Dell EMC SC Series SC5020 9,000 Mailbox Exchange 2016 Resiliency Storage Solution using 7.2K Drives

Microsoft ESRP 4.0

Dell EMC Engineering
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1 Introduction

This document provides information on the Dell EMC™ SC5020 storage solution for Microsoft® Exchange Server, based on the Microsoft Exchange Solution Reviewed Program (ESRP) – Storage program.

This document describes the performance characteristics of a fully hardware-redundant Microsoft Exchange 2016 solution housing 9,000 typical user mailboxes in two 3U SC5020 arrays containing 7.2K 1TB drives. Test results show the SC5020 solution provided the sufficient IOPS with minimal latencies required.

The ESRP – Storage program was developed by Microsoft Corporation to provide a common storage testing framework for vendors to provide information on its storage solutions for Microsoft Exchange Server software. For more details on the Microsoft ESRP – Storage program, visit https://technet.microsoft.com/en-us/office/dn756396.aspx.

1.1 Simulated environment

The solution presented in this document is designed to simulate a moderate-sized number of mailboxes hosted on highly redundant hardware. Application-level redundancy is augmented with redundant storage to create a highly available and fault tolerant solution.

The mailbox resiliency features of Exchange Server 2016 greatly enhance the availability of Exchange Server, while also improving I/O performance. The solution presented in this paper is a mailbox resiliency solution utilizing one database availability group (DAG) and two copies of every database. The tested environment simulates all users in this DAG running on a single SC Series array, or half of the solution. The number of users simulated was 9,000 across four servers, with 2,250 users per server. The mailbox size was 1GB per user. Each server has four databases, with one copy local and the second copy replicated to the second server. This provides redundancy through hardware and software.

The replication mechanism is the native Exchange 2016 DAG database replication engine. This is an efficient and reliable replication mechanism and is the recommended method for providing highly-available and redundant Exchange solutions.

1.2 Solution description

Testing was performed on an SC5020 array running Dell Storage Center OS (SCOS) v7.2 with a redundant controller pair and redundant front-end and back-end connections. The front-end connections are Fibre-Channel based, over redundant fabrics, with two ports per server and four ports per controller. One 30-bay 2.5” built-in drive enclosure is utilized with each SC5020.

The back-end disk connectivity is SAS 12 Gbps and the disk drives used are SAS 7.2K 1.0TB. The spindle count is 28 disks and 2 spares for database and logs, on a dedicated disk pool on each SC Series array. Because this is a redundant solution, databases and logs are stored together on the same volumes. All volumes are RAID-5.

See the following link for information about compatibility:
https://www.windowsservercatalog.com/item.aspx?idItem=bb42253c-205d-da5d-e884-cbf33697346f&bCatID=1282

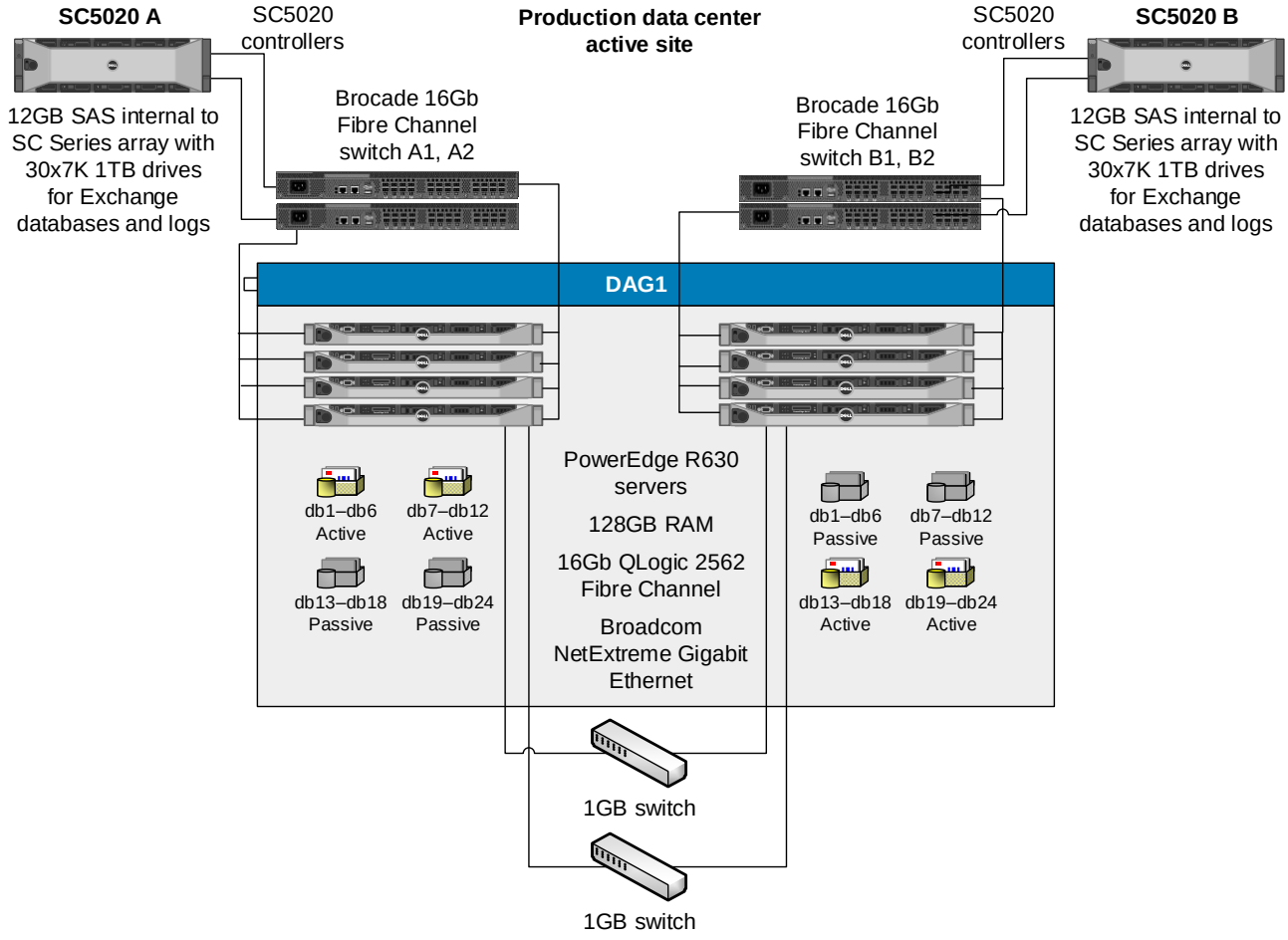

Figure 1 Highly available data center design

The solution is designed around a highly available data center model (Figure 1). There are two disk arrays for complete redundancy. The Exchange configuration is one DAG. The LAN ports are in a dedicated replication VLAN for traffic isolation. There are two networks for redundancy.

