



# IBM Storwize V5000 24,000 mailbox resiliency Microsoft Exchange 2013 storage solution

*IBM Systems and Technology Group ISV Enablement  
August 2013*

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## Abstract

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*This paper outlines an IBM Storwize V5000 test for Microsoft Exchange Server 2013, based on the Microsoft Exchange Solution Reviewed Program (ESRP) – Storage program.*

*The ESRP – Storage program was developed by Microsoft Corporation to provide a common storage testing framework for vendors to provide information on its storage performance for the Microsoft Exchange Server software. For more details on the Microsoft ESRP – Storage program, refer to the following URL:*

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

*This test demonstrates database and log storage performance for the stated mailbox count and profile only. It does not take into account all of the space requirements and variables in a production environment. For complete information about Microsoft Exchange sizing, refer to the Microsoft Exchange storage calculator and guidance at:*

*<http://blogs.technet.com/b/exchange/archive/2009/11/09/3408737.aspx>*

*For any questions or comments regarding the contents of this paper, you can visit the following URL: [ibm.com/systems/storage/disk](http://ibm.com/systems/storage/disk)*

## Disclaimer

This paper has been produced independently of Microsoft Corporation. Microsoft Corporation expressly disclaims responsibility for, and makes no warranty, express or implied, with respect to, the accuracy of the contents of this paper.

Refer to IBM disclaimer at the [end of the paper](#).

## Features

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The solution uses Microsoft® Exchange 2013 mailbox resiliency with database availability groups (DAGs) using one DAG and six servers. Each database copy resides on separate IBM® Storwize® V5000 controllers, spindles, and servers for redundancy and failover.

The design includes two IBM Storwize V5000 systems and a total of six servers. For the actual tests, one Storwize V5000 system and three servers were used, with Jetstress simulating the full environment.

Figure 1 provides a graphical view of the design. The active and passive databases are evenly distributed across all servers in the group, with eight active databases and eight passive databases per server. Each server is hosting 4000 active mailboxes, allowing for failover of databases or entire servers.

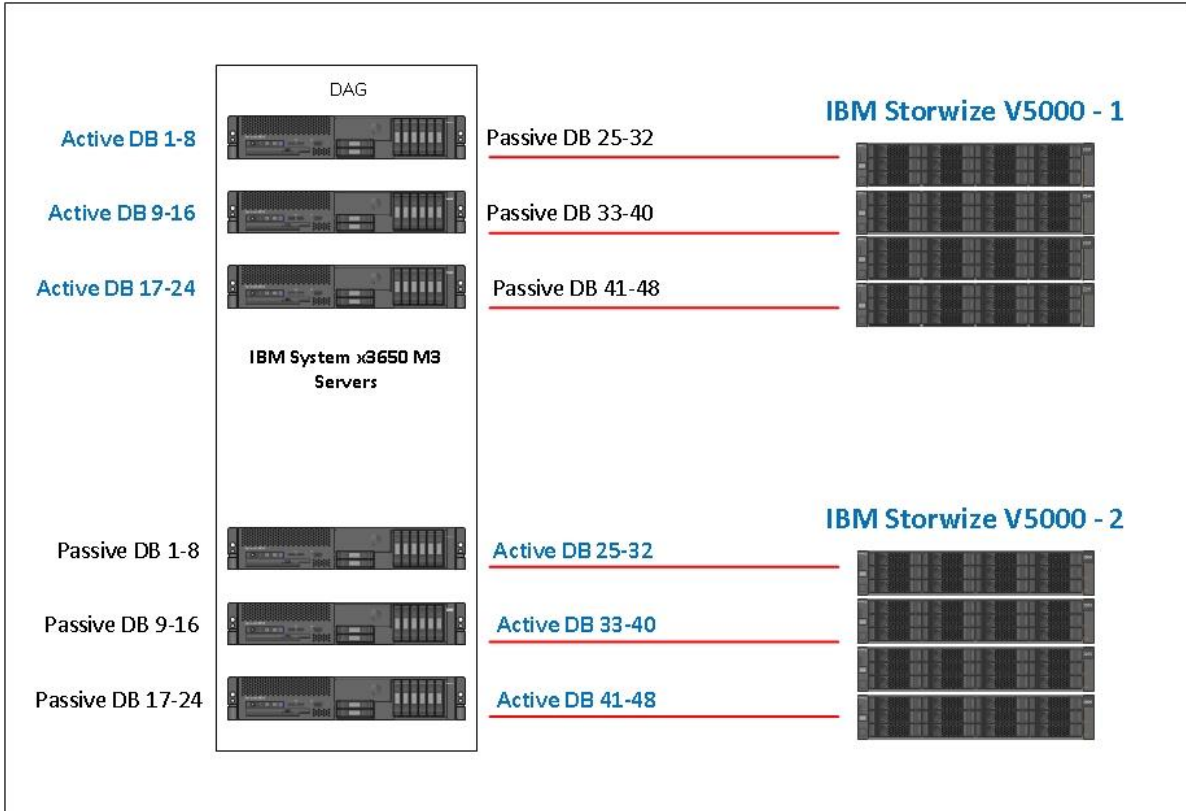


Figure 1: Graphical view of a database availability group design

## Solution description

This paper describes the storage performance for 24,000 Exchange 2013 mailboxes on the IBM Storwize V5000 system. The solution uses two Storwize V5000 systems, each with three expansion enclosures for a total of 96 disks. The two separate controllers and disks are required to provide DAG redundancy and failover capability. This system can scale out considerably by attaching up to six expansion enclosures per storage controller for a total of 168 drives, or by using additional external virtualized storage.

### IBM Storwize V5000

IBM Storwize V5000 is an entry-level mid-range storage system that offers innovative design and advanced features at a very competitive price. By enabling virtualization, consolidation, and tiering in small to mid-size businesses, it offers easy-to-use, efficient, and cost-effective management capabilities for both new and existing storage resources. The Storwize V5000 system is positioned between the proven IBM Storwize V7000 and Storwize V3700 systems, offering mid-size environments a powerful yet affordable system with proven reliability, performance, and scalability.

Storwize V5000 is a full featured disk system that can also virtualize nearly any external storage system, based on the proven virtualization technology of IBM System Storage® SAN Volume Controller (SVC). Storwize V5000 makes integration with existing storage simpler than ever, providing a single management interface for internal and external storage.



Each storage enclosure houses up to twelve 3.5-inch drives or twenty-four 2.5-inch drives. Control enclosures contain drives, redundant dual-active intelligent Redundant Array of Independent Disks (RAID) controllers and dual power supplies, batteries, and cooling components. Expansion enclosures contain drives, power supplies and cooling components. The modular design allows attachment of up to six expansion enclosures to each control enclosure, enabling the system to scale up to 168 drives. Other components and characteristics of the system include:

- Disk drives – Serial-attached SCSI (SAS) disk drives, nearline SAS disk drives, and solid-state drives (SSDs). Intermix of these drive types within RAID controller and storage expansion enclosures add flexibility.
- Efficient 2U rack-mountable modular design.
- Support for standard RAID levels 0, 1, 5, 6, and 10.
- One-way data migration to simplify implementation.
- Designed for easy customer setup and support, with flexible warranty and extended support options
- IBM Subsystem Device Driver Device Specific Module (SDDDSM) path failover driver
- SMI-S provider for industry-standard storage management and monitoring solutions
- Cache memory—16 GB cache memory (8 GB per internal RAID controller) as a base feature—designed to improve performance and availability.
- Host connectivity – 8 Gbps Fibre Channel (FC), 6 Gbps SAS, or 1 Gbps iSCSI.
- Advanced features including: thin provisioning, IBM System Storage Easy Tier® automated tiering, nondisruptive data migration, replication, and IBM FlashCopy®.
- Virtualize existing external storage arrays, and manage all of it from a single interface. Take advantage of the advanced features of Storwize V5000 with existing storage systems.

You can find more detailed information about Storwize V5000 at:  
[ibm.com/systems/storage/disk](http://ibm.com/systems/storage/disk)

## IBM System x servers

The three IBM System x®3650 M3 servers used for this test provide excellent performance for business-critical applications, such as Exchange Server 2013. The System x3650 M3 server provides a highly available and energy-saving design in a manageable 2U package. It includes Intel® Xeon® processors, impressive memory capacity, and the following enterprise-class features:

- 2U chassis with Low 675 W design and up to 95% efficient power supplies and up to four PCIe slots
- Six cooling fan modules, new UEFI BIOS, integrated management module (IMM) and IBM Systems Director Active Energy Manager™
- Up to two 3.46 GHz six-core (3.60 GHz four-core) Intel Xeon 5600 series processors and up to 1333 MHz memory access speed
- Up to 288 GB RDIMMs or 48 GB UDIMMs high-performance, new-generation DDR-3 memory
- Internal storage flexibility with up to sixteen 2.5-inch hot-swap SAS/SATA hard disk drives (HDDs) or SSDs



You can find more information on IBM System x servers at:

[ibm.com/systems/x](http://ibm.com/systems/x)

## Solution overview and layout

This solution focuses on using the IBM Storwize V5000 internal disks. The system is based on the well-established virtualization technology of IBM SAN Volume Controller and the innovative Storwize V7000 architecture, running the same software and graphical management interface.

The system uses RAID arrays called managed disks (MDisks) created from either the Storwize V5000 internal drives or externally attached storage systems. The MDisk arrays are then placed in storage pools. These pools are where the virtualization takes place, creating extents from which volumes are created. Data and workload isolation can be attained by placing MDisks in separate storage pools, the volumes then reside on different physical spindles. For example, in some Exchange configurations, you can create a separate database pool and a log pool to achieve isolation and provide RAID-level control. In this solution, because it takes advantage of Exchange 2013 DAGs, you can host the databases and logs on the same physical spindles, within the same storage pool.

The following table outlines the MDisk, storage pool, and volume layout used in this solution.

Jetstress test virtualization layout	
Total internal MDisks	15
Total storage pools	3 (one for each server)
Virtual extent size	256 MB (default)
Physical disks per pool	30
MDisks per storage pool	5 (six disk RAID 5 arrays)
Volumes	24 (8 per storage pool)

*Table 1: Test virtualization layout*

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 that 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 the ESRP-Storage program. Therefore, the number of mailboxes hosted per server as part of the tested configuration might not necessarily be viable for some customer deployments.



For more information on identifying and addressing performance issues in an Exchange system, refer to *Troubleshooting Microsoft Exchange Server Performance*, available at the following Microsoft website: <http://go.microsoft.com/fwlink/?LinkId=23454>

## Targeted customer profile

IBM Storwize V5000 system targets small- to mid-range customers, with the ability to scale out as their business grows. The targeted profile for this solution includes:

- Six Exchange 2013 servers
- Two identical IBM Storwize V5000 systems
- 24,000 mailboxes
- 0.07 input/output operations per second (IOPS) user profile (0.09 tested for growth)
- 1.5 GB mailbox size
- Background database maintenance, enabled during all Jetstress tests
- DAG mailbox resiliency provides high availability and is the primary data protection mechanism.

