



Infortrend EonStor DS 1016R 5,000 Mailbox Resiliency Exchange 2013 Storage Solution

Technical White Paper

Tested with: ESRP – Storage Version 4.0

Tested Date: 2016/05/24

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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>

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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 5,000 mailbox users with single exchange server per DAG on Infortrend DS 1016R storage. The host was configured to support up to 5,000 mailbox accounts with 4 GB mailbox capacity and 0.16 user profile (200 Messages sent and received per day, including 20% overhead).

The solution uses 16 disks for databases on storage array.

- 16 spindles in a RAID1 disk group
- 10 Exchange databases per disk group

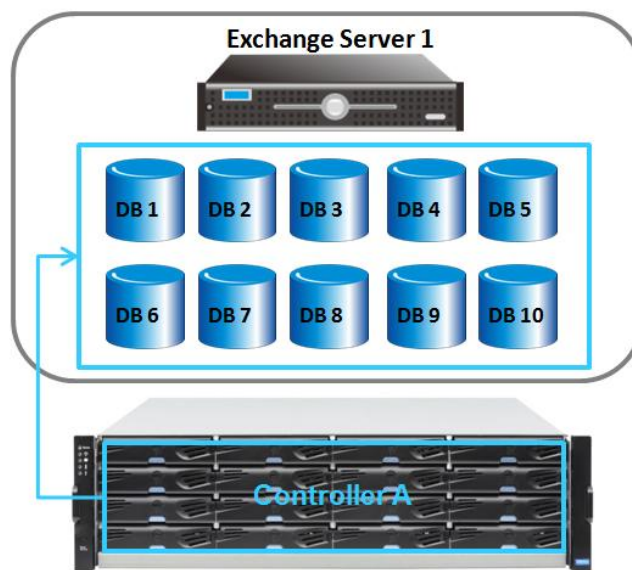


Figure 1: Solution configuration

A RAID1 disk group was created with 16 HDDs (16 x 4TB 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 16 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.

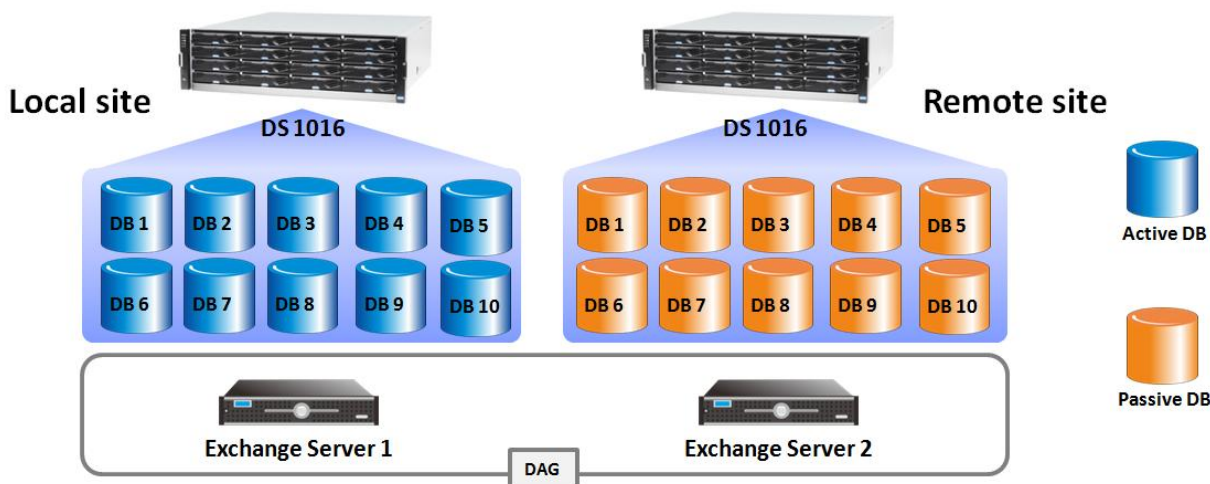


Figure 2: Database architecture

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.

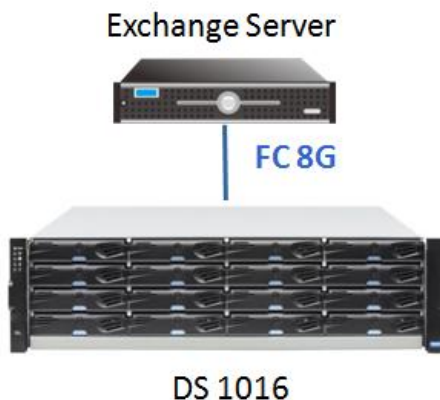


Figure 3: Solution connection topology

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 5,000-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:

- 5,000 active mailboxes
- 4.0 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 5,000 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	5,000
Number of Database Availability Groups (DAGs)	1
Number of servers/DAG	2 (1 tested)
Number of active mailboxes/server	5,000
Number of databases/host	10
Number of copies/database	2
Number of mailboxes/database	500
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	19.2TB
% storage capacity used by Exchange database**	96%

**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	4 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	2 per host
Host server type	Intel(R) Xeon(R) x3470 2.93Ghz 2.93Ghz x 32GB RAM
Total number of disks tested in solution	16
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)	3725.77GB
Number of physical disks in test	16
Total raw storage capacity (GB)	59612.32GB (58.22TB)
Disk slice size (GB)	N/A
RAID level	RAID 1
Total formatted capacity	20TB
Storage capacity utilization	34.35%
Database capacity utilization	32.98%

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	1483.186
Database Disks Reads/sec	1041.447
Database Disks Writes/sec	441.741
Average Database Disk Read Latency (ms)	16.84
Average Database Disk Write Latency (ms)	1.67
Transaction Log I/O	
Log Disks Writes/sec	309.218
Average Log Disk Write Latency (ms)	0.402

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	1483.186
Database Disks Reads/sec	1041.447
Database Disks Writes/sec	441.741
Average Database Disk Read Latency (ms)	16.84
Average Database Disk Write Latency (ms)	1.67
Transaction Log I/O	
Log Disks Writes/sec	309.218
Average Log Disk Write Latency (ms)	0.402

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	76.22
MB read/sec total per server	762.15

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)	3.26
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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 5,000 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-4VVEHEOP6PE
Test Description
Test Start Time 5/25/2016 12:44:14 AM
Test End Time 5/26/2016 12:47:50 AM
Collection Start Time 5/25/2016 12:47:45 AM
Collection End Time 5/26/2016 12:47:41 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\20160524-4_TC=30_50004G\(Stress\)\Stress_2016_5_25_0_44_35.blg](C:\Program Files\Exchange Jetstress\20160524-4_TC=30_50004G(Stress)\Stress_2016_5_25_0_44_35.blg)

Database Sizing and Throughput

Achieved Transactional I/O per Second 1378.664
Target Transactional I/O per Second 800
Initial Database Size (bytes) 21115170324480
Final Database Size (bytes) 21152742899712
Database Files (Count) 10

Jetstress System Parameters

Thread Count 30
Minimum Database Cache 320.0 MB
Maximum Database Cache 2560.0 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

Instance2080.1 Log path: E:\DB1
 Database: E:\DB1\Jetstress001001.edb
Instance2080.2 Log path: E:\DB2
 Database: E:\DB2\Jetstress002001.edb
Instance2080.3 Log path: E:\DB3
 Database: E:\DB3\Jetstress003001.edb
Instance2080.4 Log path: E:\DB4
 Database: E:\DB4\Jetstress004001.edb
Instance2080.5 Log path: E:\DB5
 Database: E:\DB5\Jetstress005001.edb
Instance2080.6 Log path: E:\DB6
 Database: E:\DB6\Jetstress006001.edb
Instance2080.7 Log path: E:\DB7
 Database: E:\DB7\Jetstress007001.edb
Instance2080.8 Log path: E:\DB8
 Database: E:\DB8\Jetstress008001.edb
Instance2080.9 Log path: E:\DB9
 Database: E:\DB9\Jetstress009001.edb