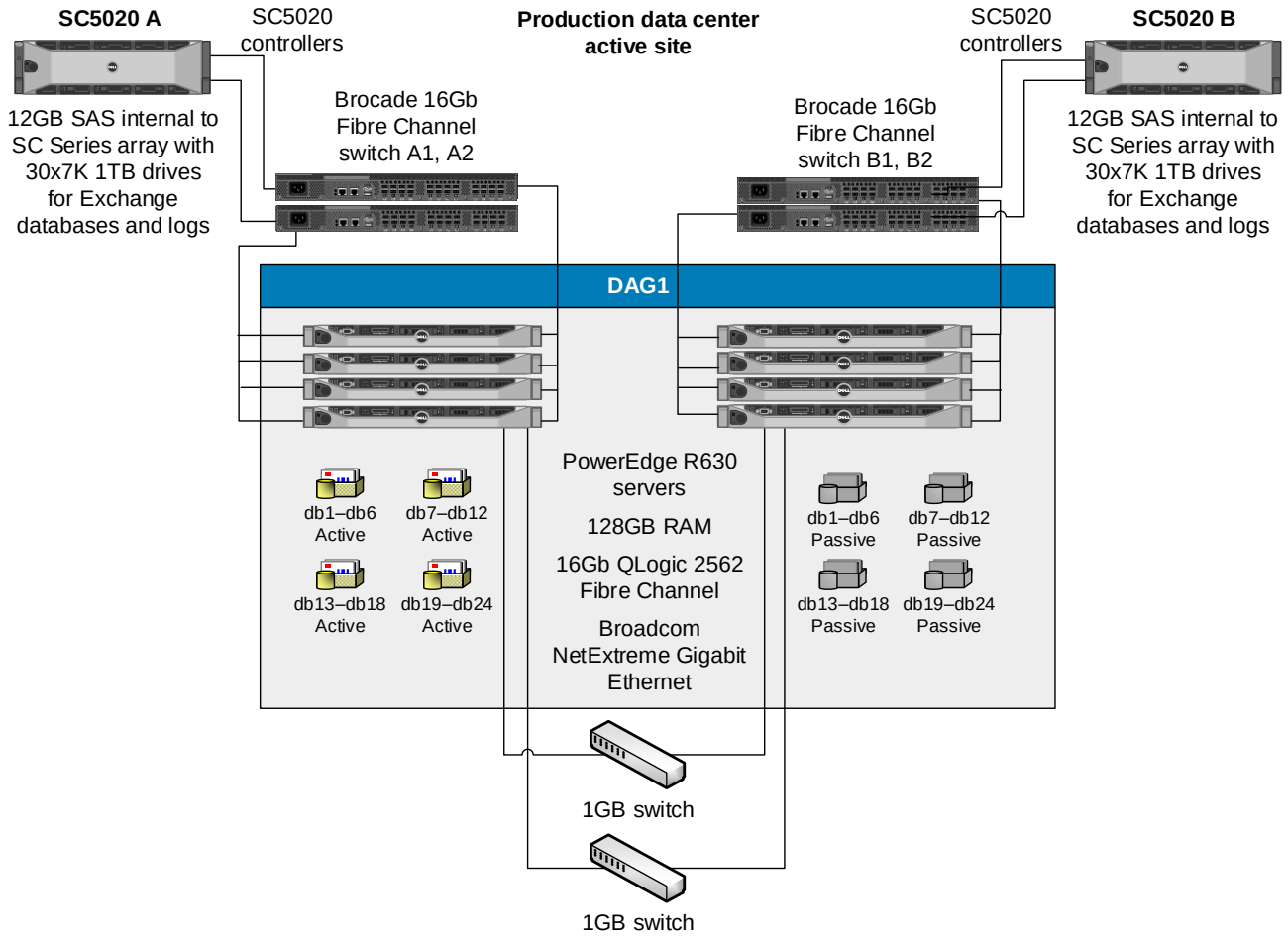

Figure 2 Tested configuration: SC5020 A with a full user load and SC5020 B offline

The tested configuration is a single SC5020 array (Figure 2), running with the full user load. This is tested to clearly show a single array can handle the user load in an array failure scenario. Under normal operating conditions, the preferred activation scenario would be to run half of the mailbox databases active on each SC5020 array, while either array could handle the entire workload at any given time.

The ability to handle the entire workload on a single SC5020 array means no I/O performance degradation will occur if an array or any volumes were to fail. All mailbox servers would have volumes mapped to both arrays, with one copy of each database on each array.

2 SC5020 solution overview

2.1 Accelerate your workloads, automate your savings

The SC5020 array makes storage cost savings automatic with a modern architecture that optimizes the data center for economics while delivering transformational SSD, HDD, or hybrid performance.

SC Series storage provides the lowest effective cost per GB for flash and hybrid flash[1], giving organizations of any size the technology advantage needed to compete in today's fast-changing markets. Highlights include:

- Data Progression: Achieve IOPS goals with the least expensive mix of storage media, even as your performance needs evolve.
- Deduplication and compression: Dramatically reduce the raw capacity required to store data.
- RAID tiering: Eliminate manual RAID provisioning, and increase efficiency and utilization.
- Federation: Simplify multi-array environments with quick and seamless data movement, plus proactive load balancing assistance using Live Migrate and Volume Advisor.
- Dell ProSupport™ services: Reduce deployment costs with remote installation options that ensure the project is successful the first time.
- Persistent software licensing: Future-proof the investment, and minimize the cost of upgrades and expansions.

