance3272.1	16.034	10.556	388.707	1.796	40834.222	29374.171	15.193	0.000	2.247	0.000	185880.822	0.000
Instance3272.2	17.655	13.596	391.418	1.832	41253.401	30491.612	20.640	0.000	2.292	0.000	192249.319	0.000
Instance3272.3	14.999	12.739	417.310	1.885	41203.699	30016.489	17.728	0.000	2.368	0.002	187853.458	7.817

Background Database Maintenance I/O Performance

MSEExchange Database ==> Instances	Database Maintenance IO Reads/sec	Database Maintenance IO Reads Average Bytes
Instance3272.1	8.072	261989.023
Instance3272.2	8.506	262031.757
Instance3272.3	8.331	261853.410

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
Instance3272.1	16.034	10.556	396.779	1.796	45333.374	29374.171	15.193	0.000	2.247	0.000	185880.822	0.000
Instance3272.2	17.655	13.596	399.924	1.832	45949.295	30491.612	20.640	0.000	2.292	0.000	192249.319	0.000
Instance3272.3	14.999	12.739	425.641	1.885	45522.458	30016.489	17.728	0.000	2.368	0.002	187853.458	7.817

Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	9.092	0.000	20.331
Available MBytes	28786.652	28736.000	29585.000
Free System Page Table Entries	33555240.453	33555141.000	33555660.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	54060307.622	53936128.000	54198272.000
Pool Paged Bytes	148532014.089	147685376.000	149594112.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log

5/27/2016 1:06:56 PM -- Preparing for testing ...
 5/27/2016 1:06:59 PM -- Attaching databases ...
 5/27/2016 1:06:59 PM -- Preparations for testing are complete.
 5/27/2016 1:07:00 PM -- Starting transaction dispatch ..
 5/27/2016 1:07:00 PM -- Database cache settings: (minimum: 96.0 MB, maximum: 768.0 MB)
 5/27/2016 1:07:00 PM -- Database flush thresholds: (start: 7.7 MB, stop: 15.3 MB)
 5/27/2016 1:07:03 PM -- Database read latency thresholds: (average: 20 msec/read, maximum: 100 msec/read).
 5/27/2016 1:07:03 PM -- Log write latency thresholds: (average: 10 msec/write, maximum: 100 msec/write).
 5/27/2016 1:07:06 PM -- Operation mix: Sessions 26, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
 5/27/2016 1:07:06 PM -- Performance logging started (interval: 15000 ms).
 5/27/2016 1:07:06 PM -- Generating log files ...
 5/27/2016 1:55:42 PM -- E:\DB1 (102.0% generated), E:\DB2 (101.6% generated) and E:\DB3 (100.2% generated)
 5/27/2016 1:55:42 PM -- Performance logging has ended.