Instance2080.10 Log path: E:\DB10
 Database: E:\DB10\Jetstress010001.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
Instance2080.1	17.553	1.578	96.947	41.017	33167.900	35006.971	0.000	0.355	0.000	28.750	0.000	7756.337
Instance2080.2	16.930	1.583	96.916	40.958	33163.947	35001.549	0.000	0.355	0.000	28.682	0.000	7762.930
Instance2080.3	16.271	1.576	96.871	40.990	33157.457	35005.332	0.000	0.354	0.000	28.704	0.000	7778.006
Instance2080.4	15.828	1.577	96.970	41.063	33159.562	34998.435	0.000	0.355	0.000	28.716	0.000	7766.122
Instance2080.5	15.346	1.581	96.948	41.117	33168.044	35013.079	0.000	0.355	0.000	28.820	0.000	7775.757
Instance2080.6	15.440	1.575	96.799	40.863	33169.868	35019.445	0.000	0.355	0.000	28.639	0.000	7781.389
Instance2080.7	15.501	1.578	96.809	40.945	33153.588	35015.704	0.000	0.355	0.000	28.690	0.000	7783.955
Instance2080.8	15.765	1.581	96.800	40.937	33161.668	35014.213	0.000	0.355	0.000	28.685	0.000	7784.249
Instance2080.9	16.011	1.582	96.894	41.055	33169.239	34996.147	0.000	0.355	0.000	28.788	0.000	7778.519
Instance2080.10	16.855	1.582	96.840	40.923	33159.527	35019.114	0.000	0.355	0.000	28.780	0.000	7760.209

Background Database Maintenance I/O Performance

MSExchange Database ==> Instances	Database Maintenance IO Reads/sec	Database Maintenance IO Reads Average Bytes
Instance2080.1	8.152	261941.015
Instance2080.2	8.003	261938.186
Instance2080.3	8.077	261943.547
Instance2080.4	8.116	261938.857
Instance2080.5	8.340	261955.631
Instance2080.6	8.166	261937.491
Instance2080.7	8.164	261949.394
Instance2080.8	8.131	261949.247
Instance2080.9	8.282	261962.254
Instance2080.10	8.025	261945.268

Log Replication I/O Performance

MSExchange Database ==> Instances	I/O Log Reads/sec	I/O Log Reads Average Bytes
Instance2080.1	0.643	221466.389
Instance2080.2	0.642	222640.546
Instance2080.3	0.645	223126.666
Instance2080.4	0.643	221587.680
Instance2080.5	0.646	221910.001
Instance2080.6	0.643	221788.679
Instance2080.7	0.645	221449.817
Instance2080.8	0.645	221429.593
Instance2080.9	0.646	221351.648
Instance2080.10	0.644	221787.867

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
Instance2080.1	17.553	1.578	105.099	41.017	50913.329	35006.971	0.600	0.355	0.643	28.750	221466.389	7756.337
Instance2080.2	16.930	1.583	104.920	40.958	50615.052	35001.549	0.529	0.355	0.642	28.682	222640.546	7762.930
Instance2080.3	16.271	1.576	104.948	40.990	50766.127	35005.332	0.507	0.354	0.645	28.704	223126.666	7778.006
Instance2080.4	15.828	1.577	105.086	41.063	50829.005	34998.435	0.522	0.355	0.643	28.716	221587.680	7766.122
Instance2080.5	15.346	1.581	105.289	41.117	51290.827	35013.079	0.504	0.355	0.646	28.820	221910.001	7775.757
Instance2080.6	15.440	1.575	104.965	40.863	50966.961	35019.445	0.546	0.355	0.643	28.639	221788.679	7781.389
Instance2080.7	15.501	1.578	104.973	40.945	50948.034	35015.704	0.543	0.355	0.645	28.690	221449.817	7783.955
Instance2080.8	15.765	1.581	104.931	40.937	50890.622	35014.213	0.654	0.355	0.645	28.685	221429.593	7784.249
Instance2080.9	16.011	1.582	105.177	41.055	51185.727	34996.147	0.546	0.355	0.646	28.788	221351.648	7778.519
Instance2080.10	16.855	1.582	104.866	40.923	50668.420	35019.114	0.515	0.355	0.644	28.780	221787.867	7760.209

Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	2.818	0.000	6.926
Available MBytes	27315.968	27243.000	27585.000
Free System Page Table Entries	33555042.759	33555024.000	33556056.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	40621769.805	40595456.000	40665088.000
Pool Paged Bytes	141678331.008	139378688.000	142819328.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log

5/25/2016 12:44:14 AM -- Preparing for testing ...
 5/25/2016 12:44:24 AM -- Attaching databases ...
 5/25/2016 12:44:24 AM -- Preparations for testing are complete.
 5/25/2016 12:44:24 AM -- Starting transaction dispatch ..
 5/25/2016 12:44:24 AM -- Database cache settings: (minimum: 320.0 MB, maximum: 2.5 GB)
 5/25/2016 12:44:24 AM -- Database flush thresholds: (start: 25.6 MB, stop: 51.2 MB)
 5/25/2016 12:44:35 AM -- Database read latency thresholds: (average: 20 msec/read, maximum: 200 msec/read).
 5/25/2016 12:44:35 AM -- Log write latency thresholds: (average: 10 msec/write, maximum: 200 msec/write).
 5/25/2016 12:44:44 AM -- Operation mix: Sessions 30, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
 5/25/2016 12:44:44 AM -- Performance logging started (interval: 15000 ms).
 5/25/2016 12:44:44 AM -- Attaining prerequisites:
 5/25/2016 12:47:45 AM -- \\MSEExchange Database(JetstressWin)\Database Cache Size, Last: 2423345000.0 (lower bound: 2415919000.0, upper bound: none)
 5/26/2016 12:47:45 AM -- Performance logging has ended.
 5/26/2016 12:47:45 AM -- JetInterop batch transaction stats: 267320, 267320, 267320, 267320, 267320, 267320, 267320, 267320, 267319, 267319 and 267319.
 5/26/2016 12:47:45 AM -- Dispatching transactions ends.
 5/26/2016 12:47:45 AM -- Shutting down databases ...
 5/26/2016 12:47:50 AM -- Instance2080.1 (complete), Instance2080.2 (complete), Instance2080.3 (complete), Instance2080.4 (complete), Instance2080.5 (complete), Instance2080.6 (complete), Instance2080.7 (complete), Instance2080.8 (complete), Instance2080.9 (complete) and Instance2080.10 (complete)
 5/26/2016 12:47:50 AM -- [C:\Program Files\Exchange Jetstress\20160524-4_TC=30_50004G\(Stress\)\Stress_2016_5_25_0_44_35.blg](#) has 5755 samples.
 5/26/2016 12:47:50 AM -- Creating test report ...
 5/26/2016 12:48:42 AM -- Instance2080.1 has 17.6 for I/O Database Reads Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.1 has 0.4 for I/O Log Writes Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.1 has 0.4 for I/O Log Reads Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.2 has 16.9 for I/O Database Reads Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.2 has 0.4 for I/O Log Writes Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.2 has 0.4 for I/O Log Reads Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.3 has 16.3 for I/O Database Reads Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.3 has 0.4 for I/O Log Writes Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.3 has 0.4 for I/O Log Reads Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.4 has 15.8 for I/O Database Reads Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.4 has 0.4 for I/O Log Writes Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.4 has 0.4 for I/O Log Reads Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.5 has 15.3 for I/O Database Reads Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.5 has 0.4 for I/O Log Writes Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.5 has 0.4 for I/O Log Reads Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.6 has 15.4 for I/O Database Reads Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.6 has 0.4 for I/O Log Writes Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.6 has 0.4 for I/O Log Reads Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.7 has 15.5 for I/O Database Reads Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.7 has 0.4 for I/O Log Writes Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.7 has 0.4 for I/O Log Reads Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.8 has 15.8 for I/O Database Reads Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.8 has 0.4 for I/O Log Writes Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.8 has 0.4 for I/O Log Reads Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.9 has 16.0 for I/O Database Reads Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.9 has 0.4 for I/O Log Writes Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.9 has 0.4 for I/O Log Reads Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.10 has 16.9 for I/O Database Reads Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.10 has 0.4 for I/O Log Writes Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.10 has 0.4 for I/O Log Reads Average Latency.
 5/26/2016 12:48:42 AM -- Test has 0 Maximum Database Page Fault Stalls/sec.
 5/26/2016 12:48:42 AM -- The test has 0 Database Page Fault Stalls/sec samples higher than 0.
 5/26/2016 12:48:42 AM -- [C:\Program Files\Exchange Jetstress\20160524-4_TC=30_50004G\(Stress\)\Stress_2016_5_25_0_44_35.xml](#) has 5743 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	64552306	0	0	0	2017259 MB/2806 sec
E:\DB2\Jetstress002001.edb	64553074	0	0	0	2017283 MB/2591 sec
E:\DB3\Jetstress003001.edb	64552562	0	0	0	2017267 MB/2610 sec
E:\DB4\Jetstress004001.edb	64551794	0	0	0	2017243 MB/2673 sec
E:\DB5\Jetstress005001.edb	64554098	0	0	0	2017315 MB/2684 sec
E:\DB6\Jetstress006001.edb	64553330	0	0	0	2017291 MB/2655 sec
E:\DB7\Jetstress007001.edb	64552818	0	0	0	2017275 MB/2701 sec
E:\DB8\Jetstress008001.edb	64553586	0	0	0	2017299 MB/2735 sec
E:\DB9\Jetstress009001.edb	64553842	0	0	0	2017307 MB/2811 sec
E:\DB10\Jetstress010001.edb	64553074	0	0	0	2017283 MB/2836 sec
(Sum)	645530484	0	0	0	20172827 MB/27108 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:	0.026	0.000	11908.980	0.000	65536.000