## Test environment

The following tables summarize the Jetstress testing environment:

### Simulated Exchange configuration

Number of Exchange mailboxes simulated	24,000
Number of DAGs	1
Number of servers/DAG	6
Number of active mailboxes/server	4000
Number of databases/host	16 (8 active / 8 passive)
Number of copies/database	2
Number of mailboxes/database	500
Simulated profile: I/O per second per mailbox (IOPS, include 20% headroom)	0.07 (0.09 tested)
Database logical unit number (LUN) size	1.7 TB (2 DB per LUN)
Log LUN size	Logs on DB volumes
Total database size for performance testing	35.2 TB (734 GB x 48)
Percentage of storage capacity used by the Exchange database*	86%

Table 2: Simulated Exchange configuration



### Storage hardware

Storage connectivity (Fiber Channel, SAS, Serial Advanced Technology Attachment (SATA), iSCSI)	Fibre Channel
Storage model and OS / firmware revision	IBM Storwize V5000 Version 7.1.0.0 <a href="#">Windows Server Catalog link</a>
Storage cache	16 GB (8 GB per controller canister)
Number of storage controllers	2
Number of storage ports	Eight 8 GB FC ports, four 6 GB SAS, four iSCSI
Maximum bandwidth of storage connectivity to host	16 Gb (two 8 Gb FC)
Switch type/model/firmware revision	IBM 2498-B24, 8Gb, FW 6.4.0c
Host bus adapter (HBA) model and firmware	QLogic QLE2562, 8Gb, FW 5.03.06
Number of HBAs/host	2
Host server type	IBM System x3650 M3, Intel Xeon dual processor 2.93Ghz, 64 GB RAM
Total number of disks tested in solution	96 (90 + 6 spares)
Maximum number of spindles that can be hosted in the storage	168 (seven 24 disk enclosures)

Table 3: Storage hardware

### Storage software

HBA driver	QLogic STOR miniport 9.1.10.27
HBA QueueTarget setting	N/A
HBA QueueDepth setting	100
Multipathing	IBM SDDDSM v. 2.4.3.3-5 Load balanced, fault tolerant, multipath I/O (MPIO)
Host OS	Microsoft Windows Server 2012 standard
ESE.dll file version	15.0.516.26
Replication solution name/version	N/A

Table 4: Storage software



## Storage disk configuration (mailbox store and log disks)

Disk type, speed, and firmware revision	SAS, 10 k, firmware level J2E8
Raw capacity per disk (GB)	558 GB (600 GB)
Number of physical disks in test	90
Total raw storage capacity (GB)	50.2 TB (before RAID)
Disk slice size (GB)	N/A
Number of disks per LUN	3.75 virtual average (90 disks, 24 LUNs)
Raid level	RAID 5, storage level
Total formatted capacity	40.8 TB
Storage capacity utilization	81%
Database capacity utilization	70%

Table 5: Storage disk configuration

## Best practices

Microsoft Exchange Server is a disk-intensive application. Based on the tests run using the ESRP framework, the test team recommends the following reference to improve the storage performance.

For Exchange 2013 best practices on storage design, visit:

<http://technet.microsoft.com/en-us/library/ee832792%28v=exchg.150%29.aspx>

### Storage – mailbox resiliency

Use the following guidelines to optimize the Exchange 2013 environment for IBM Storwize V5000.

1. Format the volumes at 64 KB allocation unit size, as recommended by Microsoft.
2. As per Microsoft storage guidance for Exchange 2013, a maximum of seven disks per array group are allowed. This solution used six disk array groups.
3. Isolate the Exchange Server database and the log files from other disk-intensive application workloads to avoid performance conflicts. During testing, the storage subsystems were dedicated to Exchange Server. Sharing the storage with other applications might negatively impact Exchange I/O performance.
4. It is now optional with database availability groups to isolate the Exchange database and log disk I/O on separate, physical disk arrays. Isolation allows separate log and database array tuning, such as RAID or disk types. With Storwize V5000, LUNs can be separated physically by using separate storage pools. This solution kept the database and logs on the same physical spindles in the same storage pool.
5. The Storwize V5000 system can use external virtualized storage, which are external storage systems connected to Storwize V5000, similar to SAN Volume Controller. This is an optional premium feature. In this configuration, do not assign multiple back-end storage controllers to the same storage pool. Each external controller must have its own storage pools.

6. For most Exchange 2013 environments, it is now recommended to use hardware level RAID 5 for databases and RAID 5 or 10 for the logs. RAID 5 for databases also provides better space utilization when using larger mailboxes (1 GB plus), provided there is an adequate number of spindles to meet the I/O requirements.
7. Enable caching on Storwize V5000 when creating the volumes. Note that the cache option is either read/write combined or none, and is enabled by default.
8. The recommended disk stripe size for Exchange 2013 is 256 KB (or larger). The default stripe size on Storwize V5000 is 256 KB, which was used for this testing.
9. Use single-initiator zoning when configuring the FC switch zones. Each server HBA port is zoned to two Storwize V5000 ports—one port per controller.
10. Troubleshooting performance on Storwize V5000 is performed using standard tools such as Performance Monitor, or the monitoring features of the HBA software. These tools can help determine the location where the heaviest disk I/O reads and writes are occurring, and the data transfer rates. Assuming all storage components are functioning and configured correctly, most Exchange Server 2013 storage latency issues are caused by an insufficient number of disks for the I/O load.
11. The number of IOPS hitting a given drive can be measured using the Performance Monitor Logical Disk object and Disk Transfers/sec counter. Add the data from all database volumes to find the total IOPS being generated.
12. The average disk latency should be less than 20 milliseconds (ms), with the maximum value no higher than 100 ms. Disk latency can be measured using the Performance Monitor Logical Disk object, Avg Disk sec/read.

## Backup strategy

The solution does not include a backup strategy.

## Additional information

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It is recommended to visit the following URL for additional information and support resources:  
[ibm.com/systems/storage/disk](http://ibm.com/systems/storage/disk)

## Test result summary

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This section provides a high-level summary of the test data from ESRP and links to the detailed HTML reports that are generated by the ESRP testing framework. You can click the cross references in the following section to view the HTML report for each test category.

## Reliability

A number of tests in the framework are to check reliability with tests running for 24 hours. The goal is to verify whether the storage can handle high I/O load for a long period of time. Both log and database files are analyzed for integrity after the stress test to ensure no database or log corruption.



The following list provides an overview. (Click the underlined words to view the HTML report after the reliability tests run).

- There were no errors reported in the saved event log file.
- There were no errors reported 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 I/O for 2 hours. The test is to show how long it takes for the storage to respond to an I/O under load. The following data is the sum of all of the logical disk I/O and average of all the logical disks I/O latency in the 2-hour test. Each server is listed separately and the aggregate numbers across all servers are listed.

### Individual server metrics:

This section includes the sum of I/O and the average latency across all the databases on a per server basis.

#### Server 1 (L22-3650-1)

<b>Database I/O</b>	
Database disks transfers/sec	945
Database disks reads/sec	638
Database disks writes/sec	307
Average database disk read latency (ms)	8.7
Average database disk write latency (ms)	1.3
<b>Transaction log I/O</b>	
Log disks writes/sec	221
Average log disk write latency (ms)	0.19

#### Server 2 (L22-3650-3)

<b>Database I/O</b>	
Database disks transfers/sec	945
Database disks reads/sec	637
Database disks writes/sec	308
Average database disk read latency (ms)	8.7
Average database disk write latency (ms)	1.3
<b>Transaction log I/O</b>	
Log disks writes/sec	223
Average log disk write latency (ms)	0.19



### Server 3 (L22-3650-4)

<b>Database I/O</b>	
Database disks transfers/sec	943
Database disks reads/sec	636
Database disks writes/sec	307
Average database disk read latency (ms)	8.7
Average database disk write latency (ms)	1.3
<b>Transaction log I/O</b>	
Log disks writes/sec	222
Average log disk write latency (ms)	0.19

### Aggregate performance across all servers metrics:

This section includes the sum of I/O and the average latency across all servers in the solution.

<b>Database I/O</b>	
Database disks transfers/sec	2833
Database disks reads/sec	1911
Database disks writes/sec	922
Average database disk read latency (ms)	8.7
Average database disk write latency (ms)	1.3
<b>Transaction log I/O</b>	
Log disks writes/sec	222
Average log disk write latency (ms)	0.19

## Database backup and recovery performance

There are two test 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 or replay performance (playing transaction logs into the database).



### Database read-only performance

This test is to measure the maximum rate at which databases can be backed up using Volume Shadow Copy Service (VSS). The following table shows the average rate for a single database file.

MB read/sec per database	52.1
MB read/sec total per server	834

### Transaction log recovery / replay performance

This test is to measure the maximum rate at which the log files can be played against the databases. The following table shows the average rate for 500 log files played in a single database. Each log file is 1 MB in size.

Average time to play one log file (sec)	1.9
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## Conclusion

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The IBM Storwize V5000 proved more than capable of handling the IOPS load generated by this ESRP configuration. Highly flexible and scalable, Storwize V5000 provides the ability to start small and grow your storage as needed. This medium-sized configuration used half of the supported number of disk enclosures, leaving plenty of room to grow. In addition, multiple and diverse back-end storage arrays can also be added, all managed by one interface.

This paper is developed by storage solution providers, and reviewed by the Microsoft Exchange Product team. The test results and data presented in this paper are based on the tests introduced in the ESRP test framework version 4.0. Customers cannot quote the data directly for their predeployment verification. It is still necessary to go through the exercises to validate the storage design for any specific customer environment.

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



## Appendix - Test results

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This section includes test reports for stress, performance, streaming backup and soft recovery. Each server's test results were reviewed by Microsoft, and experienced similar performance. The test team has included the following results from only one of the servers.