2.2 All-new hardware platform

Designed as the next-generation successor to the popular SC4020 array, the SC5020 array is a performance powerhouse. With dual 8-core Intel® processors, 4x more memory, and a 12Gb SAS back end, the SC5020 delivers:

- Up to 45% more IOPs[2]
- Up to 3x more bandwidth[2]
- 2x greater maximum capacity

The new 3U all-in-one chassis includes 30 drive bays plus dual hot-swappable controllers, providing up to 460TB raw capacity in a single compact unit. A variety of expansion enclosures enables scaling up to 2 petabytes (2PB) per array — with even larger scale-out potential in federated multi-array systems. In addition to fast hardware, the SC5020 includes all of the SCOS features to be expected from SC Series storage.

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[1] Net usable capacity of Dell array with 5 years of support, after 4:1 data reduction, vs. major competitors net of data reduction. Street price analysis is based on a variety of sources including analyst data, price sheets when available, and public information as of January 2017.
[2] Based on April 2017 internal Dell EMC testing, compared to previous-generation SC4020. Actual performance will vary depending upon application and configuration.

2.3 Targeted customer profile

This solution is targeted for a medium-sized organization, but it can be sized to meet the needs of any size of organization. Capacity can be dynamically scaled up to 2 petabytes (2PB). This provides excellent growth potential with no downtime required for upgrades.

The solution was tested with the following configuration:

- User I/O profile: .083 IOPS per user, .10 tested, giving 20% headroom
- User mailbox size: 1GB quota
- Backup: VSS backup using SAN-based snapshots and mailbox resiliency as the primary data-protection mechanism.
- Restore: SAN-based snapshots and boot from SAN enable a complete server restore in minutes
- RAID type: RAID 5 for database volumes and log volumes; a mix of RAID 10, RAID 5, and RAID 6 can be blended, with fully automated tiered storage providing the most efficient and best performing storage where needed

2.4 Volume sizing

The volume size tested was just large enough to support the database size. Volumes on SC Series storage can be grown dynamically, without affecting service. As database sizes approach volume sizes, any volume can be automatically increased on demand. This simplifies sizing because capacity can be added as needed.

Using SC Series dynamic capacity and hot upgrades, additional disk capacity can be added as needed. If more spindles are required to accommodate growth, they can simply be cabled and added to the disk pool to grow volume space. Since volumes are not tied to spindle boundaries, adding spindles can increase performance and capacity as the system grows.

The testing environment was configured for 71% storage utilization. If the storage requirement grows beyond the design specified, additional drives provide additional capacity for any volume to be expanded.

3 Tested deployment

The following tables summarize the testing environment.

3.1 Simulated Exchange configuration

Table 1 Simulated Exchange configuration

Configuration	Detail
Exchange mailboxes simulated	9,000
Database availability groups (DAGs)	1
Servers per DAG	8
Active mailboxes per server	1,125
Databases per host	4
Copies per database	2
Mailboxes per database	281 or 282
Simulated profile: I/Os per second per mailbox (IOPS, include 20% headroom)	.083 (.10 tested)
Database per log LUN size	800 GB
Total database size for performance testing	10 TB
Storage capacity used by Exchange database*	71%

*Note: Database size and capacity utilized may not match on a thin-provisioned system because only used pages will consume space. Pages that are allocated, but contain blank data, may not use disk.

3.2 Primary storage hardware

Table 2 Primary storage hardware

Configuration	Detail
Storage connectivity (Fibre Channel, SAS, SATA, iSCSI)	Fibre Channel
Storage model and OS or firmware revision	Storage Center OS (SC5020) v7.2 https://www.windowsservercatalog.com/item.aspx?idItem=bb42253c-205d-da5d-e884-cbf33697346f&bCatID=1282
Storage cache	8GB
Storage controllers	2
Storage ports	4 active ports per controller
Maximum bandwidth of storage connectivity to host	48Gb/sec (4x12Gb HBA)
Switch type, model, and firmware revision	Brocade® Model 6505 24- port 16Gb Fibre Channel Switch Firmware version 7.4.1b
HBA model and firmware	QLogic® QLE2694 16G Fibre Channel Adapter (driver FW 08.04.02)
HBAs per host	1 dual-port QLogic 2562 16Gb HBA
Host server type	2x8 Intel® Xeon® Processor E5-2660 0 @ 2.20GHz, 128GB RAM
Total disks tested in solution	28 active for DB and logs 2 hot spares = 30 total spindles
Maximum spindles hosted in the storage	30 drive bay + dual controllers in a 2U chassis; Scalable to 222 drives (30 internal, plus 192 external with modular expansion enclosures); Total of 2PB per array

3.3 Primary storage software

Table 3 Primary storage software

Configuration	Detail
HBA driver	QLogic StorPort FC HBA Driver 9.1.15.1
HBA queue depth setting	65535
Multi-Pathing	Microsoft Windows Server® 2016 R2 MPIO Round Robin (in-box DSM)
Host OS	Microsoft Windows Server 2016
ESE.dll file version	15.1.669.32
Replication solution name and version	Microsoft Exchange Server 2016 DAG replication

3.4 Primary storage disk configuration (mailbox store/log disks)

Table 4 Primary storage disk configuration

Configuration	Detail
Disk type, speed	SAS 7.2K 1.0TB
Raw capacity per disk (GB)	931.51GB
Number of physical disks in test	28
Total raw storage capacity (GB)	26.08TB
RAID level	RAID 5
Total formatted capacity	12.80TB
Storage capacity utilization	71.08%
Database capacity utilization	80%

4 Test results summary

This section provides a high-level summary of the test data from ESRP. The detailed HTML reports generated by the ESRP testing framework are shown in the appendices of this paper.