Memory System Performance (of checksum)

Counter	Average	Minimum	Maximum
% Processor Time	11.402	7.594	25.040
Available MBytes	30053.752	29919.000	30060.000
Free System Page Table Entries	33555322.342	33554968.000	33556055.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	40629512.221	40599552.000	40669184.000
Pool Paged Bytes	143398737.364	142626816.000	145342464.000

Test Log

5/25/2016 12:44:14 AM -- Preparing for testing ...
 5/25/2016 12:44:24 AM -- Attaching databases ...
 5/25/2016 12:44:24 AM -- Preparations for testing are complete.
 5/25/2016 12:44:24 AM -- Starting transaction dispatch ..
 5/25/2016 12:44:24 AM -- Database cache settings: (minimum: 320.0 MB, maximum: 2.5 GB)
 5/25/2016 12:44:24 AM -- Database flush thresholds: (start: 25.6 MB, stop: 51.2 MB)
 5/25/2016 12:44:35 AM -- Database read latency thresholds: (average: 20 msec/read, maximum: 200 msec/read).
 5/25/2016 12:44:35 AM -- Log write latency thresholds: (average: 10 msec/write, maximum: 200 msec/write).
 5/25/2016 12:44:44 AM -- Operation mix: Sessions 30, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
 5/25/2016 12:44:44 AM -- Performance logging started (interval: 15000 ms).
 5/25/2016 12:44:44 AM -- Attaining prerequisites:
 5/25/2016 12:47:45 AM -- \\MSEXchange Database(JetstressWin)\Database Cache Size, Last: 2423345000.0 (lower bound: 2415919000.0, upper bound: none)
 5/26/2016 12:47:45 AM -- Performance logging has ended.
 5/26/2016 12:47:45 AM -- JetInterop batch transaction stats: 267320, 267320, 267320, 267320, 267320, 267320, 267320, 267319, 267319 and 267319.
 5/26/2016 12:47:45 AM -- Dispatching transactions ends.
 5/26/2016 12:47:45 AM -- Shutting down databases ...
 5/26/2016 12:47:50 AM -- Instance2080.1 (complete), Instance2080.2 (complete), Instance2080.3 (complete), Instance2080.4 (complete), Instance2080.5 (complete), Instance2080.6 (complete), Instance2080.7 (complete), Instance2080.8 (complete), Instance2080.9 (complete) and Instance2080.10 (complete)
 5/26/2016 12:47:50 AM -- [C:\Program Files\Exchange Jetstress\20160524-4 TC=30 50004G\(Stress\)\Stress_2016_5_25_0_44_35.blq](C:\Program Files\Exchange Jetstress\20160524-4 TC=30 50004G(Stress)\Stress_2016_5_25_0_44_35.blq) has 5755 samples.
 5/26/2016 12:47:50 AM -- Creating test report ...
 5/26/2016 12:48:42 AM -- Instance2080.1 has 17.6 for I/O Database Reads Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.1 has 0.4 for I/O Log Writes Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.1 has 0.4 for I/O Log Reads Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.2 has 16.9 for I/O Database Reads Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.2 has 0.4 for I/O Log Writes Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.2 has 0.4 for I/O Log Reads Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.3 has 16.3 for I/O Database Reads Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.3 has 0.4 for I/O Log Writes Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.3 has 0.4 for I/O Log Reads Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.4 has 15.8 for I/O Database Reads Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.4 has 0.4 for I/O Log Writes Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.4 has 0.4 for I/O Log Reads Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.5 has 15.3 for I/O Database Reads Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.5 has 0.4 for I/O Log Writes Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.5 has 0.4 for I/O Log Reads Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.6 has 15.4 for I/O Database Reads Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.6 has 0.4 for I/O Log Writes Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.6 has 0.4 for I/O Log Reads Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.7 has 15.5 for I/O Database Reads Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.7 has 0.4 for I/O Log Writes Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.7 has 0.4 for I/O Log Reads Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.8 has 15.8 for I/O Database Reads Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.8 has 0.4 for I/O Log Writes Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.8 has 0.4 for I/O Log Reads Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.9 has 16.0 for I/O Database Reads Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.9 has 0.4 for I/O Log Writes Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.9 has 0.4 for I/O Log Reads Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.10 has 16.9 for I/O Database Reads Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.10 has 0.4 for I/O Log Writes Average Latency.
 5/26/2016 12:48:42 AM -- Instance2080.10 has 0.4 for I/O Log Reads Average Latency.
 5/26/2016 12:48:42 AM -- Test has 0 Maximum Database Page Fault Stalls/sec.
 5/26/2016 12:48:42 AM -- The test has 0 Database Page Fault Stalls/sec samples higher than 0.
 5/26/2016 12:48:42 AM -- [C:\Program Files\Exchange Jetstress\20160524-4 TC=30 50004G\(Stress\)\Stress_2016_5_25_0_44_35.xml](C:\Program Files\Exchange Jetstress\20160524-4 TC=30 50004G(Stress)\Stress_2016_5_25_0_44_35.xml) has 5743 samples queried.
 5/26/2016 12:48:42 AM -- [C:\Program Files\Exchange Jetstress\20160524-4 TC=30 50004G\(Stress\)\Stress_2016_5_25_0_44_35.html](C:\Program Files\Exchange Jetstress\20160524-4 TC=30 50004G(Stress)\Stress_2016_5_25_0_44_35.html) was saved.
 5/26/2016 12:48:43 AM -- Performance logging started (interval: 30000 ms).
 5/26/2016 12:48:43 AM -- Verifying database checksums ...
 5/26/2016 8:20:32 AM -- E: (100% processed)
 5/26/2016 8:20:32 AM -- Performance logging has ended.
 5/26/2016 8:20:32 AM -- [C:\Program Files\Exchange Jetstress\20160524-4 TC=30 50004G\(Stress\)\DBChecksum_2016_5_26_0_48_42.blq](C:\Program Files\Exchange Jetstress\20160524-4 TC=30 50004G(Stress)\DBChecksum_2016_5_26_0_48_42.blq) has 903 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-4VVEHEOP6PE

Test Description

Test Start Time 5/24/2016 2:07:32 PM

Test End Time 5/24/2016 4:11:02 PM

Collection Start Time 5/24/2016 2:10:56 PM

Collection End Time 5/24/2016 4:10:45 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\20160524-3_TC=30_50004G\Performance_2016_5_24_14_7_54.blg

Database Sizing and Throughput

Achieved Transactional I/O per Second 1483.186

Target Transactional I/O per Second 800

Initial Database Size (bytes) 21111739383808

Final Database Size (bytes) 21115170324480

Database Files (Count) 10

Jetstress System Parameters

Thread Count 30

Minimum Database Cache 320.0 MB

Maximum Database Cache 2560.0 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

Instance2680.1 Log path: E:\DB1
Database: E:\DB1\Jetstress001001.edb

Instance2680.2 Log path: E:\DB2
Database: E:\DB2\Jetstress002001.edb

Instance2680.3 Log path: E:\DB3
Database: E:\DB3\Jetstress003001.edb

Instance2680.4 Log path: E:\DB4
Database: E:\DB4\Jetstress004001.edb

Instance2680.5 Log path: E:\DB5
Database: E:\DB5\Jetstress005001.edb

Instance2680.6 Log path: E:\DB6
Database: E:\DB6\Jetstress006001.edb

Instance2680.7 Log path: E:\DB7
Database: E:\DB7\Jetstress007001.edb

Instance2680.8 Log path: E:\DB8
Database: E:\DB8\Jetstress008001.edb

Instance2680.9 Log path: E:\DB9
Database: E:\DB9\Jetstress009001.edb

Instance2680.10 Log path: E:\DB10
Database: E:\DB10\Jetstress010001.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
Instance2680.1	18.422	1.673	104.131	44.168	33103.866	35031.616	0.000	0.404	0.000	31.047	0.000	7760.984
Instance2680.2	17.703	1.661	104.126	44.209	33103.664	35016.735	0.000	0.399	0.000	30.872	0.000	7811.618
Instance2680.3	16.957	1.660	104.357	44.326	33107.557	35006.086	0.000	0.404	0.000	30.843	0.000	7785.103