### Stress testing

Microsoft Exchange Jetstress 2013

Stress test result report

Test summary

**Overall Test Result** Pass

**Machine Name** L22-3650-1

**Test Description** 8000 1.5GB mailboxes, 16 databases, 8 (1.75 TB) LUNs, .09 IOPS, 14 thrsd

**Test Start Time** 5/28/2013 4:34:42 PM

**Test End Time** 5/29/2013 4:45:41 PM

**Collection Start Time** 5/28/2013 4:40:44 PM

**Collection End Time** 5/29/2013 4:40:29 PM

**Jetstress Version** 15.00.0658.004

**ESE Version** 15.00.0516.026

**Operating System** Windows Server 2012 Standard (6.2.9200.0)

**Performance Log** C:\Program Files\Exchange Jetstress\2\24hr\Stress\_2013\_5\_28\_16\_35\_15.blg

Database sizing and throughput

**Achieved Transactional I/O per Second** 944.478

**Target Transactional I/O per Second** 720

**Initial Database Size (bytes)** 12584121008128

**Final Database Size (bytes)** 12614479380480

**Database Files (Count)** 16

Jetstress system parameters

**Thread Count** 14

**Minimum Database Cache** 512.0 MB

**Maximum Database Cache** 4096.0 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: G:\log1  
Database: G:\db1\Jetstress001001.edb
- Instance2680.2** Log path: G:\log2  
Database: G:\db2\Jetstress002001.edb
- Instance2680.3** Log path: H:\log3  
Database: H:\db3\Jetstress003001.edb
- Instance2680.4** Log path: H:\log4  
Database: H:\db4\Jetstress004001.edb
- Instance2680.5** Log path: I:\log5  
Database: I:\db5\Jetstress005001.edb
- Instance2680.6** Log path: I:\log6  
Database: I:\db6\Jetstress006001.edb
- Instance2680.7** Log path: J:\log7  
Database: J:\db7\Jetstress007001.edb
- Instance2680.8** Log path: J:\log8  
Database: J:\db8\Jetstress008001.edb
- Instance2680.9** Log path: K:\log9  
Database: K:\db9\Jetstress009001.edb
- Instance2680.10** Log path: K:\log10  
Database: K:\db10\Jetstress010001.edb
- Instance2680.11** Log path: L:\log11  
Database: L:\db11\Jetstress011001.edb
- Instance2680.12** Log path: L:\log12  
Database: L:\db12\Jetstress012001.edb
- Instance2680.13** Log path: M:\log13  
Database: M:\db13\Jetstress013001.edb
- Instance2680.14** Log path: M:\log14  
Database: M:\db14\Jetstress014001.edb
- Instance2680.15** Log path: N:\log15  
Database: N:\db15\Jetstress015001.edb
- Instance2680.16** Log path: N:\log16  
Database: N:\db16\Jetstress016001.edb





## Transactional I/O performance

<b>MSEXchange Database ==&gt; Instances</b>	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
<b>Instance 2680.1</b>	9.465	1.505	39.792	19.237	33151.264	36911.212	0.000	0.187	0.000	14.350	0.000	7972.959
<b>Instance 2680.2</b>	9.123	1.499	39.767	19.266	33138.873	36919.618	0.000	0.190	0.000	14.363	0.000	7984.073
<b>Instance 2680.3</b>	8.773	1.448	39.754	19.233	33151.518	36926.968	0.000	0.189	0.000	14.328	0.000	7989.947
<b>Instance 2680.4</b>	8.545	1.443	39.813	19.337	33134.418	36917.071	0.000	0.189	0.000	14.430	0.000	7972.297
<b>Instance 2680.5</b>	8.340	1.351	39.732	19.259	33141.511	36928.804	0.000	0.189	0.000	14.331	0.000	8032.775
<b>Instance 2680.6</b>	8.231	1.339	39.762	19.295	33147.391	36926.410	0.000	0.191	0.000	14.369	0.000	8021.268
<b>Instance 2680.7</b>	8.131	1.228	39.706	19.213	33140.259	36919.425	0.000	0.190	0.000	14.323	0.000	8001.483
<b>Instance 2680.8</b>	8.091	1.224	39.742	19.184	33144.814	36897.861	0.000	0.189	0.000	14.295	0.000	7992.323
<b>Instance 2680.9</b>	8.113	1.177	39.820	19.304	33150.240	36907.882	0.000	0.189	0.000	14.353	0.000	7989.280
<b>Instance 2680.10</b>	8.184	1.174	39.771	19.266	33150.114	36907.360	0.000	0.189	0.000	14.325	0.000	8004.657
<b>Instance 2680.11</b>	8.298	1.194	39.768	19.202	33144.615	36914.895	0.000	0.186	0.000	14.277	0.000	7996.607
<b>Instance 2680.12</b>	8.454	1.190	39.830	19.313	33150.557	36885.079	0.000	0.188	0.000	14.340	0.000	7987.656
<b>Instance 2680.13</b>	8.741	1.292	39.767	19.227	33139.959	36896.681	0.000	0.192	0.000	14.302	0.000	7973.821
<b>Instance 2680.14</b>	9.060	1.284	39.780	19.271	33136.740	36899.620	0.000	0.192	0.000	14.348	0.000	8003.067
<b>Instance 2680.15</b>	9.549	1.390	39.805	19.256	33149.338	36920.906	0.000	0.189	0.000	14.332	0.000	7990.275
<b>Instance 2680.16</b>	10.123	1.386	39.748	19.263	33144.772	36911.733	0.000	0.191	0.000	14.404	0.000	7970.607



### Background database maintenance I/O performance

<b>MSExchange Database ==&gt; Instances</b>	<b>Database Maintenance IO Reads/sec</b>	<b>Database Maintenance IO Reads Average Bytes</b>
Instance2680.1	9.157	261635.623
Instance2680.2	9.158	261577.793
Instance2680.3	9.157	261612.313
Instance2680.4	9.157	261608.309
Instance2680.5	9.157	261618.191
Instance2680.6	9.158	261604.401
Instance2680.7	9.158	261587.274
Instance2680.8	9.157	261627.977
Instance2680.9	9.157	261635.212
Instance2680.10	9.157	261617.281
Instance2680.11	9.157	261618.209
Instance2680.12	9.157	261608.614
Instance2680.13	9.158	261609.815
Instance2680.14	9.158	261602.644
Instance2680.15	9.159	261554.532
Instance2680.16	9.158	261598.430

### Log replication I/O performance

<b>MSExchange Database ==&gt; Instances</b>	<b>I/O Log Reads/sec</b>	<b>I/O Log Reads Average Bytes</b>
Instance2680.1	0.328	127698.845
Instance2680.2	0.330	128172.923
Instance2680.3	0.329	127948.701
Instance2680.4	0.330	128313.899
Instance2680.5	0.331	128842.031
Instance2680.6	0.331	128842.253
Instance2680.7	0.329	128068.294
Instance2680.8	0.328	127616.800
Instance2680.9	0.329	127818.688
Instance2680.10	0.330	128109.004
Instance2680.11	0.328	127493.546
Instance2680.12	0.329	127901.653
Instance2680.13	0.328	127461.972
Instance2680.14	0.330	128339.565
Instance2680.15	0.329	127914.706
Instance2680.16	0.330	128590.854



## Total I/O performance

<b>MSExchange Database ==&gt; Instances</b>	<b>I/O Database Reads Average Latency (msec)</b>	<b>I/O Database Writes Average Latency (msec)</b>	<b>I/O Database Reads/sec</b>	<b>I/O Database Writes/sec</b>	<b>I/O Database Reads Average Bytes</b>	<b>I/O Database Writes Average Bytes</b>	<b>I/O Log Reads Average Latency (msec)</b>	<b>I/O Log Writes Average Latency (msec)</b>	<b>I/O Log Reads/sec</b>	<b>I/O Log Writes/sec</b>	<b>I/O Log Reads Average Bytes</b>	<b>I/O Log Writes Average Bytes</b>
<b>Instance 2680.1</b>	9.465	1.505	48.949	19.237	75892.717	36911.212	0.982	0.187	0.328	14.350	127698.845	7972.959
<b>Instance 2680.2</b>	9.123	1.499	48.926	19.266	75900.490	36919.618	1.004	0.190	0.330	14.363	128172.923	7984.073
<b>Instance 2680.3</b>	8.773	1.448	48.911	19.233	75923.737	36926.968	0.443	0.189	0.329	14.328	127948.701	7989.947
<b>Instance 2680.4</b>	8.545	1.443	48.971	19.337	75858.390	36917.071	0.450	0.189	0.330	14.430	128313.899	7972.297
<b>Instance 2680.5</b>	8.340	1.351	48.889	19.259	75935.836	36928.804	0.915	0.189	0.331	14.331	128842.031	8032.775
<b>Instance 2680.6</b>	8.231	1.339	48.919	19.295	75914.473	36926.410	0.867	0.191	0.331	14.369	128842.253	8021.268
<b>Instance 2680.7</b>	8.131	1.228	48.864	19.213	75955.321	36919.425	0.396	0.190	0.329	14.323	128068.294	8001.483
<b>Instance 2680.8</b>	8.091	1.224	48.899	19.184	75929.931	36897.861	0.416	0.189	0.328	14.295	127616.800	7992.323
<b>Instance 2680.9</b>	8.113	1.177	48.976	19.304	75868.652	36907.882	0.881	0.189	0.329	14.353	127818.688	7989.280
<b>Instance 2680.10</b>	8.184	1.174	48.928	19.266	75909.341	36907.360	0.896	0.189	0.330	14.325	128109.004	8004.657
<b>Instance 2680.11</b>	8.298	1.194	48.925	19.202	75906.533	36914.895	0.409	0.186	0.328	14.277	127493.546	7996.607
<b>Instance 2680.12</b>	8.454	1.190	48.987	19.313	75857.332	36885.079	0.420	0.188	0.329	14.340	127901.653	7987.656
<b>Instance 2680.13</b>	8.741	1.291	48.920	19.227	75908.541	36896.681	0.934	0.192	0.328	14.302	127461.972	7973.821
<b>Instance 2680.14</b>	9.060	1.284	48.937	19.271	75889.945	36899.620	0.929	0.192	0.330	14.348	128339.565	8003.067
<b>Instance 2680.15</b>	9.549	1.390	48.964	19.256	75873.162	36920.906	0.444	0.189	0.329	14.332	127914.706	7990.275
<b>Instance 2680.16</b>	10.123	1.386	48.906	19.263	75922.709	36911.733	0.434	0.191	0.330	14.404	128590.854	7970.607



## Host system performance

Counter	Average	Minimum	Maximum
% Processor Time	0.231	0.020	0.946
Available MBytes	57788.114	57606.000	58118.000
Free System Page Table Entries	33556687.984	33556640.000	33556690.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	93799133.644	92557312.000	97234944.000
Pool Paged Bytes	96138669.741	95973376.000	96673792.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log 5/28/2013 4:34:42 PM -- Preparing for testing ...

5/28/2013 4:34:59 PM -- Attaching databases ...

5/28/2013 4:34:59 PM -- Preparations for testing are complete.

5/28/2013 4:34:59 PM -- Starting transaction dispatch ..