4.1 Reliability

A number of reliability tests were run for 24 hours to verify the storage can handle high I/O load for a long period of time. Both log and database files were analyzed for integrity after the stress test to ensure no database or log corruption.

The following list provides an overview of the test results. Click the hyperlinks to view the HTML reports that were generated after the reliability tests were performed.

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

4.2 Storage performance results

The primary storage performance testing is designed to exercise the storage with the maximum sustainable Exchange type of I/O for two hours. The test shows how long it takes for the storage to respond to an I/O under load. The data in the following tables is the sum of all of the logical disk I/Os and average of all the I/O latency of the logical disks during the two-hour test duration. Each server is listed separately and the aggregate numbers across all servers is listed as well.

Table 5 Server 1 test results

Database I/O	**Value**
Database Disks Transfers/sec	295.771
Database Disks Reads/sec	205.419
Database Disks Writes/sec	90.352
Average Database Disk Read Latency (ms)	17.098
Average Database Disk Write Latency (ms)	0.570
Transaction Log I/O	**Value**
Log Disks Writes/sec	23.316
Average Log Disk Write Latency (ms)	0.519

Table 6 Server 2 test results

Database I/O	**Value**
Database Disks Transfers/sec	294.572
Database Disks Reads/sec	204.704
Database Disks Writes/sec	89.868
Average Database Disk Read Latency (ms)	17.337
Average Database Disk Write Latency (ms)	0.725
Transaction Log I/O	**Value**
Log Disks Writes/sec	23.142
Average Log Disk Write Latency (ms)	0.691

Table 7 Server 3 test results

Database I/O	**Value**
Database Disks Transfers/sec	270.358
Database Disks Reads/sec	189.14
Database Disks Writes/sec	81.218
Average Database Disk Read Latency (ms)	15.836
Average Database Disk Write Latency (ms)	0.760
Transaction Log I/O	**Value**
Log Disks Writes/sec	20.858
Average Log Disk Write Latency (ms)	0.713

Table 8 Server 4 test results

Database I/O	**Value**
Database Disks Transfers/sec	270.772
Database Disks Reads/sec	189.447
Database Disks Writes/sec	81.325
Average Database Disk Read Latency (ms)	15.732
Average Database Disk Write Latency (ms)	0.764
Transaction Log I/O	**Value**
Log Disks Writes/sec	20.965
Average Log Disk Write Latency (ms)	0.712

4.3 Database backup/recovery performance

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

4.3.1 Database read-only performance

This test measures the maximum rate at which databases could be backed up through VSS. The following results show the average rate for a single database file.

MB read/sec per database: 60.24

MB read/sec total per server: 240.95

4.3.2 Transaction log recovery/replay performance

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

Average time to play one log file (sec): 2.516

5 Conclusion

The testing described in this paper shows the scalability and performance of the SC5020 array. Improvements in I/O efficiency are seen with this newest version of SCOS and the latest Dell EMC hardware solution. These tests discovered that write I/O response times to Exchange databases improved 287% and transaction logs improved by 182%.

This document is developed by storage solution providers, and reviewed by the Microsoft Exchange Product team. The test results and data presented in this document are based on the tests introduced in the ESRP v4.0 test framework. Customers should not quote the data directly for pre-deployment verification. It is still necessary to go through the prescribed exercises to validate the storage design for a specific customer environment.

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

A Performance testing

A.1 Server 1

A.1.1 Test results

Table 9 Test summary

Parameter	Detail
Overall Test Result	**Pass**
Machine Name	JS8
Test Description	Run Database Maintenance: True Performance Mailbox Profile: mailbox count 2250, mailbox quota 1024, mailbox Iops 0.1 Suppress tuning: True ThreadCount: 7 Output path: C:\Program Files\Exchange Jetstress Database source: AttachExistingDatabases Number of copies per database: 2
Test Start Time	5/19/2017 10:23:09 AM
Test End Time	5/19/2017 12:31:01 PM
Collection Start Time	5/19/2017 10:28:42 AM
Collection End Time	5/19/2017 12:28:29 PM
Jetstress Version	15.01.0466.031
ESE Version	15.01.0669.032
Operating System	Windows Server 2012 R2 Datacenter (6.2.9200.0)
Performance Log	C:\Program Files\Exchange Jetstress\Performance_2017_5_19_10_23_19.blg

Table 10 Database sizing and throughput

Performance counter	Value
Achieved Transactional I/O per Second	259.38
Target Transactional I/O per Second	225
Initial Database Size (bytes)	2416850239488
Final Database Size (bytes)	2417655545856
Database Files (Count)	4

Table 11 Jetstress system parameters

Performance counter	Value
Thread Count	7
Minimum Database Cache	128.0 MB
Maximum Database Cache	1024.0 MB
Insert Operations	40%
Delete Operations	20%
Replace Operations	5%
Read Operations	35%
Lazy Commits	70%
Run Background Database Maintenance	True
Number of Copies per Database	2

Table 12 Database configuration

Performance counter	Value
Instance4952.1	Log path: C:\DB\DB9 Database: C:\DB\DB9\Jetstress001001.edb
Instance4952.2	Log path: C:\DB\DB10 Database: C:\DB\DB10\Jetstress002001.edb
Instance4952.3	Log path: C:\DB\DB11 Database: C:\DB\DB11\Jetstress003001.edb
Instance4952.4	Log path: C:\DB\DB12 Database: C:\DB\DB12\Jetstress004001.edb

Table 13 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
Instance4952.1	17.743	0.574	42.193	22.516	33043.814	36940.376	0.000	0.519	0.000	5.820	0.000	19155.453
Instance4952.2	16.598	0.568	42.251	22.670	33066.520	36956.311	0.000	0.520	0.000	5.881	0.000	19315.652
Instance4952.3	16.648	0.567	42.424	22.665	33041.859	36941.275	0.000	0.518	0.000	5.816	0.000	19211.826
Instance4952.4	17.404	0.570	42.160	22.501	33005.483	36990.072	0.000	0.518	0.000	5.799	0.000	19358.903