Infotrend EonStor DS 1016R 5,000 Mailbox Resiliency Exchange 2013 Storage Solution

Instance2680.4	16.486	1.660	104.067	44.193	33139.798	35039.134	0.000	0.401	0.000	31.080	0.000	7782.236
Instance2680.5	15.953	1.683	104.295	44.089	33070.961	35023.127	0.000	0.401	0.000	30.717	0.000	7768.731
Instance2680.6	16.060	1.685	103.882	44.064	33070.432	35021.577	0.000	0.401	0.000	30.991	0.000	7802.941
Instance2680.7	16.119	1.665	104.352	44.180	33079.743	34962.379	0.000	0.404	0.000	30.738	0.000	7763.078
Instance2680.8	16.410	1.662	103.598	43.869	33116.884	35050.918	0.000	0.400	0.000	30.822	0.000	7848.271
Instance2680.9	16.680	1.679	104.210	44.119	33114.331	34991.054	0.000	0.400	0.000	30.864	0.000	7777.384
Instance2680.10	17.603	1.673	104.429	44.524	33108.587	34994.792	0.000	0.403	0.000	31.244	0.000	7738.625

Background Database Maintenance I/O Performance

MSExchange Database ==> Instances	Database Maintenance IO Reads/sec	Database Maintenance IO Reads Average Bytes
Instance2680.1	7.932	261892.310
Instance2680.2	7.777	261960.434
Instance2680.3	7.860	261953.958
Instance2680.4	7.896	262007.277
Instance2680.5	8.144	261888.521
Instance2680.6	7.957	261879.595
Instance2680.7	7.952	261974.510
Instance2680.8	7.917	261937.850
Instance2680.9	8.088	261977.590
Instance2680.10	7.809	261918.122

Log Replication I/O Performance

MSExchange Database ==> Instances	I/O Log Reads/sec	I/O Log Reads Average Bytes
Instance2680.1	0.696	226711.167
Instance2680.2	0.699	228173.820
Instance2680.3	0.694	226714.125
Instance2680.4	0.696	225248.514
Instance2680.5	0.687	225736.065
Instance2680.6	0.701	226217.619
Instance2680.7	0.687	225248.514
Instance2680.8	0.701	229148.922
Instance2680.9	0.694	228173.820
Instance2680.10	0.696	228173.820

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
Instance2680.1	18.422	1.673	112.063	44.168	49297.492	35031.616	0.578	0.404	0.696	31.047	226711.167	7760.984
Instance2680.2	17.703	1.661	111.903	44.209	49008.324	35016.735	0.576	0.399	0.699	30.872	228173.820	7811.618
Instance2680.3	16.957	1.660	112.217	44.326	49137.480	35006.086	0.582	0.404	0.694	30.843	226714.125	7785.103
Instance2680.4	16.486	1.660	111.963	44.193	49280.003	35039.134	0.568	0.401	0.696	31.080	225248.514	7782.236
Instance2680.5	15.953	1.683	112.439	44.089	49643.431	35023.127	0.544	0.401	0.687	30.717	225736.065	7768.731
Instance2680.6	16.060	1.685	111.839	44.064	49349.606	35021.577	0.543	0.401	0.701	30.991	226217.619	7802.941
Instance2680.7	16.119	1.665	112.303	44.180	49286.592	34962.379	0.570	0.404	0.687	30.738	225248.514	7763.078
Instance2680.8	16.410	1.662	111.515	43.869	49362.911	35050.918	0.576	0.400	0.701	30.822	229148.922	7848.271
Instance2680.9	16.680	1.679	112.297	44.119	49596.802	34991.054	0.599	0.400	0.694	30.864	228173.820	7777.384
Instance2680.10	17.603	1.673	112.238	44.524	49027.266	34994.792	0.629	0.403	0.696	31.244	228173.820	7738.625

Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	2.765	0.999	6.490
Available MBytes	27332.435	27301.000	27392.000
Free System Page Table Entries	33555047.128	33555030.000	33555546.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	40709844.084	40652800.000	40771584.000
Pool Paged Bytes	138922986.577	138833920.000	142065664.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log

5/24/2016 2:07:32 PM -- Preparing for testing ...
 5/24/2016 2:07:43 PM -- Attaching databases ...
 5/24/2016 2:07:43 PM -- Preparations for testing are complete.
 5/24/2016 2:07:43 PM -- Starting transaction dispatch ..
 5/24/2016 2:07:43 PM -- Database cache settings: (minimum: 320.0 MB, maximum: 2.5 GB)
 5/24/2016 2:07:43 PM -- Database flush thresholds: (start: 25.6 MB, stop: 51.2 MB)
 5/24/2016 2:07:54 PM -- Database read latency thresholds: (average: 20 msec/read, maximum: 100 msec/read).
 5/24/2016 2:07:54 PM -- Log write latency thresholds: (average: 10 msec/write, maximum: 100 msec/write).
 5/24/2016 2:08:10 PM -- Operation mix: Sessions 30, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
 5/24/2016 2:08:10 PM -- Performance logging started (interval: 15000 ms).
 5/24/2016 2:08:10 PM -- Attaining prerequisites:
 5/24/2016 2:10:56 PM -- \MSExchange Database(JetstressWin)\Database Cache Size, Last: 2441597000.0 (lower bound: 2415919000.0, upper bound: none)
 5/24/2016 4:10:57 PM -- Performance logging has ended.
 5/24/2016 4:10:57 PM -- JetInterop batch transaction stats: 24366, 24366, 24365, 24365, 24365, 24365, 24365, 24365, 24365 and 24365.