5/28/2013 4:34:59 PM -- Database cache settings: (minimum: 512.0 MB, maximum: 4.0 GB)

5/28/2013 4:34:59 PM -- Database flush thresholds: (start: 40.9 MB, stop: 81.9 MB)

5/28/2013 4:35:15 PM -- Database read latency thresholds: (average: 20 msec/read, maximum: 200 msec/read).

5/28/2013 4:35:15 PM -- Log write latency thresholds: (average: 10 msec/write, maximum: 200 msec/write).

5/28/2013 4:35:17 PM -- Operation mix: Sessions 14, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.

5/28/2013 4:35:17 PM -- Performance logging started (interval: 15000 ms).

5/28/2013 4:35:17 PM -- Attaining prerequisites:

5/28/2013 4:40:44 PM -- \MSEExchange Database(JetstressWin)\Database Cache Size, Last: 3898671000.0 (lower bound: 3865470000.0, upper bound: none)

5/29/2013 4:40:44 PM -- Performance logging has ended.

5/29/2013 4:45:29 PM -- JetInterop batch transaction stats: 136434, 136434, 136433, 136433, 136433, 136433, 136433, 136433, 136433, 136433, 136433, 136433, 136433 and 136433.

5/29/2013 4:45:29 PM -- Dispatching transactions ends.

5/29/2013 4:45:30 PM -- Shutting down databases ...

5/29/2013 4:45:41 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), Instance2680.10 (complete), Instance2680.11 (complete), Instance2680.12 (complete), Instance2680.13 (complete), Instance2680.14 (complete), Instance2680.15 (complete) and Instance2680.16 (complete)

5/29/2013 4:45:41 PM -- C:\Program Files\Exchange Jetstress\2\24hr\Stress\_2013\_5\_28\_16\_35\_15.blg has 5766 samples.

5/29/2013 4:45:41 PM -- Creating test report ...

5/29/2013 4:47:00 PM -- Instance2680.1 has 9.5 for I/O Database Reads Average Latency.

5/29/2013 4:47:00 PM -- Instance2680.1 has 0.2 for I/O Log Writes Average Latency.

5/29/2013 4:47:00 PM -- Instance2680.1 has 0.2 for I/O Log Reads Average Latency.

5/29/2013 4:47:00 PM -- Instance2680.2 has 9.1 for I/O Database Reads Average Latency.

5/29/2013 4:47:00 PM -- Instance2680.2 has 0.2 for I/O Log Writes Average Latency.

5/29/2013 4:47:00 PM -- Instance2680.2 has 0.2 for I/O Log Reads Average Latency.

5/29/2013 4:47:00 PM -- Instance2680.3 has 8.8 for I/O Database Reads Average Latency.

5/29/2013 4:47:00 PM -- Instance2680.3 has 0.2 for I/O Log Writes Average Latency.

5/29/2013 4:47:00 PM -- Instance2680.3 has 0.2 for I/O Log Reads Average Latency.

5/29/2013 4:47:00 PM -- Instance2680.4 has 8.5 for I/O Database Reads Average Latency.

5/29/2013 4:47:00 PM -- Instance2680.4 has 0.2 for I/O Log Writes Average Latency.

5/29/2013 4:47:00 PM -- Instance2680.4 has 0.2 for I/O Log Reads Average Latency.

5/29/2013 4:47:00 PM -- Instance2680.5 has 8.3 for I/O Database Reads Average Latency.

5/29/2013 4:47:00 PM -- Instance2680.5 has 0.2 for I/O Log Writes Average Latency.

5/29/2013 4:47:00 PM -- Instance2680.5 has 0.2 for I/O Log Reads Average Latency.

5/29/2013 4:47:00 PM -- Instance2680.6 has 8.2 for I/O Database Reads Average Latency.

5/29/2013 4:47:00 PM -- Instance2680.6 has 0.2 for I/O Log Writes Average Latency.

5/29/2013 4:47:00 PM -- Instance2680.6 has 0.2 for I/O Log Reads Average Latency.

5/29/2013 4:47:00 PM -- Instance2680.7 has 8.1 for I/O Database Reads Average Latency.

5/29/2013 4:47:00 PM -- Instance2680.7 has 0.2 for I/O Log Writes Average Latency.



5/29/2013 4:47:00 PM -- Instance2680.7 has 0.2 for I/O Log Reads Average Latency.  
5/29/2013 4:47:00 PM -- Instance2680.8 has 8.1 for I/O Database Reads Average Latency.  
5/29/2013 4:47:00 PM -- Instance2680.8 has 0.2 for I/O Log Writes Average Latency.  
5/29/2013 4:47:00 PM -- Instance2680.8 has 0.2 for I/O Log Reads Average Latency.  
5/29/2013 4:47:00 PM -- Instance2680.9 has 8.1 for I/O Database Reads Average Latency.  
5/29/2013 4:47:00 PM -- Instance2680.9 has 0.2 for I/O Log Writes Average Latency.  
5/29/2013 4:47:00 PM -- Instance2680.9 has 0.2 for I/O Log Reads Average Latency.  
5/29/2013 4:47:00 PM -- Instance2680.10 has 8.2 for I/O Database Reads Average Latency.  
5/29/2013 4:47:00 PM -- Instance2680.10 has 0.2 for I/O Log Writes Average Latency.  
5/29/2013 4:47:00 PM -- Instance2680.10 has 0.2 for I/O Log Reads Average Latency.  
5/29/2013 4:47:00 PM -- Instance2680.11 has 8.3 for I/O Database Reads Average Latency.  
5/29/2013 4:47:00 PM -- Instance2680.11 has 0.2 for I/O Log Writes Average Latency.  
5/29/2013 4:47:00 PM -- Instance2680.11 has 0.2 for I/O Log Reads Average Latency.  
5/29/2013 4:47:00 PM -- Instance2680.12 has 8.5 for I/O Database Reads Average Latency.  
5/29/2013 4:47:00 PM -- Instance2680.12 has 0.2 for I/O Log Writes Average Latency.  
5/29/2013 4:47:00 PM -- Instance2680.12 has 0.2 for I/O Log Reads Average Latency.  
5/29/2013 4:47:00 PM -- Instance2680.13 has 8.7 for I/O Database Reads Average Latency.  
5/29/2013 4:47:00 PM -- Instance2680.13 has 0.2 for I/O Log Writes Average Latency.  
5/29/2013 4:47:00 PM -- Instance2680.13 has 0.2 for I/O Log Reads Average Latency.  
5/29/2013 4:47:00 PM -- Instance2680.14 has 9.1 for I/O Database Reads Average Latency.  
5/29/2013 4:47:00 PM -- Instance2680.14 has 0.2 for I/O Log Writes Average Latency.  
5/29/2013 4:47:00 PM -- Instance2680.14 has 0.2 for I/O Log Reads Average Latency.  
5/29/2013 4:47:00 PM -- Instance2680.15 has 9.5 for I/O Database Reads Average Latency.  
5/29/2013 4:47:00 PM -- Instance2680.15 has 0.2 for I/O Log Writes Average Latency.  
5/29/2013 4:47:00 PM -- Instance2680.15 has 0.2 for I/O Log Reads Average Latency.  
5/29/2013 4:47:00 PM -- Instance2680.16 has 10.1 for I/O Database Reads Average Latency.  
5/29/2013 4:47:00 PM -- Instance2680.16 has 0.2 for I/O Log Writes Average Latency.  
5/29/2013 4:47:00 PM -- Instance2680.16 has 0.2 for I/O Log Reads Average Latency.  
5/29/2013 4:47:00 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.  
5/29/2013 4:47:00 PM -- The test has 0 Database Page Fault Stalls/sec samples higher than 0.  
5/29/2013 4:47:00 PM -- C:\Program Files\Exchange Jetstress\2\24hr\Stress\_2013\_5\_28\_16\_35\_15.xml has 5744 samples queried.

## Performance testing

Microsoft Exchange Jetstress 2013  
Performance test result report

Test summary

**Overall Test Result** Pass

**Machine Name** L22-3650-1

**Test Description** 8000 1.5GB mailboxes, 16 databases, 8 (1.75 TB) LUNs, .09 IOPS, 14 thrds

**Test Start Time** 5/30/2013 9:50:52 AM

**Test End Time** 5/30/2013 2:00:26 PM

**Collection Start Time** 5/30/2013 9:57:04 AM

**Collection End Time** 5/30/2013 11:56:51 AM

**Jetstress Version** 15.00.0658.004

**ESE Version** 15.00.0516.026

**Operating System** Windows Server 2012 Standard (6.2.9200.0)

**Performance Log** C:\Program Files\Exchange Jetstress\2\2hr\Performance\_2013\_5\_30\_9\_51\_25.blg



Database sizing and throughput

<b>Achieved Transactional I/O per Second</b>	945.541
<b>Target Transactional I/O per Second</b>	720
<b>Initial Database Size (bytes)</b>	12614479380480
<b>Final Database Size (bytes)</b>	12619546099712
<b>Database Files (Count)</b>	16

Jetstress system parameters

<b>Thread Count</b>	14
<b>Minimum Database Cache</b>	512.0 MB
<b>Maximum Database Cache</b>	4096.0 MB
<b>Insert Operations</b>	40%
<b>Delete Operations</b>	20%
<b>Replace Operations</b>	5%
<b>Read Operations</b>	35%
<b>Lazy Commits</b>	70%
<b>Run Background Database Maintenance</b>	True
<b>Number of Copies per Database</b>	2