5/27/2016 1:55:42 PM -- JetInterop batch transaction stats: 21642, 21642 and 21641.
 5/27/2016 1:55:42 PM -- Dispatching transactions ends.
 5/27/2016 1:55:43 PM -- Shutting down databases ...
 5/27/2016 1:55:44 PM -- Instance3272.1 (complete), Instance3272.2 (complete) and Instance3272.3 (complete)
 5/27/2016 1:55:44 PM -- [C:\Program Files\Exchange Jetstress\20160527-3 R1 TC=26 10005G\(Soft3\)\Performance 2016 5 27 13 7 3.blg](#) has 194 samples.
 5/27/2016 1:55:44 PM -- Creating test report ...
 5/27/2016 1:55:46 PM -- Instance3272.1 has 19.3 for I/O Database Reads Average Latency.
 5/27/2016 1:55:46 PM -- Instance3272.1 has 0.4 for I/O Log Writes Average Latency.
 5/27/2016 1:55:46 PM -- Instance3272.1 has 0.4 for I/O Log Reads Average Latency.
 5/27/2016 1:55:46 PM -- Instance3272.2 has 18.7 for I/O Database Reads Average Latency.
 5/27/2016 1:55:46 PM -- Instance3272.2 has 0.4 for I/O Log Writes Average Latency.
 5/27/2016 1:55:46 PM -- Instance3272.2 has 0.4 for I/O Log Reads Average Latency.
 5/27/2016 1:55:46 PM -- Instance3272.3 has 17.8 for I/O Database Reads Average Latency.
 5/27/2016 1:55:46 PM -- Instance3272.3 has 0.4 for I/O Log Writes Average Latency.
 5/27/2016 1:55:46 PM -- Instance3272.3 has 0.4 for I/O Log Reads Average Latency.
 5/27/2016 1:55:46 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.
 5/27/2016 1:55:46 PM -- The test has 0 Database Page Fault Stalls/sec samples higher than 0.
 5/27/2016 1:55:46 PM -- [C:\Program Files\Exchange Jetstress\20160527-3 R1 TC=26 10005G\(Soft3\)\Performance 2016 5 27 13 7 3.xml](#) has 193 samples queried.
 5/27/2016 1:55:46 PM -- [C:\Program Files\Exchange Jetstress\20160527-3 R1 TC=26 10005G\(Soft3\)\Performance 2016 5 27 13 7 3.html](#) was saved.
 5/27/2016 1:55:49 PM -- Performance logging started (interval: 2000 ms).
 5/27/2016 1:55:49 PM -- Recovering databases ...
 5/27/2016 2:14:42 PM -- Performance logging has ended.
 5/27/2016 2:14:42 PM -- Instance3272.1 (1132.7537899), Instance3272.2 (1106.7493025) and Instance3272.3 (1059.4945997)
 5/27/2016 2:14:42 PM -- [C:\Program Files\Exchange Jetstress\20160527-3 R1 TC=26 10005G\(Soft3\)\SoftRecovery 2016 5 27 13 55 46.blg](#) has 561 samples.
 5/27/2016 2:14:42 PM -- Creating test report ...

Soft Recovery Performance Test Result Report (Server 1)

Test Summary

Overall Test Result Pass

Machine Name WIN-HI0B12E59BK

Test Description

Test Start Time 5/27/2016 1:06:56 PM

Test End Time 5/27/2016 1:55:44 PM

Collection Start Time 5/27/2016 1:07:21 PM

Collection End Time 5/27/2016 1:55:40 PM

Jetstress Version 15.01.0466.019

ESE Version 15.00.0516.026

Operating System Windows Server 2008 R2 Standard (6.1.7600.0)

Performance Log [C:\Program Files\Exchange Jetstress\20160527-3 R1 TC=26 10005G\(Soft3\)\Performance 2016 5 27 13 7 3.blg](#)

Database Sizing and Throughput

Achieved Transactional I/O per Second 995.072

Target Transactional I/O per Second 160

Initial Database Size (bytes) 5277501030400

Final Database Size (bytes) 5278432165888

Database Files (Count) 3

Jetstress System Parameters

Thread Count 26

Minimum Database Cache 96.0 MB

Maximum Database Cache 768.0 MB

Insert Operations 40%

Delete Operations 20%

Replace Operations 5%

Read Operations 35%

Lazy Commits 70%

Database Configuration

Instance3272.1 Log path: E:\DB1
 Database: E:\DB1\Jetstress001001.edb

Instance3272.2 Log path: E:\DB2
 Database: E:\DB2\Jetstress002001.edb

Instance3272.3 Log path: E:\DB3
 Database: E:\DB3\Jetstress003001.edb

Transactional I/O Performance

MSExchange Database ==> Instances	I/O Database Reads Average Latency (msec)	I/O Database Writes Average Latency (msec)	I/O Database Reads/sec	I/O Database Writes/sec	I/O Database Reads Average Bytes	I/O Database Writes Average Bytes	I/O Log Reads Average Latency (msec)	I/O Log Writes Average Latency (msec)	I/O Log Reads/sec	I/O Log Writes/sec	I/O Log Reads Average Bytes	I/O Log Writes Average Bytes
Instance3272.1	19.296	1.044	232.592	99.518	32768.446	34947.399	0.000	0.365	0.000	68.337	0.000	7834.684
Instance3272.2	18.731	1.047	231.256	98.092	32768.649	34923.374	0.000	0.365	0.000	67.803	0.000	7846.562
Instance3272.3	17.847	1.094	233.847	99.767	32768.050	34893.226	0.000	0.366	0.000	68.221	0.000	7756.771