5/24/2016 4:10:57 PM -- Dispatching transactions ends.
 5/24/2016 4:10:57 PM -- Shutting down databases ...
 5/24/2016 4:11:02 PM -- Instance2680.1 (complete), Instance2680.2 (complete), Instance2680.3 (complete), Instance2680.4 (complete), Instance2680.5 (complete), Instance2680.6 (complete), Instance2680.7 (complete), Instance2680.8 (complete), Instance2680.9 (complete) and Instance2680.10 (complete)
 5/24/2016 4:11:02 PM -- C:\Program Files\Exchange Jetstress\20160524-3 TC=30_50004G\Performance_2016_5_24_14_7_54.blg has 489 samples.
 5/24/2016 4:11:02 PM -- Creating test report ...
 5/24/2016 4:11:07 PM -- Instance2680.1 has 18.4 for I/O Database Reads Average Latency.
 5/24/2016 4:11:07 PM -- Instance2680.1 has 0.4 for I/O Log Writes Average Latency.
 5/24/2016 4:11:07 PM -- Instance2680.1 has 0.4 for I/O Log Reads Average Latency.
 5/24/2016 4:11:07 PM -- Instance2680.2 has 17.7 for I/O Database Reads Average Latency.
 5/24/2016 4:11:07 PM -- Instance2680.2 has 0.4 for I/O Log Writes Average Latency.
 5/24/2016 4:11:07 PM -- Instance2680.2 has 0.4 for I/O Log Reads Average Latency.
 5/24/2016 4:11:07 PM -- Instance2680.3 has 17.0 for I/O Database Reads Average Latency.
 5/24/2016 4:11:07 PM -- Instance2680.3 has 0.4 for I/O Log Writes Average Latency.
 5/24/2016 4:11:07 PM -- Instance2680.3 has 0.4 for I/O Log Reads Average Latency.
 5/24/2016 4:11:07 PM -- Instance2680.4 has 16.5 for I/O Database Reads Average Latency.
 5/24/2016 4:11:07 PM -- Instance2680.4 has 0.4 for I/O Log Writes Average Latency.
 5/24/2016 4:11:07 PM -- Instance2680.4 has 0.4 for I/O Log Reads Average Latency.
 5/24/2016 4:11:07 PM -- Instance2680.5 has 16.0 for I/O Database Reads Average Latency.
 5/24/2016 4:11:07 PM -- Instance2680.5 has 0.4 for I/O Log Writes Average Latency.
 5/24/2016 4:11:07 PM -- Instance2680.5 has 0.4 for I/O Log Reads Average Latency.
 5/24/2016 4:11:07 PM -- Instance2680.6 has 16.1 for I/O Database Reads Average Latency.
 5/24/2016 4:11:07 PM -- Instance2680.6 has 0.4 for I/O Log Writes Average Latency.
 5/24/2016 4:11:07 PM -- Instance2680.6 has 0.4 for I/O Log Reads Average Latency.
 5/24/2016 4:11:07 PM -- Instance2680.7 has 16.1 for I/O Database Reads Average Latency.
 5/24/2016 4:11:07 PM -- Instance2680.7 has 0.4 for I/O Log Writes Average Latency.
 5/24/2016 4:11:07 PM -- Instance2680.7 has 0.4 for I/O Log Reads Average Latency.
 5/24/2016 4:11:07 PM -- Instance2680.8 has 16.4 for I/O Database Reads Average Latency.
 5/24/2016 4:11:07 PM -- Instance2680.8 has 0.4 for I/O Log Writes Average Latency.
 5/24/2016 4:11:07 PM -- Instance2680.8 has 0.4 for I/O Log Reads Average Latency.
 5/24/2016 4:11:07 PM -- Instance2680.9 has 16.7 for I/O Database Reads Average Latency.
 5/24/2016 4:11:07 PM -- Instance2680.9 has 0.4 for I/O Log Writes Average Latency.
 5/24/2016 4:11:07 PM -- Instance2680.9 has 0.4 for I/O Log Reads Average Latency.
 5/24/2016 4:11:07 PM -- Instance2680.10 has 17.6 for I/O Database Reads Average Latency.
 5/24/2016 4:11:07 PM -- Instance2680.10 has 0.4 for I/O Log Writes Average Latency.
 5/24/2016 4:11:07 PM -- Instance2680.10 has 0.4 for I/O Log Reads Average Latency.
 5/24/2016 4:11:07 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.
 5/24/2016 4:11:07 PM -- The test has 0 Database Page Fault Stalls/sec samples higher than 0.
 5/24/2016 4:11:07 PM -- C:\Program Files\Exchange Jetstress\20160524-3 TC=30_50004G\Performance_2016_5_24_14_7_54.xml has 477 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	64438130	0	0	0	2013691 MB/2838 sec
E:\DB2\Jetstress002001.edb	64438898	0	0	0	2013715 MB/2594 sec
E:\DB3\Jetstress003001.edb	64437874	0	0	0	2013683 MB/2628 sec
E:\DB4\Jetstress004001.edb	64437362	0	0	0	2013667 MB/2655 sec
E:\DB5\Jetstress005001.edb	64439154	0	0	0	2013723 MB/2666 sec
E:\DB6\Jetstress006001.edb	64438642	0	0	0	2013707 MB/2690 sec
E:\DB7\Jetstress007001.edb	64437874	0	0	0	2013683 MB/2734 sec
E:\DB8\Jetstress008001.edb	64438642	0	0	0	2013707 MB/2749 sec
E:\DB9\Jetstress009001.edb	64438898	0	0	0	2013715 MB/2785 sec
E:\DB10\Jetstress010001.edb	64438386	0	0	0	2013699 MB/2839 sec
(Sum)	644383860	0	0	0	20136995 MB/27183 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:	0.026	0.000	11862.137	0.000	65536.000

Memory System Performance (of checksum)

Counter	Average	Minimum	Maximum
% Processor Time	11.275	8.499	13.936
Available MBytes	30118.902	30098.000	30143.000
Free System Page Table Entries	33555309.303	33555027.000	33555546.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	40635990.559	40624128.000	40665088.000
Pool Paged Bytes	139386907.156	139100160.000	142508032.000

Test Log

5/24/2016 2:07:32 PM -- Preparing for testing ...
 5/24/2016 2:07:43 PM -- Attaching databases ...
 5/24/2016 2:07:43 PM -- Preparations for testing are complete.
 5/24/2016 2:07:43 PM -- Starting transaction dispatch ..
 5/24/2016 2:07:43 PM -- Database cache settings: (minimum: 320.0 MB, maximum: 2.5 GB)
 5/24/2016 2:07:43 PM -- Database flush thresholds: (start: 25.6 MB, stop: 51.2 MB)
 5/24/2016 2:07:54 PM -- Database read latency thresholds: (average: 20 msec/read, maximum: 100 msec/read).
 5/24/2016 2:07:54 PM -- Log write latency thresholds: (average: 10 msec/write, maximum: 100 msec/write).
 5/24/2016 2:08:10 PM -- Operation mix: Sessions 30, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
 5/24/2016 2:08:10 PM -- Performance logging started (interval: 15000 ms).
 5/24/2016 2:08:10 PM -- Attaining prerequisites:
 5/24/2016 2:10:56 PM -- \MSEExchange Database(JetstressWin)\Database Cache Size, Last: 2441597000.0 (lower bound: 2415919000.0, upper bound: none)
 5/24/2016 4:10:57 PM -- Performance logging has ended.

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5/24/2016 4:10:57 PM -- JetInterop batch transaction stats: 24366, 24366, 24365, 24365, 24365, 24365, 24365, 24365, 24365 and 24365.
5/24/2016 4:10:57 PM -- Dispatching transactions ends.
5/24/2016 4:10:57 PM -- Shutting down databases ...
5/24/2016 4:11:02 PM -- Instance2680.1 (complete), Instance2680.2 (complete), Instance2680.3 (complete), Instance2680.4 (complete), Instance2680.5 (complete), Instance2680.6 (complete), Instance2680.7 (complete), Instance2680.8 (complete), Instance2680.9 (complete) and Instance2680.10 (complete)
5/24/2016 4:11:02 PM -- C:\Program Files\Exchange Jetstress\20160524-3_TC=30_50004G\Performance_2016_5_24_14_7_54.blg has 489 samples.
5/24/2016 4:11:02 PM -- Creating test report ...
5/24/2016 4:11:07 PM -- Instance2680.1 has 18.4 for I/O Database Reads Average Latency.
5/24/2016 4:11:07 PM -- Instance2680.1 has 0.4 for I/O Log Writes Average Latency.
5/24/2016 4:11:07 PM -- Instance2680.1 has 0.4 for I/O Log Reads Average Latency.
5/24/2016 4:11:07 PM -- Instance2680.2 has 17.7 for I/O Database Reads Average Latency.
5/24/2016 4:11:07 PM -- Instance2680.2 has 0.4 for I/O Log Writes Average Latency.
5/24/2016 4:11:07 PM -- Instance2680.2 has 0.4 for I/O Log Reads Average Latency.
5/24/2016 4:11:07 PM -- Instance2680.3 has 17.0 for I/O Database Reads Average Latency.
5/24/2016 4:11:07 PM -- Instance2680.3 has 0.4 for I/O Log Writes Average Latency.
5/24/2016 4:11:07 PM -- Instance2680.3 has 0.4 for I/O Log Reads Average Latency.
5/24/2016 4:11:07 PM -- Instance2680.4 has 16.5 for I/O Database Reads Average Latency.
5/24/2016 4:11:07 PM -- Instance2680.4 has 0.4 for I/O Log Writes Average Latency.
5/24/2016 4:11:07 PM -- Instance2680.4 has 0.4 for I/O Log Reads Average Latency.
5/24/2016 4:11:07 PM -- Instance2680.5 has 16.0 for I/O Database Reads Average Latency.
5/24/2016 4:11:07 PM -- Instance2680.5 has 0.4 for I/O Log Writes Average Latency.
5/24/2016 4:11:07 PM -- Instance2680.5 has 0.4 for I/O Log Reads Average Latency.
5/24/2016 4:11:07 PM -- Instance2680.6 has 16.1 for I/O Database Reads Average Latency.
5/24/2016 4:11:07 PM -- Instance2680.6 has 0.4 for I/O Log Writes Average Latency.
5/24/2016 4:11:07 PM -- Instance2680.6 has 0.4 for I/O Log Reads Average Latency.
5/24/2016 4:11:07 PM -- Instance2680.7 has 16.1 for I/O Database Reads Average Latency.
5/24/2016 4:11:07 PM -- Instance2680.7 has 0.4 for I/O Log Writes Average Latency.
5/24/2016 4:11:07 PM -- Instance2680.7 has 0.4 for I/O Log Reads Average Latency.
5/24/2016 4:11:07 PM -- Instance2680.8 has 16.4 for I/O Database Reads Average Latency.
5/24/2016 4:11:07 PM -- Instance2680.8 has 0.4 for I/O Log Writes Average Latency.
5/24/2016 4:11:07 PM -- Instance2680.8 has 0.4 for I/O Log Reads Average Latency.
5/24/2016 4:11:07 PM -- Instance2680.9 has 16.7 for I/O Database Reads Average Latency.
5/24/2016 4:11:07 PM -- Instance2680.9 has 0.4 for I/O Log Writes Average Latency.
5/24/2016 4:11:07 PM -- Instance2680.9 has 0.4 for I/O Log Reads Average Latency.
5/24/2016 4:11:07 PM -- Instance2680.10 has 17.6 for I/O Database Reads Average Latency.
5/24/2016 4:11:07 PM -- Instance2680.10 has 0.4 for I/O Log Writes Average Latency.
5/24/2016 4:11:07 PM -- Instance2680.10 has 0.4 for I/O Log Reads Average Latency.
5/24/2016 4:11:07 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.
5/24/2016 4:11:07 PM -- The test has 0 Database Page Fault Stalls/sec samples higher than 0.
5/24/2016 4:11:07 PM -- C:\Program Files\Exchange Jetstress\20160524-3_TC=30_50004G\Performance_2016_5_24_14_7_54.xml has 477 samples queried.
5/24/2016 4:11:07 PM -- C:\Program Files\Exchange Jetstress\20160524-3_TC=30_50004G\Performance_2016_5_24_14_7_54.html was saved.
5/24/2016 4:11:08 PM -- Performance logging started (interval: 30000 ms).
5/24/2016 4:11:08 PM -- Verifying database checksums ...
5/24/2016 11:44:11 PM -- E: (100% processed)
5/24/2016 11:44:11 PM -- Performance logging has ended.
5/24/2016 11:44:11 PM -- C:\Program Files\Exchange Jetstress\20160524-3_TC=30_50004G\DBChecksum_2016_5_24_16_11_7.blg has 905 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
Instance3424.1	2017251.59	07:33:48	74.09
Instance3424.2	2017275.59	07:47:35	71.90
Instance3424.3	2017259.59	07:08:02	78.55
Instance3424.4	2017235.59	06:57:35	80.51
Instance3424.5	2017307.59	06:50:15	81.95
Instance3424.6	2017283.59	07:35:01	73.89
Instance3424.7	2017267.59	07:06:39	78.80
Instance3424.8	2017291.59	07:17:06	76.92
Instance3424.9	2017299.59	07:30:16	74.67
Instance3424.10	2017275.59	07:54:21	70.88
Avg			76.22
Sum			762.15