Database configuration

- Instance96.1** Log path: G:\log1  
Database: G:\db1\Jetstress001001.edb
- Instance96.2** Log path: G:\log2  
Database: G:\db2\Jetstress002001.edb
- Instance96.3** Log path: H:\log3  
Database: H:\db3\Jetstress003001.edb
- Instance96.4** Log path: H:\log4  
Database: H:\db4\Jetstress004001.edb
- Instance96.5** Log path: I:\log5  
Database: I:\db5\Jetstress005001.edb
- Instance96.6** Log path: I:\log6  
Database: I:\db6\Jetstress006001.edb
- Instance96.7** Log path: J:\log7  
Database: J:\db7\Jetstress007001.edb
- Instance96.8** Log path: J:\log8  
Database: J:\db8\Jetstress008001.edb
- Instance96.9** Log path: K:\log9  
Database: K:\db9\Jetstress009001.edb
- Instance96.10** Log path: K:\log10  
Database: K:\db10\Jetstress010001.edb
- Instance96.11** Log path: L:\log11  
Database: L:\db11\Jetstress011001.edb
- Instance96.12** Log path: L:\log12  
Database: L:\db12\Jetstress012001.edb
- Instance96.13** Log path: M:\log13  
Database: M:\db13\Jetstress013001.edb
- Instance96.14** Log path: M:\log14  
Database: M:\db14\Jetstress014001.edb
- Instance96.15** Log path: N:\log15  
Database: N:\db15\Jetstress015001.edb
- Instance96.16** Log path: N:\log16  
Database: N:\db16\Jetstress016001.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
<b>Instance 96.1</b>	9.331	1.526	39.884	19.220	33068.443	36168.674	0.000	0.188	0.000	13.840	0.000	7957.586
<b>Instance 96.2</b>	9.022	1.506	39.790	19.086	33128.581	36264.931	0.000	0.187	0.000	13.619	0.000	8086.053
<b>Instance 96.3</b>	8.725	1.459	40.130	19.283	33087.336	36193.791	0.000	0.192	0.000	13.692	0.000	7917.151
<b>Instance 96.4</b>	8.493	1.469	39.992	19.386	33108.543	36177.242	0.000	0.190	0.000	13.900	0.000	7943.219
<b>Instance 96.5</b>	8.278	1.364	39.817	19.076	33159.336	36307.688	0.000	0.188	0.000	13.695	0.000	8006.504
<b>Instance 96.6</b>	8.217	1.383	39.962	19.491	33117.767	36199.345	0.000	0.192	0.000	14.178	0.000	7906.344
<b>Instance 96.7</b>	8.118	1.250	39.584	18.917	33102.723	36287.326	0.000	0.188	0.000	13.846	0.000	7954.726
<b>Instance 96.8</b>	8.103	1.250	40.126	19.432	33135.627	36197.313	0.000	0.192	0.000	13.867	0.000	7916.688
<b>Instance 96.9</b>	8.103	1.206	39.700	19.126	33154.923	36275.281	0.000	0.185	0.000	13.928	0.000	8009.444
<b>Instance 96.10</b>	8.148	1.195	40.010	19.335	33119.299	36177.309	0.000	0.185	0.000	13.754	0.000	7973.951
<b>Instance 96.11</b>	8.311	1.220	39.849	19.021	33156.369	36206.130	0.000	0.188	0.000	13.630	0.000	7998.171
<b>Instance 96.12</b>	8.444	1.225	39.854	19.291	33150.731	36223.618	0.000	0.189	0.000	13.790	0.000	8083.980
<b>Instance 96.13</b>	8.745	1.318	39.973	19.451	33134.681	36265.205	0.000	0.189	0.000	14.083	0.000	7966.123
<b>Instance 96.14</b>	9.058	1.311	39.749	18.965	33132.611	36231.132	0.000	0.194	0.000	13.585	0.000	8043.979
<b>Instance 96.15</b>	9.563	1.418	39.761	19.204	33158.399	36280.274	0.000	0.192	0.000	13.940	0.000	8009.003
<b>Instance 96.16</b>	10.179	1.403	39.945	19.130	33103.639	36223.397	0.000	0.194	0.000	13.704	0.000	8015.321





## Background database maintenance I/O performance

<b>MSExchange Database ==&gt; Instances</b>	<b>Database Maintenance IO Reads/sec</b>	<b>Database Maintenance IO Reads Average Bytes</b>
Instance96.1	9.155	261652.645
Instance96.2	9.153	261720.777
Instance96.3	9.158	261580.266
Instance96.4	9.158	261591.754
Instance96.5	9.156	261655.625
Instance96.6	9.158	261564.350
Instance96.7	9.154	261708.803
Instance96.8	9.156	261639.930
Instance96.9	9.158	261581.356
Instance96.10	9.156	261630.450
Instance96.11	9.158	261588.573
Instance96.12	9.155	261687.185
Instance96.13	9.156	261648.950
Instance96.14	9.160	261508.865
Instance96.15	9.155	261681.197
Instance96.16	9.158	261559.156

## Log replication I/O performance

<b>MSExchange Database ==&gt; Instances</b>	<b>I/O Log Reads/sec</b>	<b>I/O Log Reads Average Bytes</b>
Instance96.1	0.316	122862.826
Instance96.2	0.317	123350.377
Instance96.3	0.308	119937.521
Instance96.4	0.317	123884.679
Instance96.5	0.316	122931.283
Instance96.6	0.321	124813.030
Instance96.7	0.317	123350.377
Instance96.8	0.313	121887.724
Instance96.9	0.321	124813.030
Instance96.10	0.312	121400.173
Instance96.11	0.312	121400.173
Instance96.12	0.321	124813.030
Instance96.13	0.321	125330.158
Instance96.14	0.316	123335.731
Instance96.15	0.321	124813.030
Instance96.16	0.315	122375.275



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
<b>Instance 96.1</b>	9.331	1.526	49.039	19.220	75743.382	36168.674	1.126	0.188	0.316	13.840	122862.826	7957.586
<b>Instance 96.2</b>	9.022	1.506	48.944	19.086	75879.653	36264.931	0.877	0.187	0.317	13.619	123350.377	8086.053
<b>Instance 96.3</b>	8.725	1.459	49.288	19.283	75541.503	36193.791	0.433	0.192	0.308	13.692	119937.521	7917.151
<b>Instance 96.4</b>	8.493	1.469	49.150	19.386	75679.753	36177.242	0.472	0.190	0.317	13.900	123884.679	7943.219
<b>Instance 96.5</b>	8.278	1.364	48.973	19.076	75877.820	36307.688	0.894	0.188	0.316	13.695	122931.283	8006.504
<b>Instance 96.6</b>	8.217	1.383	49.120	19.491	75710.983	36199.345	0.894	0.192	0.321	14.178	124813.030	7906.344
<b>Instance 96.7</b>	8.118	1.250	48.738	18.917	76040.695	36287.326	0.385	0.188	0.317	13.846	123350.377	7954.726
<b>Instance 96.8</b>	8.103	1.250	49.282	19.432	75589.718	36197.313	0.496	0.192	0.313	13.867	121887.724	7916.688
<b>Instance 96.9</b>	8.103	1.206	48.858	19.126	75972.457	36275.281	0.811	0.185	0.321	13.928	124813.030	8009.444
<b>Instance 96.10</b>	8.148	1.195	49.166	19.335	75676.050	36177.309	0.993	0.185	0.312	13.754	121400.173	7973.951
<b>Instance 96.11</b>	8.311	1.220	49.007	19.021	75844.857	36206.130	0.483	0.188	0.312	13.630	121400.173	7998.171
<b>Instance 96.12</b>	8.444	1.225	49.009	19.291	75840.882	36223.618	0.427	0.189	0.321	13.790	124813.030	8083.980
<b>Instance 96.13</b>	8.745	1.318	49.129	19.451	75719.948	36265.205	0.873	0.189	0.321	14.083	125330.158	7966.123
<b>Instance 96.14</b>	9.058	1.311	48.910	18.965	75905.626	36231.132	1.013	0.194	0.316	13.585	123335.731	8043.979
<b>Instance 96.15</b>	9.563	1.418	48.915	19.204	75928.476	36280.274	0.502	0.192	0.321	13.940	124813.030	8009.003
<b>Instance 96.16</b>	10.179	1.403	49.103	19.130	75713.385	36223.397	0.624	0.194	0.315	13.704	122375.275	8015.321



Host system performance

Counter	Average	Minimum	Maximum
% Processor Time	0.232	0.067	0.327
Available MBytes	57794.025	57789.000	58070.000
Free System Page Table Entries	33556688.000	33556688.000	33556688.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	93833721.573	93462528.000	93933568.000
Pool Paged Bytes	103415850.845	103325696.000	103526400.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log 5/30/2013 9:50:52 AM -- Preparing for testing ...

5/30/2013 9:51:09 AM -- Attaching databases ...

5/30/2013 9:51:09 AM -- Preparations for testing are complete.

5/30/2013 9:51:09 AM -- Starting transaction dispatch ..

5/30/2013 9:51:09 AM -- Database cache settings: (minimum: 512.0 MB, maximum: 4.0 GB)

5/30/2013 9:51:09 AM -- Database flush thresholds: (start: 40.9 MB, stop: 81.9 MB)

5/30/2013 9:51:25 AM -- Database read latency thresholds: (average: 20 msec/read, maximum: 100 msec/read).

5/30/2013 9:51:25 AM -- Log write latency thresholds: (average: 10 msec/write, maximum: 100 msec/write).

5/30/2013 9:51:27 AM -- Operation mix: Sessions 14, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.

5/30/2013 9:51:27 AM -- Performance logging started (interval: 15000 ms).

5/30/2013 9:51:27 AM -- Attaining prerequisites:

5/30/2013 9:57:04 AM -- \\MSEExchange Database(JetstressWin)\Database Cache Size, Last: 3868230000.0 (lower bound: 3865470000.0, upper bound: none)

5/30/2013 11:57:05 AM -- Performance logging has ended.

5/30/2013 2:00:07 PM -- JetInterop batch transaction stats: 22624, 22624, 22624, 22624, 22624, 22624, 22624, 22624, 22624, 22624, 22624, 22624, 22623, 22623, 22623 and 22623.

5/30/2013 2:00:07 PM -- Dispatching transactions ends.

5/30/2013 2:00:07 PM -- Shutting down databases ...

5/30/2013 2:00:26 PM -- Instance96.1 (complete), Instance96.2 (complete), Instance96.3 (complete), Instance96.4 (complete), Instance96.5 (complete), Instance96.6 (complete), Instance96.7 (complete), Instance96.8 (complete), Instance96.9 (complete), Instance96.10 (complete), Instance96.11 (complete), Instance96.12 (complete), Instance96.13 (complete), Instance96.14 (complete), Instance96.15 (complete) and Instance96.16 (complete)

5/30/2013 2:00:26 PM -- C:\Program Files\Exchange Jetstress\2\2h\Performance\_2013\_5\_30\_9\_51\_25.blg has 500 samples.

5/30/2013 2:00:26 PM -- Creating test report ...

5/30/2013 2:00:34 PM -- Instance96.1 has 9.3 for I/O Database Reads Average Latency.

5/30/2013 2:00:34 PM -- Instance96.1 has 0.2 for I/O Log Writes Average Latency.

5/30/2013 2:00:34 PM -- Instance96.1 has 0.2 for I/O Log Reads Average Latency.

5/30/2013 2:00:34 PM -- Instance96.2 has 9.0 for I/O Database Reads Average Latency.

5/30/2013 2:00:34 PM -- Instance96.2 has 0.2 for I/O Log Writes Average Latency.

5/30/2013 2:00:34 PM -- Instance96.2 has 0.2 for I/O Log Reads Average Latency.

5/30/2013 2:00:34 PM -- Instance96.3 has 8.7 for I/O Database Reads Average Latency.

5/30/2013 2:00:34 PM -- Instance96.3 has 0.2 for I/O Log Writes Average Latency.