Host System Performance

Counter	Average	Minimum	Maximum
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% Processor Time	0.965	0.000	4.143
Available MBytes	28799.000	28784.000	29347.000
Free System Page Table Entries	33555304.515	33555146.000	33555660.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	53907054.845	53899264.000	53923840.000
Pool Paged Bytes	148032395.876	147935232.000	148090880.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log

5/27/2016 1:06:56 PM -- Preparing for testing ...
 5/27/2016 1:06:59 PM -- Attaching databases ...
 5/27/2016 1:06:59 PM -- Preparations for testing are complete.
 5/27/2016 1:07:00 PM -- Starting transaction dispatch ..
 5/27/2016 1:07:00 PM -- Database cache settings: (minimum: 96.0 MB, maximum: 768.0 MB)
 5/27/2016 1:07:00 PM -- Database flush thresholds: (start: 7.7 MB, stop: 15.3 MB)
 5/27/2016 1:07:03 PM -- Database read latency thresholds: (average: 20 msec/read, maximum: 100 msec/read).
 5/27/2016 1:07:03 PM -- Log write latency thresholds: (average: 10 msec/write, maximum: 100 msec/write).
 5/27/2016 1:07:06 PM -- Operation mix: Sessions 26, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
 5/27/2016 1:07:06 PM -- Performance logging started (interval: 15000 ms).
 5/27/2016 1:07:06 PM -- Generating log files ...
 5/27/2016 1:55:42 PM -- E:\DB1 (102.0% generated), E:\DB2 (101.6% generated) and E:\DB3 (100.2% generated)
 5/27/2016 1:55:42 PM -- Performance logging has ended.
 5/27/2016 1:55:42 PM -- JetInterop batch transaction stats: 21642, 21642 and 21641.
 5/27/2016 1:55:42 PM -- Dispatching transactions ends.
 5/27/2016 1:55:43 PM -- Shutting down databases ...
 5/27/2016 1:55:44 PM -- Instance3272.1 (complete), Instance3272.2 (complete) and Instance3272.3 (complete)
 5/27/2016 1:55:44 PM -- [C:\Program Files\Exchange Jetstress\20160527-3_R1_TC=26_10005G\(Soft3\)\Performance_2016_5_27_13_7_3.blog](C:\Program Files\Exchange Jetstress\20160527-3_R1_TC=26_10005G(Soft3)\Performance_2016_5_27_13_7_3.blog) has 194 samples.
 5/27/2016 1:55:44 PM -- Creating test report ...
 5/27/2016 1:55:46 PM -- Instance3272.1 has 19.3 for I/O Database Reads Average Latency.
 5/27/2016 1:55:46 PM -- Instance3272.1 has 0.4 for I/O Log Writes Average Latency.
 5/27/2016 1:55:46 PM -- Instance3272.1 has 0.4 for I/O Log Reads Average Latency.
 5/27/2016 1:55:46 PM -- Instance3272.2 has 18.7 for I/O Database Reads Average Latency.
 5/27/2016 1:55:46 PM -- Instance3272.2 has 0.4 for I/O Log Writes Average Latency.
 5/27/2016 1:55:46 PM -- Instance3272.2 has 0.4 for I/O Log Reads Average Latency.
 5/27/2016 1:55:46 PM -- Instance3272.3 has 17.8 for I/O Database Reads Average Latency.
 5/27/2016 1:55:46 PM -- Instance3272.3 has 0.4 for I/O Log Writes Average Latency.
 5/27/2016 1:55:46 PM -- Instance3272.3 has 0.4 for I/O Log Reads Average Latency.
 5/27/2016 1:55:46 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.
 5/27/2016 1:55:46 PM -- The test has 0 Database Page Fault Stalls/sec samples higher than 0.
 5/27/2016 1:55:46 PM -- [C:\Program Files\Exchange Jetstress\20160527-3_R1_TC=26_10005G\(Soft3\)\Performance_2016_5_27_13_7_3.xml](C:\Program Files\Exchange Jetstress\20160527-3_R1_TC=26_10005G(Soft3)\Performance_2016_5_27_13_7_3.xml) has 193 samples queried.