Jetstress System Parameters

Thread Count	30
Minimum Database Cache	320.0 MB
Maximum Database Cache	2560.0 MB
Insert Operations	40%
Delete Operations	20%
Replace Operations	5%
Read Operations	35%
Lazy Commits	70%

Database Configuration

Instance3424.1	Log path: E:\DB1 Database: E:\DB1\Jetstress001001.edb
Instance3424.2	Log path: E:\DB2 Database: E:\DB2\Jetstress002001.edb
Instance3424.3	Log path: E:\DB3 Database: E:\DB3\Jetstress003001.edb
Instance3424.4	Log path: E:\DB4 Database: E:\DB4\Jetstress004001.edb
Instance3424.5	Log path: E:\DB5 Database: E:\DB5\Jetstress005001.edb
Instance3424.6	Log path: E:\DB6 Database: E:\DB6\Jetstress006001.edb
Instance3424.7	Log path: E:\DB7 Database: E:\DB7\Jetstress007001.edb
Instance3424.8	Log path: E:\DB8 Database: E:\DB8\Jetstress008001.edb
Instance3424.9	Log path: E:\DB9 Database: E:\DB9\Jetstress009001.edb
Instance3424.10	Log path: E:\DB10 Database: E:\DB10\Jetstress010001.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
Instance3424.1	4.835	0.000	296.430	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance3424.2	4.448	0.000	287.601	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance3424.3	5.474	0.000	314.277	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance3424.4	5.445	0.000	322.172	0.000	261829.301	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance3424.5	5.385	0.000	328.052	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance3424.6	4.239	0.000	295.595	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance3424.7	4.412	0.000	315.338	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance3424.8	4.559	0.000	307.754	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance3424.9	4.816	0.000	298.797	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Instance3424.10	4.818	0.000	283.324	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
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Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	5.106	0.952	6.637
Available MBytes	30080.517	30062.000	30098.000
Free System Page Table Entries	33555086.728	33555028.000	33556056.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	40636035.379	40624128.000	40652800.000
Pool Paged Bytes	142848423.873	142626816.000	145854464.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log

5/26/2016 9:12:14 AM -- Preparing for testing ...
 5/26/2016 9:12:24 AM -- Attaching databases ...
 5/26/2016 9:12:24 AM -- Preparations for testing are complete.
 5/26/2016 9:12:42 AM -- Performance logging started (interval: 30000 ms).
 5/26/2016 9:12:42 AM -- Backing up databases ...

5/26/2016 12:24:16 PM -- JetstressWin (3424) Instance3424.4: A request to read from the file "E:\DB4\Jetstress004001.edb" at offset 988308307968 (0x000000e61bc40000) for 262144 (0x00040000) bytes has not completed for 36 second(s). This problem is likely due to faulty hardware. Please contact your hardware vendor for further assistance diagnosing the problem.

5/26/2016 5:07:03 PM -- Performance logging has ended.
 5/26/2016 5:07:03 PM -- Instance3424.1 (100% processed), Instance3424.2 (100% processed), Instance3424.3 (100% processed), Instance3424.4 (100% processed), Instance3424.5 (100% processed), Instance3424.6 (100% processed), Instance3424.7 (100% processed), Instance3424.8 (100% processed), Instance3424.9 (100% processed) and Instance3424.10 (100% processed)
 5/26/2016 5:07:03 PM -- [C:\Program Files\Exchange Jetstress\20160526-1_TC=30_50004G\(Backup\)\DatabaseBackup_2016_5_26_9_12_24.blg](#) has 947 samples.
 5/26/2016 5:07:03 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
Instance2908.1	514	1793.3505738
Instance2908.2	501	1740.0115229
Instance2908.3	501	1674.4067706
Instance2908.4	502	1619.3326205
Instance2908.5	506	1591.3020172
Instance2908.6	505	1540.2440969
Instance2908.7	504	1556.2620131
Instance2908.8	501	1579.5383444
Instance2908.9	502	1640.6128377
Instance2908.10	503	1684.6673574
Avg	503	1641.973
Sum	5039	16419.7281545

Database Configuration

- Instance2908.1** Log path: E:\DB1
Database: E:\DB1\Jetstress001001.edb
- Instance2908.2** Log path: E:\DB2
Database: E:\DB2\Jetstress002001.edb
- Instance2908.3** Log path: E:\DB3
Database: E:\DB3\Jetstress003001.edb
- Instance2908.4** Log path: E:\DB4
Database: E:\DB4\Jetstress004001.edb
- Instance2908.5** Log path: E:\DB5
Database: E:\DB5\Jetstress005001.edb
- Instance2908.6** Log path: E:\DB6
Database: E:\DB6\Jetstress006001.edb
- Instance2908.7** Log path: E:\DB7
Database: E:\DB7\Jetstress007001.edb
- Instance2908.8** Log path: E:\DB8
Database: E:\DB8\Jetstress008001.edb
- Instance2908.9** Log path: E:\DB9
Database: E:\DB9\Jetstress009001.edb
- Instance2908.10** Log path: E:\DB10
Database: E:\DB10\Jetstress010001.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
Instance2908.1	25.164	8.510	225.192	1.143	40508.232	31070.559	28.572	0.000	1.430	0.000	198636.440	0.000
Instance2908.2	23.390	8.882	243.222	1.149	40351.988	31931.694	30.063	0.000	1.438	0.000	204887.421	0.000
Instance2908.3	21.785	7.178	260.110	1.191	40174.482	32451.401	30.979	0.000	1.491	0.000	206936.843	0.000
Instance2908.4	20.765	8.275	268.331	1.237	40297.918	32522.853	32.223	0.000	1.548	0.000	207516.833	0.000
Instance2908.5	19.922	9.112	274.600	1.269	40381.691	32435.330	33.975	0.000	1.588	0.000	207511.735	0.000
Instance2908.6	19.591	8.586	281.383	1.307	40115.372	32509.984	35.290	0.000	1.636	0.000	207765.027	0.000
Instance2908.7	19.529	8.581	281.027	1.294	40294.492	32342.442	35.087	0.000	1.619	0.000	207309.862	0.000
Instance2908.8	19.946	10.085	277.960	1.264	40187.473	32516.583	34.642	0.000	1.581	0.000	207819.409	0.000
Instance2908.9	20.512	10.570	269.300	1.220	40217.620	32525.872	34.253	0.000	1.526	0.000	208065.760	0.000
Instance2908.10	21.660	8.723	257.461	1.192	40173.268	32532.259	33.419	0.000	1.492	0.000	208031.675	0.000