5/30/2013 2:00:34 PM -- Instance96.3 has 0.2 for I/O Log Reads Average Latency.

5/30/2013 2:00:34 PM -- Instance96.4 has 8.5 for I/O Database Reads Average Latency.

5/30/2013 2:00:34 PM -- Instance96.4 has 0.2 for I/O Log Writes Average Latency.

5/30/2013 2:00:34 PM -- Instance96.4 has 0.2 for I/O Log Reads Average Latency.

5/30/2013 2:00:34 PM -- Instance96.5 has 8.3 for I/O Database Reads Average Latency.

5/30/2013 2:00:34 PM -- Instance96.5 has 0.2 for I/O Log Writes Average Latency.

5/30/2013 2:00:34 PM -- Instance96.5 has 0.2 for I/O Log Reads Average Latency.

5/30/2013 2:00:34 PM -- Instance96.6 has 8.2 for I/O Database Reads Average Latency.

5/30/2013 2:00:34 PM -- Instance96.6 has 0.2 for I/O Log Writes Average Latency.

5/30/2013 2:00:34 PM -- Instance96.6 has 0.2 for I/O Log Reads Average Latency.

5/30/2013 2:00:34 PM -- Instance96.7 has 8.1 for I/O Database Reads Average Latency.

5/30/2013 2:00:34 PM -- Instance96.7 has 0.2 for I/O Log Writes Average Latency.

5/30/2013 2:00:34 PM -- Instance96.7 has 0.2 for I/O Log Reads Average Latency.



5/30/2013 2:00:34 PM -- Instance96.8 has 8.1 for I/O Database Reads Average Latency.  
5/30/2013 2:00:34 PM -- Instance96.8 has 0.2 for I/O Log Writes Average Latency.  
5/30/2013 2:00:34 PM -- Instance96.8 has 0.2 for I/O Log Reads Average Latency.  
5/30/2013 2:00:34 PM -- Instance96.9 has 8.1 for I/O Database Reads Average Latency.  
5/30/2013 2:00:34 PM -- Instance96.9 has 0.2 for I/O Log Writes Average Latency.  
5/30/2013 2:00:34 PM -- Instance96.9 has 0.2 for I/O Log Reads Average Latency.  
5/30/2013 2:00:34 PM -- Instance96.10 has 8.1 for I/O Database Reads Average Latency.  
5/30/2013 2:00:34 PM -- Instance96.10 has 0.2 for I/O Log Writes Average Latency.  
5/30/2013 2:00:34 PM -- Instance96.10 has 0.2 for I/O Log Reads Average Latency.  
5/30/2013 2:00:34 PM -- Instance96.11 has 8.3 for I/O Database Reads Average Latency.  
5/30/2013 2:00:34 PM -- Instance96.11 has 0.2 for I/O Log Writes Average Latency.  
5/30/2013 2:00:34 PM -- Instance96.11 has 0.2 for I/O Log Reads Average Latency.  
5/30/2013 2:00:34 PM -- Instance96.12 has 8.4 for I/O Database Reads Average Latency.  
5/30/2013 2:00:34 PM -- Instance96.12 has 0.2 for I/O Log Writes Average Latency.  
5/30/2013 2:00:34 PM -- Instance96.12 has 0.2 for I/O Log Reads Average Latency.  
5/30/2013 2:00:34 PM -- Instance96.13 has 8.7 for I/O Database Reads Average Latency.  
5/30/2013 2:00:34 PM -- Instance96.13 has 0.2 for I/O Log Writes Average Latency.  
5/30/2013 2:00:34 PM -- Instance96.13 has 0.2 for I/O Log Reads Average Latency.  
5/30/2013 2:00:34 PM -- Instance96.14 has 9.1 for I/O Database Reads Average Latency.  
5/30/2013 2:00:34 PM -- Instance96.14 has 0.2 for I/O Log Writes Average Latency.  
5/30/2013 2:00:34 PM -- Instance96.14 has 0.2 for I/O Log Reads Average Latency.  
5/30/2013 2:00:34 PM -- Instance96.15 has 9.6 for I/O Database Reads Average Latency.  
5/30/2013 2:00:34 PM -- Instance96.15 has 0.2 for I/O Log Writes Average Latency.  
5/30/2013 2:00:34 PM -- Instance96.15 has 0.2 for I/O Log Reads Average Latency.  
5/30/2013 2:00:34 PM -- Instance96.16 has 10.2 for I/O Database Reads Average Latency.  
5/30/2013 2:00:34 PM -- Instance96.16 has 0.2 for I/O Log Writes Average Latency.  
5/30/2013 2:00:34 PM -- Instance96.16 has 0.2 for I/O Log Reads Average Latency.  
5/30/2013 2:00:34 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.  
5/30/2013 2:00:34 PM -- The test has 0 Database Page Fault Stalls/sec samples higher than 0.  
5/30/2013 2:00:34 PM -- C:\Program Files\Exchange Jetstress\2\2hr\Performance\_2013\_5\_30\_9\_51\_25.xml has 477 samples queried.



## Streaming backup testing

Microsoft Exchange Jetstress 2013  
Database backup test result report

Database backup statistics - all

Database Instance	Database Size (MBytes)	Elapsed Backup Time	MBytes Transferred/sec
Instance3972.1	752177.59	03:59:55	52.25
Instance3972.2	752177.59	03:59:48	52.28
Instance3972.3	752169.59	04:00:42	52.08
Instance3972.4	752185.59	04:00:50	52.05
Instance3972.5	752177.59	04:00:36	52.10
Instance3972.6	752185.59	03:59:45	52.29
Instance3972.7	752185.59	04:01:07	51.99
Instance3972.8	752169.59	03:59:45	52.29
Instance3972.9	752169.59	04:00:57	52.03
Instance3972.10	752169.59	04:00:18	52.17
Instance3972.11	752161.59	04:00:17	52.17
Instance3972.12	752177.59	03:59:40	52.30
Instance3972.13	752169.59	04:00:20	52.16
Instance3972.14	752177.59	04:00:35	52.11
Instance3972.15	752169.59	04:00:36	52.10
Instance3972.16	752185.59	04:00:18	52.17
<b>Avg</b>			52.16
<b>Sum</b>			834.52

Jetstress system parameters

**Thread Count** 14  
**Minimum Database Cache** 512.0 MB  
**Maximum Database Cache** 4096.0 MB  
**Insert Operations** 40%  
**Delete Operations** 20%  
**Replace Operations** 5%  
**Read Operations** 35%  
**Lazy Commits** 70%



## Database configuration

- Instance3972.1** Log path: g:\log1  
Database: g:\db1\Jetstress001001.edb
- Instance3972.2** Log path: g:\log2  
Database: g:\db2\Jetstress002001.edb
- Instance3972.3** Log path: h:\log3  
Database: h:\db3\Jetstress003001.edb
- Instance3972.4** Log path: h:\log4  
Database: h:\db4\Jetstress004001.edb
- Instance3972.5** Log path: i:\log5  
Database: i:\db5\Jetstress005001.edb
- Instance3972.6** Log path: i:\log6  
Database: i:\db6\Jetstress006001.edb
- Instance3972.7** Log path: j:\log7  
Database: j:\db7\Jetstress007001.edb
- Instance3972.8** Log path: j:\log8  
Database: j:\db8\Jetstress008001.edb
- Instance3972.9** Log path: k:\log9  
Database: k:\db9\Jetstress009001.edb
- Instance3972.10** Log path: k:\log10  
Database: k:\db10\Jetstress010001.edb
- Instance3972.11** Log path: l:\log11  
Database: l:\db11\Jetstress011001.edb
- Instance3972.12** Log path: l:\log12  
Database: l:\db12\Jetstress012001.edb
- Instance3972.13** Log path: m:\log13  
Database: m:\db13\Jetstress013001.edb
- Instance3972.14** Log path: m:\log14  
Database: m:\db14\Jetstress014001.edb
- Instance3972.15** Log path: n:\log15  
Database: n:\db15\Jetstress015001.edb
- Instance3972.16** Log path: n:\log16  
Database: n:\db16\Jetstress016001.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
Instance 3972.1	8.550	0.000	208.881	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance 3972.2	8.550	0.000	209.046	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance 3972.3	8.595	0.000	207.581	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance 3972.4	8.597	0.000	207.904	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance 3972.5	8.592	0.000	207.783	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance 3972.6	8.563	0.000	209.031	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance 3972.7	8.636	0.000	206.074	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance 3972.8	8.557	0.000	209.023	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance 3972.9	8.627	0.000	206.792	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance 3972.10	8.570	0.000	208.535	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance 3972.11	8.578	0.000	208.594	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance 3972.12	8.557	0.000	209.141	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance 3972.13	8.572	0.000	208.472	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance 3972.14	8.585	0.000	207.835	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance 3972.15	8.578	0.000	207.973	0.000	262144.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Instance 3972.16	8.577	0.000	208.569	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	0.899	0.770	1.182
Available MBytes	62168.840	62118.000	62175.000
Free System Page Table Entries	33556173.210	33556112.000	33556178.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	88119802.678	87859200.000	88195072.000
Pool Paged Bytes	102356953.680	101249024.000	102502400.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log 6/3/2013 10:51:38 AM -- Preparing for testing ...

6/3/2013 10:51:54 AM -- Attaching databases ...

6/3/2013 10:51:54 AM -- Preparations for testing are complete.

6/3/2013 10:52:11 AM -- Performance logging started (interval: 30000 ms).

6/3/2013 10:52:11 AM -- Backing up databases ...

6/3/2013 2:53:19 PM -- Performance logging has ended.

6/3/2013 2:53:19 PM -- Instance3972.1 (100% processed), Instance3972.2 (100% processed), Instance3972.3 (100% processed), Instance3972.4 (100% processed), Instance3972.5 (100% processed), Instance3972.6 (100% processed), Instance3972.7 (100% processed), Instance3972.8 (100% processed), Instance3972.9 (100% processed), Instance3972.10 (100% processed), Instance3972.11 (100% processed), Instance3972.12 (100% processed), Instance3972.13 (100% processed), Instance3972.14 (100% processed), Instance3972.15 (100% processed) and Instance3972.16 (100% processed)

6/3/2013 2:53:19 PM -- C:\Program Files\Exchange Jetstress\2\Bkup\DatabaseBackup\_2013\_6\_3\_10\_51\_54.blg has 481 samples.

6/3/2013 2:53:19 PM -- Creating test report ...