Table 14 Background database maintenance I/O performance

MSExchange Database ==> Instances	Database Maintenance IO Reads/sec	Database Maintenance IO Reads Average Bytes
Instance4952.1	9.148	261434.906
Instance4952.2	9.163	261446.139
Instance4952.3	9.154	261428.859
Instance4952.4	8.926	261417.274

Table 15 Log replication I/O performance

MSExchange Database ==> Instances	I/O Log Reads/sec	I/O Log Reads Average Bytes
Instance4952.1	0.476	182449.093
Instance4952.2	0.484	187314.403
Instance4952.3	0.476	184395.217
Instance4952.4	0.479	185318.531

Table 16 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
Instance4952.1	17.743	0.574	51.341	22.516	73738.563	36940.376	10.955	0.519	0.476	5.820	182449.093	19155.453
Instance4952.2	16.598	0.568	51.414	22.670	73767.837	36956.311	10.452	0.520	0.484	5.881	187314.403	19315.652
Instance4952.3	16.648	0.567	51.578	22.665	73577.687	36941.275	10.230	0.518	0.476	5.816	184395.217	19211.826
Instance4952.4	17.404	0.570	51.086	22.501	72914.651	36990.072	11.262	0.518	0.479	5.799	185318.531	19358.903

Table 17 Host system performance

Counter	Average	Minimum	Maximum
% Processor Time	0.107	0.000	0.187
Available MBytes	62690.466	62671.000	62784.000
Free System Page Table Entries	16482216.205	16482010.000	16482468.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	93033320.217	92971008.000	93093888.000
Pool Paged Bytes	140409605.879	140369920.000	140468224.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

A.1.2 Test log

5/19/2017 10:23:09 AM -- Preparing for testing ...
5/19/2017 10:23:14 AM -- Attaching databases ...
5/19/2017 10:23:14 AM -- Preparations for testing are complete.
5/19/2017 10:23:14 AM -- Starting transaction dispatch ..
5/19/2017 10:23:14 AM -- Database cache settings: (minimum: 128.0 MB, maximum: 1.0 GB)
5/19/2017 10:23:14 AM -- Database flush thresholds: (start: 10.2 MB, stop: 20.5 MB)
5/19/2017 10:23:19 AM -- Database read latency thresholds: (average: 20 msec/read, maximum: 100 msec/read).
5/19/2017 10:23:19 AM -- Log write latency thresholds: (average: 10 msec/write, maximum: 100 msec/write).
5/19/2017 10:23:20 AM -- Operation mix: Sessions 7, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
5/19/2017 10:23:20 AM -- Performance logging started (interval: 15000 ms).
5/19/2017 10:23:20 AM -- Attaining prerequisites:
5/19/2017 10:28:42 AM -- \MSExchange Database(JetstressWin)\Database Cache Size, Last: 970448900.0 (lower bound: 966367600.0, upper bound: none)
5/19/2017 12:28:43 PM -- Performance logging has ended.
5/19/2017 12:30:59 PM -- JetInterop batch transaction stats: 14531, 14531, 14531 and 14531.
5/19/2017 12:30:59 PM -- Dispatching transactions ends.
5/19/2017 12:30:59 PM -- Shutting down databases ...
5/19/2017 12:31:01 PM -- Instance4952.1 (complete), Instance4952.2 (complete), Instance4952.3 (complete) and Instance4952.4 (complete)
5/19/2017 12:31:01 PM -- C:\Program Files\Exchange Jetstress\Performance_2017_5_19_10_23_19.blg has 500 samples.
5/19/2017 12:31:01 PM -- Creating test report ...
5/19/2017 12:31:03 PM -- Instance4952.1 has 17.7 for I/O Database Reads Average Latency.
5/19/2017 12:31:03 PM -- Instance4952.1 has 0.5 for I/O Log Writes Average Latency.
5/19/2017 12:31:03 PM -- Instance4952.1 has 0.5 for I/O Log Reads Average Latency.
5/19/2017 12:31:03 PM -- Instance4952.2 has 16.6 for I/O Database Reads Average Latency.
5/19/2017 12:31:03 PM -- Instance4952.2 has 0.5 for I/O Log Writes Average Latency.
5/19/2017 12:31:03 PM -- Instance4952.2 has 0.5 for I/O Log Reads Average Latency.
5/19/2017 12:31:03 PM -- Instance4952.3 has 16.6 for I/O Database Reads Average Latency.
5/19/2017 12:31:03 PM -- Instance4952.3 has 0.5 for I/O Log Writes Average Latency.
5/19/2017 12:31:03 PM -- Instance4952.3 has 0.5 for I/O Log Reads Average Latency.
5/19/2017 12:31:03 PM -- Instance4952.4 has 17.4 for I/O Database Reads Average Latency.
5/19/2017 12:31:03 PM -- Instance4952.4 has 0.5 for I/O Log Writes Average Latency.
5/19/2017 12:31:03 PM -- Instance4952.4 has 0.5 for I/O Log Reads Average Latency.
5/19/2017 12:31:03 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.
5/19/2017 12:31:03 PM -- The test has 0 Database Page Fault Stalls/sec samples higher than 0.
5/19/2017 12:31:03 PM -- C:\Program Files\Exchange Jetstress\Performance_2017_5_19_10_23_19.xml has 478 samples queried.