Background Database Maintenance I/O Performance

MSExchange Database ==> Instances	Database Maintenance IO Reads/sec	Database Maintenance IO Reads Average Bytes
Instance2908.1	7.032	262046.897
Instance2908.2	6.776	261959.741
Instance2908.3	6.953	262144.000
Instance2908.4	7.119	262017.560
Instance2908.5	7.679	261912.854
Instance2908.6	7.347	262083.889

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Instance2908.7	7.368	262012.248
Instance2908.8	7.327	262038.347
Instance2908.9	7.665	262024.262
Instance2908.10	7.148	261743.718

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
Instance2908.1	25.164	8.510	232.224	1.143	47216.352	31070.559	28.572	0.000	1.430	0.000	198636.440	0.000
Instance2908.2	23.390	8.882	249.999	1.149	46358.776	31931.694	30.063	0.000	1.438	0.000	204887.421	0.000
Instance2908.3	21.785	7.178	267.063	1.191	45953.512	32451.401	30.979	0.000	1.491	0.000	206936.843	0.000
Instance2908.4	20.765	8.275	275.450	1.237	46027.981	32522.853	32.223	0.000	1.548	0.000	207516.833	0.000
Instance2908.5	19.922	9.112	282.280	1.269	46408.316	32435.330	33.975	0.000	1.588	0.000	207511.735	0.000
Instance2908.6	19.591	8.586	288.730	1.307	45763.849	32509.984	35.290	0.000	1.636	0.000	207765.027	0.000
Instance2908.7	19.529	8.581	288.396	1.294	45959.337	32342.442	35.087	0.000	1.619	0.000	207309.862	0.000
Instance2908.8	19.946	10.085	285.287	1.264	45885.409	32516.583	34.642	0.000	1.581	0.000	207819.409	0.000
Instance2908.9	20.512	10.570	276.965	1.220	46356.425	32525.872	34.253	0.000	1.526	0.000	208065.760	0.000
Instance2908.10	21.660	8.723	264.609	1.192	46158.547	32532.259	33.419	0.000	1.492	0.000	208031.675	0.000

Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	4.398	0.000	13.133
Available MBytes	27444.699	27333.000	30031.000
Free System Page Table Entries	33555542.474	33555538.000	33556052.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	40618273.942	40615936.000	40632320.000
Pool Paged Bytes	143597328.683	143593472.000	143613952.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log

5/26/2016 5:14:48 PM -- Preparing for testing ...
 5/26/2016 5:14:58 PM -- Attaching databases ...
 5/26/2016 5:14:58 PM -- Preparations for testing are complete.
 5/26/2016 5:14:58 PM -- Starting transaction dispatch ..
 5/26/2016 5:14:58 PM -- Database cache settings: (minimum: 320.0 MB, maximum: 2.5 GB)
 5/26/2016 5:14:58 PM -- Database flush thresholds: (start: 25.6 MB, stop: 51.2 MB)
 5/26/2016 5:15:09 PM -- Database read latency thresholds: (average: 20 msec/read, maximum: 100 msec/read).
 5/26/2016 5:15:09 PM -- Log write latency thresholds: (average: 10 msec/write, maximum: 100 msec/write).
 5/26/2016 5:15:14 PM -- Operation mix: Sessions 30, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
 5/26/2016 5:15:14 PM -- Performance logging started (interval: 15000 ms).
 5/26/2016 5:15:14 PM -- Generating log files ...
 5/26/2016 6:54:38 PM -- E:\DB1 (102.8% generated), E:\DB2 (100.2% generated), E:\DB3 (100.2% generated), E:\DB4 (100.4% generated), E:\DB5 (101.2% generated), E:\DB6 (101.0% generated), E:\DB7 (100.8% generated), E:\DB8 (100.2% generated), E:\DB9 (100.4% generated) and E:\DB10 (100.6% generated)
 5/26/2016 6:54:38 PM -- Performance logging has ended.
 5/26/2016 6:54:38 PM -- JetInterop batch transaction stats: 21705, 21705, 21705, 21705, 21705, 21705, 21705, 21705, 21704 and 21704.
 5/26/2016 6:54:38 PM -- Dispatching transactions ends.
 5/26/2016 6:54:38 PM -- Shutting down databases ...
 5/26/2016 6:54:41 PM -- Instance2908.1 (complete), Instance2908.2 (complete), Instance2908.3 (complete), Instance2908.4 (complete), Instance2908.5 (complete), Instance2908.6 (complete), Instance2908.7 (complete), Instance2908.8 (complete), Instance2908.9 (complete) and Instance2908.10 (complete)
 5/26/2016 6:54:41 PM -- C:\Program Files\Exchange Jetstress\20160526-2_TC=30_50004G(Soft)\Performance_2016_5_26_17_15_9.blg has 396 samples.
 5/26/2016 6:54:41 PM -- Creating test report ...
 5/26/2016 6:54:44 PM -- Instance2908.1 has 14.8 for I/O Database Reads Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.1 has 0.4 for I/O Log Writes Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.1 has 0.4 for I/O Log Reads Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.2 has 14.1 for I/O Database Reads Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.2 has 0.4 for I/O Log Writes Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.2 has 0.4 for I/O Log Reads Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.3 has 13.6 for I/O Database Reads Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.3 has 0.4 for I/O Log Writes Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.3 has 0.4 for I/O Log Reads Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.4 has 13.2 for I/O Database Reads Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.4 has 0.4 for I/O Log Writes Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.4 has 0.4 for I/O Log Reads Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.5 has 13.0 for I/O Database Reads Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.5 has 0.4 for I/O Log Writes Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.5 has 0.4 for I/O Log Reads Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.6 has 12.9 for I/O Database Reads Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.6 has 0.4 for I/O Log Writes Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.6 has 0.4 for I/O Log Reads Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.7 has 13.0 for I/O Database Reads Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.7 has 0.4 for I/O Log Writes Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.7 has 0.4 for I/O Log Reads Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.8 has 13.2 for I/O Database Reads Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.8 has 0.4 for I/O Log Writes Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.8 has 0.4 for I/O Log Reads Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.9 has 13.5 for I/O Database Reads Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.9 has 0.4 for I/O Log Writes Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.9 has 0.4 for I/O Log Reads Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.10 has 13.9 for I/O Database Reads Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.10 has 0.4 for I/O Log Writes Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.10 has 0.4 for I/O Log Reads Average Latency.
 5/26/2016 6:54:44 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.

5/26/2016 6:54:44 PM -- The test has 0 Database Page Fault Stalls/sec samples higher than 0.
 5/26/2016 6:54:44 PM -- [C:\Program Files\Exchange Jetstress\20160526-2_TC=30_50004G\(Soft\)\Performance_2016_5_26_17_15_9.xml](#) has 395 samples queried.
 5/26/2016 6:54:44 PM -- [C:\Program Files\Exchange Jetstress\20160526-2_TC=30_50004G\(Soft\)\Performance_2016_5_26_17_15_9.html](#) was saved.
 5/26/2016 6:54:50 PM -- Performance logging started (interval: 4000 ms).
 5/26/2016 6:54:50 PM -- Recovering databases ...
 5/26/2016 7:24:43 PM -- Performance logging has ended.
 5/26/2016 7:24:43 PM -- Instance2908.1 (1793.3505738), Instance2908.2 (1740.0115229), Instance2908.3 (1674.4067706), Instance2908.4 (1619.3326205), Instance2908.5 (1591.3020172), Instance2908.6 (1540.2440969), Instance2908.7 (1556.2620131), Instance2908.8 (1579.5383444), Instance2908.9 (1640.6128377) and Instance2908.10 (1684.6673574)
 5/26/2016 7:24:44 PM -- [C:\Program Files\Exchange Jetstress\20160526-2_TC=30_50004G\(Soft\)\SoftRecovery_2016_5_26_18_54_44.blg](#) has 445 samples.
 5/26/2016 7:24:44 PM -- Creating test report ...