## Soft-recovery testing

Microsoft Exchange Jetstress 2013  
Soft-recovery test result report

Soft-recovery statistics - all

Database Instance	Log files replayed	Elapsed seconds
<b>Instance1476.1</b>	506	1124.4169226
<b>Instance1476.2</b>	503	1086.6972902
<b>Instance1476.3</b>	504	1035.9617287
<b>Instance1476.4</b>	507	992.9294721
<b>Instance1476.5</b>	503	942.4595419
<b>Instance1476.6</b>	510	913.771371
<b>Instance1476.7</b>	512	860.6451285
<b>Instance1476.8</b>	506	857.9888165
<b>Instance1476.9</b>	502	860.6451285
<b>Instance1476.10</b>	508	896.5053424
<b>Instance1476.11</b>	508	931.0373999
<b>Instance1476.12</b>	508	976.7259684
<b>Instance1476.13</b>	501	1018.9613311
<b>Instance1476.14</b>	505	1068.8999991
<b>Instance1476.15</b>	507	1121.4949793
<b>Instance1476.16</b>	501	1149.3862567
<b>Avg</b>	505	989.908
<b>Sum</b>	8091	15838.5266769



## Database configuration

- Instance1476.1** Log path: g:\log1  
Database: g:\db1\Jetstress001001.edb
- Instance1476.2** Log path: g:\log2  
Database: g:\db2\Jetstress002001.edb
- Instance1476.3** Log path: h:\log3  
Database: h:\db3\Jetstress003001.edb
- Instance1476.4** Log path: h:\log4  
Database: h:\db4\Jetstress004001.edb
- Instance1476.5** Log path: i:\log5  
Database: i:\db5\Jetstress005001.edb
- Instance1476.6** Log path: i:\log6  
Database: i:\db6\Jetstress006001.edb
- Instance1476.7** Log path: j:\log7  
Database: j:\db7\Jetstress007001.edb
- Instance1476.8** Log path: j:\log8  
Database: j:\db8\Jetstress008001.edb
- Instance1476.9** Log path: k:\log9  
Database: k:\db9\Jetstress009001.edb
- Instance1476.10** Log path: k:\log10  
Database: k:\db10\Jetstress010001.edb
- Instance1476.11** Log path: l:\log11  
Database: l:\db11\Jetstress011001.edb
- Instance1476.12** Log path: l:\log12  
Database: l:\db12\Jetstress012001.edb
- Instance1476.13** Log path: m:\log13  
Database: m:\db13\Jetstress013001.edb
- Instance1476.14** Log path: m:\log14  
Database: m:\db14\Jetstress014001.edb
- Instance1476.15** Log path: n:\log15  
Database: n:\db15\Jetstress015001.edb
- Instance1476.16** Log path: n:\log16  
Database: n:\db16\Jetstress016001.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
<b>Instance 1476.1</b>	14.376	1.863	369.383	1.799	41177.029	32650.129	19.922	0.000	2.251	0.000	208547.736	0.000
<b>Instance 1476.2</b>	13.552	1.051	392.603	1.847	41042.281	32645.731	21.420	0.000	2.311	0.000	208815.978	0.000
<b>Instance 1476.3</b>	12.895	1.001	413.325	1.944	40940.708	32640.000	19.080	0.000	2.441	0.002	209462.091	16.000
<b>Instance 1476.4</b>	12.343	1.310	431.756	2.043	40802.800	32768.000	20.124	0.000	2.556	0.000	209743.591	0.000
<b>Instance 1476.5</b>	11.814	1.011	453.135	2.136	40798.860	32768.000	14.810	0.000	2.673	0.000	209660.535	0.000
<b>Instance 1476.6</b>	11.559	1.311	463.197	2.234	40810.551	32768.000	15.491	0.000	2.795	0.000	209720.762	0.000
<b>Instance 1476.7</b>	11.229	1.014	496.035	2.380	40754.010	32768.000	5.133	0.000	2.978	0.000	209696.115	0.000
<b>Instance 1476.8</b>	11.093	0.919	494.667	2.358	40690.681	32768.000	12.260	0.000	2.951	0.000	209713.416	0.000
<b>Instance 1476.9</b>	11.154	1.232	489.065	2.333	40790.329	32613.434	14.858	0.000	2.919	0.000	208785.533	0.000
<b>Instance 1476.10</b>	11.434	0.923	475.388	2.265	40815.424	32768.000	14.502	0.000	2.834	0.000	209655.176	0.000
<b>Instance 1476.11</b>	11.726	0.776	462.867	2.186	40786.302	32768.000	17.895	0.000	2.735	0.000	209633.493	0.000
<b>Instance 1476.12</b>	12.243	0.944	441.349	2.081	40809.940	32768.000	16.711	0.000	2.604	0.000	209646.125	0.000
<b>Instance 1476.13</b>	12.801	0.980	425.483	1.959	41022.673	32637.450	21.017	0.000	2.451	0.000	208668.467	0.000
<b>Instance 1476.14</b>	13.723	1.427	394.023	1.888	41074.251	32768.000	19.321	0.000	2.361	0.000	209561.101	0.000
<b>Instance 1476.15</b>	14.712	1.125	367.510	1.802	41123.556	32768.000	25.026	0.000	2.254	0.000	209574.622	0.000
<b>Instance 1476.16</b>	16.170	1.610	350.874	1.737	41354.114	32537.239	22.074	0.000	2.173	0.000	208135.174	0.000



Background database maintenance I/O performance

<b>MSExchange Database ==&gt; Instances</b>	<b>Database Maintenance IO Reads/sec</b>	<b>Database Maintenance IO Reads Average Bytes</b>
<b>Instance1476.1</b>	7.725	261802.429
<b>Instance1476.2</b>	7.801	261495.005
<b>Instance1476.3</b>	7.900	261579.481
<b>Instance1476.4</b>	7.927	261549.264
<b>Instance1476.5</b>	8.098	261889.377
<b>Instance1476.6</b>	8.139	261647.209
<b>Instance1476.7</b>	8.147	261606.514
<b>Instance1476.8</b>	8.200	261591.477
<b>Instance1476.9</b>	8.183	262020.017
<b>Instance1476.10</b>	8.142	261568.351
<b>Instance1476.11</b>	8.079	261677.861
<b>Instance1476.12</b>	8.045	261286.413
<b>Instance1476.13</b>	7.906	261710.161
<b>Instance1476.14</b>	7.867	261764.920
<b>Instance1476.15</b>	7.742	261613.532
<b>Instance1476.16</b>	7.621	261638.332



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
<b>Instance14 76.1</b>	14.3 76	1.86 3	377. 108	1.79 9	45696.4 01	32650. 129	19.9 22	0.00 0	2.25 1	0.00 0	208547. 736	0.00 0
<b>Instance14 76.2</b>	13.5 52	1.05 1	400. 403	1.84 7	45337.1 71	32645. 731	21.4 20	0.00 0	2.31 1	0.00 0	208815. 978	0.00 0
<b>Instance14 76.3</b>	12.8 95	1.00 1	421. 225	1.94 4	45078.8 52	32640. 000	19.0 80	0.00 0	2.44 1	0.00 2	209462. 091	16.0 00
<b>Instance14 76.4</b>	12.3 43	1.31 0	439. 683	2.04 3	44782.8 42	32768. 000	20.1 24	0.00 0	2.55 6	0.00 0	209743. 591	0.00 0
<b>Instance14 76.5</b>	11.8 14	1.01 1	461. 233	2.13 6	44680.5 83	32768. 000	14.8 10	0.00 0	2.67 3	0.00 0	209660. 535	0.00 0
<b>Instance14 76.6</b>	11.5 59	1.31 1	471. 336	2.23 4	44624.0 87	32768. 000	15.4 91	0.00 0	2.79 5	0.00 0	209720. 762	0.00 0
<b>Instance14 76.7</b>	11.2 29	1.01 4	504. 182	2.38 0	44322.7 30	32768. 000	5.13 3	0.00 0	2.97 8	0.00 0	209696. 115	0.00 0
<b>Instance14 76.8</b>	11.0 93	0.91 9	502. 867	2.35 8	44292.6 73	32768. 000	12.2 60	0.00 0	2.95 1	0.00 0	209713. 416	0.00 0
<b>Instance14 76.9</b>	11.1 54	1.23 2	497. 248	2.33 3	44431.1 26	32613. 434	14.8 58	0.00 0	2.91 9	0.00 0	208785. 533	0.00 0
<b>Instance14 76.10</b>	11.4 34	0.92 3	483. 530	2.26 5	44532.5 32	32768. 000	14.5 02	0.00 0	2.83 4	0.00 0	209655. 176	0.00 0
<b>Instance14 76.11</b>	11.7 26	0.77 6	470. 947	2.18 6	44575.8 70	32768. 000	17.8 95	0.00 0	2.73 5	0.00 0	209633. 493	0.00 0
<b>Instance14 76.12</b>	12.2 43	0.94 4	449. 394	2.08 1	44756.7 00	32768. 000	16.7 11	0.00 0	2.60 4	0.00 0	209646. 125	0.00 0
<b>Instance14 76.13</b>	12.8 01	0.98 0	433. 389	1.95 9	45048.3 34	32637. 450	21.0 17	0.00 0	2.45 1	0.00 0	208668. 467	0.00 0
<b>Instance14 76.14</b>	13.7 23	1.42 7	401. 890	1.88 8	45394.1 05	32768. 000	19.3 21	0.00 0	2.36 1	0.00 0	209561. 101	0.00 0
<b>Instance14 76.15</b>	14.7 12	1.12 5	375. 252	1.80 2	45672.5 28	32768. 000	25.0 26	0.00 0	2.25 4	0.00 0	209574. 622	0.00 0
<b>Instance14 76.16</b>	16.1 70	1.61 0	358. 495	1.73 7	46036.9 49	32537. 239	22.0 74	0.00 0	2.17 3	0.00 0	208135. 174	0.00 0



## Host system performance

Counter	Average	Minimum	Maximum
% Processor Time	1.277	0.148	2.069
Available MBytes	57973.372	57842.000	61747.000
Free System Page Table Entries	33556144.046	33556141.000	33556146.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	93049234.414	93032448.000	93249536.000
Pool Paged Bytes	105461724.070	105246720.000	105525248.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log 6/3/2013 8:39:13 PM -- Preparing for testing ...

6/3/2013 8:39:30 PM -- Attaching databases ...

6/3/2013 8:39:30 PM -- Preparations for testing are complete.

6/3/2013 8:39:30 PM -- Starting transaction dispatch ...

6/3/2013 8:39:30 PM -- Database cache settings: (minimum: 512.0 MB, maximum: 4.0 GB)

6/3/2013 8:39:30 PM -- Database flush thresholds: (start: 40.9 MB, stop: 81.9 MB)

6/3/2013 8:39:47 PM -- Database read latency thresholds: (average: 20 msec/read, maximum: 100 msec/read).

6/3/2013 8:39:47 PM -- Log write latency thresholds: (average: 10 msec/write, maximum: 100 msec/write).