A.2 Server 2

A.2.1 Test results

Table 18 Test summary

Paremeter	Detail
Overall Test Result	**Pass**
Machine Name	JS9
Test Description	Run Database Maintenance: True Performance Mailbox Profile: mailbox count 2250, mailbox quota 1024, mailbox Iops 0.1 Suppress tuning: True ThreadCount: 7 Output path: C:\Program Files\Exchange Jetstress Database source: AttachExistingDatabases Number of copies per database: 2
Test Start Time	5/19/2017 10:23:13 AM
Test End Time	5/19/2017 12:31:06 PM
Collection Start Time	5/19/2017 10:28:51 AM
Collection End Time	5/19/2017 12:28:41 PM
Jetstress Version	15.01.0466.031
ESE Version	15.01.0669.032
Operating System	Windows Server 2012 R2 Datacenter (6.2.9200.0)
Performance Log	C:\Program Files\Exchange Jetstress\Performance_2017_5_19_10_23_23.blg

Table 19 Database sizing and throughput

Performance counter	Value
Achieved Transactional I/O per Second	258.581
Target Transactional I/O per Second	225
Initial Database Size (bytes)	2416825073664
Final Database Size (bytes)	2417630380032
Database Files (Count)	4

Table 20 Jetstress system parameters

Performance counter	Value
Thread Count	7
Minimum Database Cache	128.0 MB
Maximum Database Cache	1024.0 MB
Insert Operations	40%
Delete Operations	20%
Replace Operations	5%
Read Operations	35%
Lazy Commits	70%
Run Background Database Maintenance	True
Number of Copies per Database	2

Table 21 Database configuration

Performance counter	Value
Instance1684.1	Log path: C:\DB\DB13 Database: C:\DB\DB13\Jetstress001001.edb
Instance1684.2	Log path: C:\DB\DB14 Database: C:\DB\DB14\Jetstress002001.edb
Instance1684.3	Log path: C:\DB\DB15 Database: C:\DB\DB15\Jetstress003001.edb
Instance1684.4	Log path: C:\DB\DB16 Database: C:\DB\DB16\Jetstress004001.edb

Table 22 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
Instance1684.1	18.662	0.717	42.289	22.629	33025.168	36891.626	0.000	0.691	0.000	5.800	0.000	19319.471
Instance1684.2	16.162	0.721	42.114	22.380	33055.443	36933.075	0.000	0.692	0.000	5.787	0.000	19284.182
Instance1684.3	18.301	0.728	42.164	22.455	33053.372	36934.849	0.000	0.691	0.000	5.797	0.000	19315.337
Instance1684.4	16.222	0.734	42.146	22.404	33050.179	36929.413	0.000	0.689	0.000	5.758	0.000	19310.469

Table 23 Background database maintenance I/O performance

MSExchange Database ==> Instances	Database Maintenance IO Reads/sec	Database Maintenance IO Reads Average Bytes
Instance1684.1	9.145	261495.173
Instance1684.2	9.162	261474.818
Instance1684.3	8.523	261411.174
Instance1684.4	9.160	261544.767

Table 24 Log replication I/O performance

MSExchange Database ==> Instances	I/O Log Reads/sec	I/O Log Reads Average Bytes
Instance1684.1	0.478	185854.810
Instance1684.2	0.476	185819.677
Instance1684.3	0.477	185625.928
Instance1684.4	0.473	183385.194

Table 25 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
Instance1684.1	18.662	0.717	51.435	22.629	73648.527	36891.626	11.874	0.691	0.478	5.800	185854.810	19319.471
Instance1684.2	16.162	0.721	51.276	22.380	73869.146	36933.075	10.853	0.692	0.476	5.787	185819.677	19284.182
Instance1684.3	18.301	0.728	50.687	22.455	71453.676	36934.849	11.188	0.691	0.477	5.797	185625.928	19315.337
Instance1684.4	16.222	0.734	51.306	22.404	73845.252	36929.413	10.743	0.689	0.473	5.758	183385.194	19310.469

Table 26 Host system performance

Counter	Average	Minimum	Maximum
% Processor Time	0.218	0.000	0.414
Available MBytes	62741.854	62735.000	62812.000
Free System Page Table Entries	16475829.426	16475553.000	16476023.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	87295140.610	87236608.000	87412736.000
Pool Paged Bytes	132992314.255	132923392.000	133136384.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

A.2.2 Test log

5/19/2017 10:23:13 AM -- Preparing for testing ...
5/19/2017 10:23:17 AM -- Attaching databases ...
5/19/2017 10:23:17 AM -- Preparations for testing are complete.
5/19/2017 10:23:17 AM -- Starting transaction dispatch ..
5/19/2017 10:23:17 AM -- Database cache settings: (minimum: 128.0 MB, maximum: 1.0 GB)
5/19/2017 10:23:17 AM -- Database flush thresholds: (start: 10.2 MB, stop: 20.5 MB)
5/19/2017 10:23:23 AM -- Database read latency thresholds: (average: 20 msec/read, maximum: 100 msec/read).
5/19/2017 10:23:23 AM -- Log write latency thresholds: (average: 10 msec/write, maximum: 100 msec/write).
5/19/2017 10:23:24 AM -- Operation mix: Sessions 7, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
5/19/2017 10:23:24 AM -- Performance logging started (interval: 15000 ms).
5/19/2017 10:23:24 AM -- Attaining prerequisites:
5/19/2017 10:28:51 AM -- \MSExchange Database(JetstressWin)\Database Cache Size, Last: 969932800.0 (lower bound: 966367600.0, upper bound: none)
5/19/2017 12:28:51 PM -- Performance logging has ended.
5/19/2017 12:31:02 PM -- JetInterop batch transaction stats: 14474, 14473, 14473 and 14473.
5/19/2017 12:31:02 PM -- Dispatching transactions ends.
5/19/2017 12:31:03 PM -- Shutting down databases ...
5/19/2017 12:31:06 PM -- Instance1684.1 (complete), Instance1684.2 (complete), Instance1684.3 (complete) and Instance1684.4 (complete)
5/19/2017 12:31:06 PM -- C:\Program Files\Exchange Jetstress\Performance_2017_5_19_10_23_23.blg has 500 samples.
5/19/2017 12:31:06 PM -- Creating test report ...
5/19/2017 12:31:09 PM -- Instance1684.1 has 18.7 for I/O Database Reads Average Latency.
5/19/2017 12:31:09 PM -- Instance1684.1 has 0.7 for I/O Log Writes Average Latency.
5/19/2017 12:31:09 PM -- Instance1684.1 has 0.7 for I/O Log Reads Average Latency.
5/19/2017 12:31:09 PM -- Instance1684.2 has 16.2 for I/O Database Reads Average Latency.
5/19/2017 12:31:09 PM -- Instance1684.2 has 0.7 for I/O Log Writes Average Latency.
5/19/2017 12:31:09 PM -- Instance1684.2 has 0.7 for I/O Log Reads Average Latency.
5/19/2017 12:31:09 PM -- Instance1684.3 has 18.3 for I/O Database Reads Average Latency.
5/19/2017 12:31:09 PM -- Instance1684.3 has 0.7 for I/O Log Writes Average Latency.
5/19/2017 12:31:09 PM -- Instance1684.3 has 0.7 for I/O Log Reads Average Latency.
5/19/2017 12:31:09 PM -- Instance1684.4 has 16.2 for I/O Database Reads Average Latency.
5/19/2017 12:31:09 PM -- Instance1684.4 has 0.7 for I/O Log Writes Average Latency.
5/19/2017 12:31:09 PM -- Instance1684.4 has 0.7 for I/O Log Reads Average Latency.
5/19/2017 12:31:09 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.
5/19/2017 12:31:09 PM -- The test has 0 Database Page Fault Stalls/sec samples higher than 0.
5/19/2017 12:31:09 PM -- C:\Program Files\Exchange Jetstress\Performance_2017_5_19_10_23_23.xml has 478 samples queried.