Soft Recovery Performance Test Result Report (Server 1)

Test Summary

Overall Test Result Pass
Machine Name WIN-4VVEHEOP6PE
Test Description
Test Start Time 5/26/2016 5:14:48 PM
Test End Time 5/26/2016 6:54:41 PM
Collection Start Time 5/26/2016 5:15:29 PM
Collection End Time 5/26/2016 6:54:25 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\20160526-2_TC=30_50004G\(Soft\)\Performance_2016_5_26_17_15_9.blg](#)

Database Sizing and Throughput

Achieved Transactional I/O per Second 1628.529
Target Transactional I/O per Second 800
Initial Database Size (bytes) 21152742899712
Final Database Size (bytes) 21155787964416
Database Files (Count) 10

Jetstress System Parameters

Thread Count 30
Minimum Database Cache 320.0 MB
Maximum Database Cache 2560.0 MB
Insert Operations 40%
Delete Operations 20%
Replace Operations 5%
Read Operations 35%
Lazy Commits 70%

Database Configuration

Instance2908.1 Log path: E:\DB1
 Database: E:\DB1\Jetstress001001.edb
Instance2908.2 Log path: E:\DB2
 Database: E:\DB2\Jetstress002001.edb
Instance2908.3 Log path: E:\DB3
 Database: E:\DB3\Jetstress003001.edb
Instance2908.4 Log path: E:\DB4
 Database: E:\DB4\Jetstress004001.edb
Instance2908.5 Log path: E:\DB5
 Database: E:\DB5\Jetstress005001.edb
Instance2908.6 Log path: E:\DB6
 Database: E:\DB6\Jetstress006001.edb
Instance2908.7 Log path: E:\DB7
 Database: E:\DB7\Jetstress007001.edb
Instance2908.8 Log path: E:\DB8
 Database: E:\DB8\Jetstress008001.edb
Instance2908.9 Log path: E:\DB9
 Database: E:\DB9\Jetstress009001.edb
Instance2908.10 Log path: E:\DB10
 Database: E:\DB10\Jetstress010001.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
Instance2908.1	14.799	2.189	114.126	47.544	32768.000	35083.032	0.000	0.354	0.000	34.138	0.000	7799.224
Instance2908.2	14.115	2.176	115.147	47.988	32768.000	34934.287	0.000	0.357	0.000	33.782	0.000	7734.450
Instance2908.3	13.619	2.181	115.226	47.950	32768.000	35001.569	0.000	0.353	0.000	33.847	0.000	7740.211
Instance2908.4	13.244	2.180	114.641	47.648	32768.000	34967.642	0.000	0.355	0.000	33.841	0.000	7744.451

Infotrend EonStor DS 1016R 5,000 Mailbox Resiliency Exchange 2013 Storage Solution

Instance2908.5	13.031	2.173	114.907	48.115	32768.000	34933.739	0.000	0.356	0.000	34.017	0.000	7758.749
Instance2908.6	12.942	2.178	114.707	47.722	32768.000	34991.528	0.000	0.356	0.000	33.625	0.000	7816.190
Instance2908.7	12.986	2.173	114.812	47.830	32768.000	34991.857	0.000	0.355	0.000	33.662	0.000	7794.947
Instance2908.8	13.168	2.165	115.193	48.190	32768.000	34954.724	0.000	0.355	0.000	33.866	0.000	7721.178
Instance2908.9	13.457	2.167	115.542	48.381	32768.000	34946.502	0.000	0.355	0.000	33.928	0.000	7740.107
Instance2908.10	13.888	2.170	114.957	47.901	32768.000	34996.771	0.000	0.356	0.000	33.742	0.000	7762.816

Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	3.441	0.953	6.294
Available MBytes	27395.404	27326.000	29820.000
Free System Page Table Entries	33555540.035	33555534.000	33555542.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	40624148.687	40615936.000	40640512.000
Pool Paged Bytes	143955999.030	143085568.000	146677760.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log

5/26/2016 5:14:48 PM -- Preparing for testing ...
 5/26/2016 5:14:58 PM -- Attaching databases ...
 5/26/2016 5:14:58 PM -- Preparations for testing are complete.
 5/26/2016 5:14:58 PM -- Starting transaction dispatch ..
 5/26/2016 5:14:58 PM -- Database cache settings: (minimum: 320.0 MB, maximum: 2.5 GB)
 5/26/2016 5:14:58 PM -- Database flush thresholds: (start: 25.6 MB, stop: 51.2 MB)
 5/26/2016 5:15:09 PM -- Database read latency thresholds: (average: 20 msec/read, maximum: 100 msec/read).
 5/26/2016 5:15:09 PM -- Log write latency thresholds: (average: 10 msec/write, maximum: 100 msec/write).
 5/26/2016 5:15:14 PM -- Operation mix: Sessions 30, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
 5/26/2016 5:15:14 PM -- Performance logging started (interval: 15000 ms).
 5/26/2016 5:15:14 PM -- Generating log files ...
 5/26/2016 6:54:38 PM -- E:\DB1 (102.8% generated), E:\DB2 (100.2% generated), E:\DB3 (100.2% generated), E:\DB4 (100.4% generated), E:\DB5 (101.2% generated), E:\DB6 (101.0% generated), E:\DB7 (100.8% generated), E:\DB8 (100.2% generated), E:\DB9 (100.4% generated) and E:\DB10 (100.6% generated)
 5/26/2016 6:54:38 PM -- Performance logging has ended.
 5/26/2016 6:54:38 PM -- JetInterop batch transaction stats: 21705, 21705, 21705, 21705, 21705, 21705, 21705, 21705, 21704 and 21704.
 5/26/2016 6:54:38 PM -- Dispatching transactions ends.
 5/26/2016 6:54:38 PM -- Shutting down databases ...
 5/26/2016 6:54:41 PM -- Instance2908.1 (complete), Instance2908.2 (complete), Instance2908.3 (complete), Instance2908.4 (complete), Instance2908.5 (complete), Instance2908.6 (complete), Instance2908.7 (complete), Instance2908.8 (complete), Instance2908.9 (complete) and Instance2908.10 (complete)
 5/26/2016 6:54:41 PM -- [C:\Program Files\Exchange Jetstress\20160526-2_TC=30_50004G\(Soft\)\Performance_2016_5_26_17_15_9.big](C:\Program Files\Exchange Jetstress\20160526-2_TC=30_50004G(Soft)\Performance_2016_5_26_17_15_9.big) has 396 samples.
 5/26/2016 6:54:41 PM -- Creating test report ...
 5/26/2016 6:54:44 PM -- Instance2908.1 has 14.8 for I/O Database Reads Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.1 has 0.4 for I/O Log Writes Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.1 has 0.4 for I/O Log Reads Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.2 has 14.1 for I/O Database Reads Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.2 has 0.4 for I/O Log Writes Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.2 has 0.4 for I/O Log Reads Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.3 has 13.6 for I/O Database Reads Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.3 has 0.4 for I/O Log Writes Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.3 has 0.4 for I/O Log Reads Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.4 has 13.2 for I/O Database Reads Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.4 has 0.4 for I/O Log Writes Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.4 has 0.4 for I/O Log Reads Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.5 has 13.0 for I/O Database Reads Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.5 has 0.4 for I/O Log Writes Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.5 has 0.4 for I/O Log Reads Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.6 has 12.9 for I/O Database Reads Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.6 has 0.4 for I/O Log Writes Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.6 has 0.4 for I/O Log Reads Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.7 has 13.0 for I/O Database Reads Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.7 has 0.4 for I/O Log Writes Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.7 has 0.4 for I/O Log Reads Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.8 has 13.2 for I/O Database Reads Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.8 has 0.4 for I/O Log Writes Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.8 has 0.4 for I/O Log Reads Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.9 has 13.5 for I/O Database Reads Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.9 has 0.4 for I/O Log Writes Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.9 has 0.4 for I/O Log Reads Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.10 has 13.9 for I/O Database Reads Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.10 has 0.4 for I/O Log Writes Average Latency.
 5/26/2016 6:54:44 PM -- Instance2908.10 has 0.4 for I/O Log Reads Average Latency.
 5/26/2016 6:54:44 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.
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