6/3/2013 8:39:48 PM -- Operation mix: Sessions 14, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.

6/3/2013 8:39:48 PM -- Performance logging started (interval: 15000 ms).

6/3/2013 8:39:48 PM -- Generating log files ...

6/4/2013 12:34:46 AM -- g:\log1 (101.2% generated), g:\log2 (100.6% generated), h:\log3 (100.8% generated), h:\log4 (101.4% generated), i:\log5 (100.6% generated), i:\log6 (102.0% generated), j:\log7 (102.4% generated), j:\log8 (101.2% generated), k:\log9 (100.4% generated), k:\log10 (101.6% generated), l:\log11 (101.6% generated), l:\log12 (101.6% generated), m:\log13 (100.2% generated), m:\log14 (101.0% generated), n:\log15 (101.4% generated) and n:\log16 (100.2% generated)

6/4/2013 12:34:46 AM -- Performance logging has ended.

6/4/2013 12:34:46 AM -- JetInterop batch transaction stats: 21741, 21741, 21741, 21741, 21740, 21740, 21740, 21740, 21740, 21740, 21740, 21740, 21740 and 21740.

6/4/2013 12:34:46 AM -- Dispatching transactions ends.

6/4/2013 12:34:46 AM -- Shutting down databases ...

6/4/2013 12:35:06 AM -- Instance1476.1 (complete), Instance1476.2 (complete), Instance1476.3 (complete), Instance1476.4 (complete), Instance1476.5 (complete), Instance1476.6 (complete), Instance1476.7 (complete), Instance1476.8 (complete), Instance1476.9 (complete), Instance1476.10 (complete), Instance1476.11 (complete), Instance1476.12 (complete), Instance1476.13 (complete), Instance1476.14 (complete), Instance1476.15 (complete) and Instance1476.16 (complete)

6/4/2013 12:35:06 AM -- C:\Program Files\Exchange Jetstress\2\rec\Performance\_2013\_6\_3\_20\_39\_47.blg has 937 samples.

6/4/2013 12:35:06 AM -- Creating test report ...

6/4/2013 12:35:12 AM -- Instance1476.1 has 11.2 for I/O Database Reads Average Latency.

6/4/2013 12:35:12 AM -- Instance1476.1 has 0.2 for I/O Log Writes Average Latency.

6/4/2013 12:35:12 AM -- Instance1476.1 has 0.2 for I/O Log Reads Average Latency.

6/4/2013 12:35:12 AM -- Instance1476.2 has 10.8 for I/O Database Reads Average Latency.

6/4/2013 12:35:12 AM -- Instance1476.2 has 0.2 for I/O Log Writes Average Latency.

6/4/2013 12:35:12 AM -- Instance1476.2 has 0.2 for I/O Log Reads Average Latency.

6/4/2013 12:35:12 AM -- Instance1476.3 has 10.4 for I/O Database Reads Average Latency.

6/4/2013 12:35:12 AM -- Instance1476.3 has 0.2 for I/O Log Writes Average Latency.

6/4/2013 12:35:12 AM -- Instance1476.3 has 0.2 for I/O Log Reads Average Latency.

6/4/2013 12:35:12 AM -- Instance1476.4 has 10.1 for I/O Database Reads Average Latency.

6/4/2013 12:35:12 AM -- Instance1476.4 has 0.2 for I/O Log Writes Average Latency.

6/4/2013 12:35:12 AM -- Instance1476.4 has 0.2 for I/O Log Reads Average Latency.

6/4/2013 12:35:12 AM -- Instance1476.5 has 9.9 for I/O Database Reads Average Latency.

6/4/2013 12:35:12 AM -- Instance1476.5 has 0.2 for I/O Log Writes Average Latency.

6/4/2013 12:35:12 AM -- Instance1476.5 has 0.2 for I/O Log Reads Average Latency.

6/4/2013 12:35:12 AM -- Instance1476.6 has 9.8 for I/O Database Reads Average Latency.



6/4/2013 12:35:12 AM -- Instance1476.6 has 0.2 for I/O Log Writes Average Latency.  
6/4/2013 12:35:12 AM -- Instance1476.6 has 0.2 for I/O Log Reads Average Latency.  
6/4/2013 12:35:12 AM -- Instance1476.7 has 9.7 for I/O Database Reads Average Latency.  
6/4/2013 12:35:12 AM -- Instance1476.7 has 0.2 for I/O Log Writes Average Latency.  
6/4/2013 12:35:12 AM -- Instance1476.7 has 0.2 for I/O Log Reads Average Latency.  
6/4/2013 12:35:12 AM -- Instance1476.8 has 9.6 for I/O Database Reads Average Latency.  
6/4/2013 12:35:12 AM -- Instance1476.8 has 0.2 for I/O Log Writes Average Latency.  
6/4/2013 12:35:12 AM -- Instance1476.8 has 0.2 for I/O Log Reads Average Latency.  
6/4/2013 12:35:12 AM -- Instance1476.9 has 9.7 for I/O Database Reads Average Latency.  
6/4/2013 12:35:12 AM -- Instance1476.9 has 0.2 for I/O Log Writes Average Latency.  
6/4/2013 12:35:12 AM -- Instance1476.9 has 0.2 for I/O Log Reads Average Latency.  
6/4/2013 12:35:12 AM -- Instance1476.10 has 9.8 for I/O Database Reads Average Latency.  
6/4/2013 12:35:12 AM -- Instance1476.10 has 0.2 for I/O Log Writes Average Latency.  
6/4/2013 12:35:12 AM -- Instance1476.10 has 0.2 for I/O Log Reads Average Latency.  
6/4/2013 12:35:12 AM -- Instance1476.11 has 9.9 for I/O Database Reads Average Latency.  
6/4/2013 12:35:12 AM -- Instance1476.11 has 0.2 for I/O Log Writes Average Latency.  
6/4/2013 12:35:12 AM -- Instance1476.11 has 0.2 for I/O Log Reads Average Latency.  
6/4/2013 12:35:12 AM -- Instance1476.12 has 10.1 for I/O Database Reads Average Latency.  
6/4/2013 12:35:12 AM -- Instance1476.12 has 0.2 for I/O Log Writes Average Latency.  
6/4/2013 12:35:12 AM -- Instance1476.12 has 0.2 for I/O Log Reads Average Latency.  
6/4/2013 12:35:12 AM -- Instance1476.13 has 10.4 for I/O Database Reads Average Latency.  
6/4/2013 12:35:12 AM -- Instance1476.13 has 0.2 for I/O Log Writes Average Latency.  
6/4/2013 12:35:12 AM -- Instance1476.13 has 0.2 for I/O Log Reads Average Latency.  
6/4/2013 12:35:12 AM -- Instance1476.14 has 10.8 for I/O Database Reads Average Latency.  
6/4/2013 12:35:12 AM -- Instance1476.14 has 0.2 for I/O Log Writes Average Latency.  
6/4/2013 12:35:12 AM -- Instance1476.14 has 0.2 for I/O Log Reads Average Latency.  
6/4/2013 12:35:12 AM -- Instance1476.15 has 11.3 for I/O Database Reads Average Latency.  
6/4/2013 12:35:12 AM -- Instance1476.15 has 0.2 for I/O Log Writes Average Latency.  
6/4/2013 12:35:12 AM -- Instance1476.15 has 0.2 for I/O Log Reads Average Latency.  
6/4/2013 12:35:12 AM -- Instance1476.16 has 12.0 for I/O Database Reads Average Latency.  
6/4/2013 12:35:12 AM -- Instance1476.16 has 0.2 for I/O Log Writes Average Latency.  
6/4/2013 12:35:12 AM -- Instance1476.16 has 0.2 for I/O Log Reads Average Latency.  
6/4/2013 12:35:12 AM -- Test has 0 Maximum Database Page Fault Stalls/sec.  
6/4/2013 12:35:12 AM -- The test has 0 Database Page Fault Stalls/sec samples higher than 0.  
6/4/2013 12:35:12 AM -- C:\Program Files\Exchange Jetstress\2\rec\Performance\_2013\_6\_3\_20\_39\_47.xml has 936 samples queried.  
6/4/2013 12:35:12 AM -- C:\Program Files\Exchange Jetstress\2\rec\Performance\_2013\_6\_3\_20\_39\_47.html was saved.  
6/4/2013 7:45:24 AM -- Performance logging started (interval: 4000 ms).  
6/4/2013 7:45:24 AM -- Recovering databases ...  
6/4/2013 8:04:33 AM -- Performance logging has ended.  
6/4/2013 8:04:33 AM -- Instance1476.1 (1124.4169226), Instance1476.2 (1086.6972902), Instance1476.3 (1035.9617287), Instance1476.4 (992.9294721), Instance1476.5 (942.4595419), Instance1476.6 (913.771371), Instance1476.7 (860.6451285), Instance1476.8 (857.9888165), Instance1476.9 (860.6451285), Instance1476.10 (896.5053424), Instance1476.11 (931.0373999), Instance1476.12 (976.7259684), Instance1476.13 (1018.9613311), Instance1476.14 (1068.8999991), Instance1476.15 (1121.4949793) and Instance1476.16 (1149.3862567)  
6/4/2013 8:04:34 AM -- C:\Program Files\Exchange Jetstress\2\rec\SoftRecovery\_2013\_6\_4\_7\_45\_23.blg has 285 samples.  
6/4/2013 8:04:34 AM -- Creating test report ...

## Resources

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The following websites provide useful references to supplement the information contained in this paper:

- IBM Systems on PartnerWorld  
[ibm.com/partnerworld/systems](http://ibm.com/partnerworld/systems)
- Virtual Loaner Program  
[ibm.com/systems/vlp](http://ibm.com/systems/vlp)
- IBM Storwize V5000  
[ibm.com/systems/storage/disk](http://ibm.com/systems/storage/disk)
- IBM System x Servers  
[ibm.com/systems/x](http://ibm.com/systems/x)
- Microsoft ESRP program  
[technet.microsoft.com/en-us/exchange/ff182054.aspx](http://technet.microsoft.com/en-us/exchange/ff182054.aspx)
- Microsoft Exchange 2013 Storage Design  
[technet.microsoft.com/en-us/library/ee832792%28v=exchg.150%29.aspx](http://technet.microsoft.com/en-us/library/ee832792%28v=exchg.150%29.aspx)
- IBM Redbooks  
[ibm.com/redbooks](http://ibm.com/redbooks)
- IBM Publications Center  
[www.elink.ibm.link.ibm.com/public/applications/publications/cgibin/pbi.cgi?CTY=US](http://www.elink.ibm.link.ibm.com/public/applications/publications/cgibin/pbi.cgi?CTY=US)

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