A.3 Server 3

A.3.1 Test results

Table 27 Test summary

Parameter	Detail
Overall Test Result	**Pass**
Machine Name	EX1
Test Description	Run Database Maintenance: True Performance Mailbox Profile: mailbox count 2250, mailbox quota 1024, mailbox Iops 0.1 Suppress tuning: True ThreadCount: 6 Output path: C:\Program Files\Exchange Jetstress Database source: AttachExistingDatabases Number of copies per database: 2
Test Start Time	5/19/2017 10:23:03 AM
Test End Time	5/19/2017 12:30:58 PM
Collection Start Time	5/19/2017 10:29:11 AM
Collection End Time	5/19/2017 12:29:02 PM
Jetstress Version	15.01.0466.031
ESE Version	15.01.0669.032
Operating System	Windows Server 2016 Datacenter (6.2.9200.0)
Performance Log	C:\Program Files\Exchange Jetstress\Performance_2017_5_19_10_23_13.blg

Table 28 Database sizing and throughput

Performance counter	Value
Achieved Transactional I/O per Second	234.036
Target Transactional I/O per Second	225
Initial Database Size (bytes)	2416942514176
Final Database Size (bytes)	2417663934464
Database Files (Count)	4

Table 29 Jetstress system parameters

Performance counter	Value
Thread Count	6
Minimum Database Cache	128.0 MB
Maximum Database Cache	1024.0 MB
Insert Operations	40%
Delete Operations	20%
Replace Operations	5%
Read Operations	35%
Lazy Commits	70%
Run Background Database Maintenance	True
Number of Copies per Database	2

Table 30 Database configuration

Performance counter	Value
Instance2112.1	Log path: C:\DB\DB1 Database: C:\DB\DB1\Jetstress001001.edb
Instance2112.2	Log path: C:\DB\DB2 Database: C:\DB\DB2\Jetstress002001.edb
Instance2112.3	Log path: C:\DB\DB3 Database: C:\DB\DB3\Jetstress003001.edb
Instance2112.4	Log path: C:\DB\DB4 Database: C:\DB\DB4\Jetstress004001.edb

Table 31 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
Instance2112.1	15.429	0.751	38.435	20.389	33124.042	36813.495	0.000	0.712	0.000	5.243	0.000	18976.111
Instance2112.2	15.585	0.756	38.110	20.312	33119.240	36813.371	0.000	0.714	0.000	5.184	0.000	19384.073
Instance2112.3	15.561	0.761	38.066	20.220	33094.284	36818.663	0.000	0.713	0.000	5.213	0.000	19240.223
Instance2112.4	16.769	0.772	38.208	20.297	33075.468	36851.988	0.000	0.712	0.000	5.218	0.000	19243.779

Table 32 Background database maintenance I/O performance

MSExchange Database ==> Instances	Database Maintenance IO Reads/sec	Database Maintenance IO Reads Average Bytes
Instance2112.1	9.138	261413.808
Instance2112.2	9.162	261459.142
Instance2112.3	9.161	261517.634
Instance2112.4	8.861	261440.170

Table 33 Log replication I/O performance

MSExchange Database ==> Instances	I/O Log Reads/sec	I/O Log Reads Average Bytes
Instance2112.1	0.425	166227.089
Instance2112.2	0.428	166298.675
Instance2112.3	0.428	166889.387
Instance2112.4	0.426	166275.511

Table 34 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
Instance2112.1	15.429	0.751	47.572	20.389	76973.740	36813.495	7.791	0.712	0.425	5.243	166227.089	18976.111
Instance2112.2	15.585	0.756	47.272	20.312	77376.187	36813.371	8.291	0.714	0.428	5.184	166298.675	19384.073
Instance2112.3	15.561	0.761	47.227	20.220	77403.126	36818.663	7.895	0.713	0.428	5.213	166889.387	19240.223
Instance2112.4	16.769	0.772	47.069	20.297	76066.788	36851.988	8.370	0.712	0.426	5.218	166275.511	19243.779

Table 35 Table 1 Host system performance

Counter	Average	Minimum	Maximum
% Processor Time	0.290	0.064	2.114
Available MBytes	126991.754	126956.000	127068.000
Free System Page Table Entries	12297647.591	12296972.000	12298080.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	118060068.342	117760000.000	122155008.000
Pool Paged Bytes	235567347.708	235331584.000	240881664.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

A.3.2 Test log

5/19/2017 10:23:03 AM -- Preparing for testing ...
5/19/2017 10:23:09 AM -- Attaching databases ...
5/19/2017 10:23:09 AM -- Preparations for testing are complete.
5/19/2017 10:23:09 AM -- Starting transaction dispatch ..
5/19/2017 10:23:09 AM -- Database cache settings: (minimum: 128.0 MB, maximum: 1.0 GB)
5/19/2017 10:23:09 AM -- Database flush thresholds: (start: 10.2 MB, stop: 20.5 MB)
5/19/2017 10:23:13 AM -- Database read latency thresholds: (average: 20 msec/read, maximum: 100 msec/read).
5/19/2017 10:23:13 AM -- Log write latency thresholds: (average: 10 msec/write, maximum: 100 msec/write).
5/19/2017 10:23:15 AM -- Operation mix: Sessions 6, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
5/19/2017 10:23:15 AM -- Performance logging started (interval: 15000 ms).
5/19/2017 10:23:15 AM -- Attaining prerequisites:
5/19/2017 10:29:11 AM -- \MSExchange Database(JetstressWin)\Database Cache Size, Last: 966750200.0 (lower bound: 966367600.0, upper bound: none)
5/19/2017 12:29:12 PM -- Performance logging has ended.
5/19/2017 12:30:53 PM -- JetInterop batch transaction stats: 12986, 12986, 12986 and 12986.
5/19/2017 12:30:53 PM -- Dispatching transactions ends.
5/19/2017 12:30:53 PM -- Shutting down databases ...
5/19/2017 12:30:58 PM -- Instance2112.1 (complete), Instance2112.2 (complete), Instance2112.3 (complete) and Instance2112.4 (complete)
5/19/2017 12:30:58 PM -- C:\Program Files\Exchange Jetstress\Performance_2017_5_19_10_23_13.blg has 502 samples.
5/19/2017 12:30:58 PM -- Creating test report ...
5/19/2017 12:31:01 PM -- Instance2112.1 has 15.4 for I/O Database Reads Average Latency.
5/19/2017 12:31:01 PM -- Instance2112.1 has 0.7 for I/O Log Writes Average Latency.
5/19/2017 12:31:01 PM -- Instance2112.1 has 0.7 for I/O Log Reads Average Latency.
5/19/2017 12:31:01 PM -- Instance2112.2 has 15.6 for I/O Database Reads Average Latency.
5/19/2017 12:31:01 PM -- Instance2112.2 has 0.7 for I/O Log Writes Average Latency.
5/19/2017 12:31:01 PM -- Instance2112.2 has 0.7 for I/O Log Reads Average Latency.
5/19/2017 12:31:01 PM -- Instance2112.3 has 15.6 for I/O Database Reads Average Latency.
5/19/2017 12:31:01 PM -- Instance2112.3 has 0.7 for I/O Log Writes Average Latency.
5/19/2017 12:31:01 PM -- Instance2112.3 has 0.7 for I/O Log Reads Average Latency.
5/19/2017 12:31:01 PM -- Instance2112.4 has 16.8 for I/O Database Reads Average Latency.
5/19/2017 12:31:01 PM -- Instance2112.4 has 0.7 for I/O Log Writes Average Latency.
5/19/2017 12:31:01 PM -- Instance2112.4 has 0.7 for I/O Log Reads Average Latency.
5/19/2017 12:31:01 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.
5/19/2017 12:31:01 PM -- The test has 0 Database Page Fault Stalls/sec samples higher than 0.
5/19/2017 12:31:01 PM -- C:\Program Files\Exchange Jetstress\Performance_2017_5_19_10_23_13.xml has 478 samples queried.

A.4 Server 4

A.4.1 Test results

Table 36 Test summary

Parameter	Detail
Overall Test Result	**Pass**
Machine Name	EX2
Test Description	Run Database Maintenance: True Performance Mailbox Profile: mailbox count 2250, mailbox quota 1024, mailbox Iops 0.1 Suppress tuning: True ThreadCount: 6 Output path: C:\Program Files\Exchange Jetstress Database source: AttachExistingDatabases Number of copies per database: 2
Test Start Time	5/19/2017 10:23:07 AM
Test End Time	5/19/2017 12:31:00 PM
Collection Start Time	5/19/2017 10:29:15 AM
Collection End Time	5/19/2017 12:29:04 PM
Jetstress Version	15.01.0466.031
ESE Version	15.01.0669.032
Operating System	Windows Server 2016 Datacenter (6.2.9200.0)
Performance Log	C:\Program Files\Exchange Jetstress\Performance_2017_5_19_10_23_16.blg

Table 37 Database sizing and throughput

Performance counter	Value
Achieved Transactional I/O per Second	234.368
Target Transactional I/O per Second	225
Initial Database Size (bytes)	2416934125568
Final Database Size (bytes)	2417663934464
Database Files (Count)	4

Table 38 Jetstress system parameters

Performance counter	Value
Thread Count	6
Minimum Database Cache	128.0 MB
Maximum Database Cache	1024.0 MB
Insert Operations	40%
Delete Operations	20%
Replace Operations	5%
Read Operations	35%
Lazy Commits	70%
Run Background Database Maintenance	True
Number of Copies per Database	2

Table 39 Database configuration

Performance counter	Value
Instance5272.1	Log path: C:\DB\DB5 Database: C:\DB\DB5\Jetstress001001.edb
Instance5272.2	Log path: C:\DB\DB6 Database: C:\DB\DB6\Jetstress002001.edb
Instance5272.3	Log path: C:\DB\DB7 Database: C:\DB\DB7\Jetstress003001.edb
Instance5272.4	Log path: C:\DB\DB8 Database: C:\DB\DB8\Jetstress004001.edb

Table 40 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
Instance5272.1	15.347	0.755	38.280	20.434	33107.274	36938.931	0.000	0.712	0.000	5.279	0.000	19324.718
Instance5272.2	15.669	0.760	38.442	20.296	33080.918	36869.036	0.000	0.712	0.000	5.180	0.000	19281.011
Instance5272.3	15.547	0.768	38.196	20.422	33119.532	36900.954	0.000	0.711	0.000	5.274	0.000	19352.989
Instance5272.4	16.365	0.773	38.125	20.173	33065.466	36929.261	0.000	0.712	0.000	5.232	0.000	19389.380

Table 41 Background database maintenance I/O performance

MSExchange Database ==> Instances	Database Maintenance IO Reads/sec	Database Maintenance IO Reads Average Bytes
Instance5272.1	9.144	261509.914
Instance5272.2	9.141	261584.943
Instance5272.3	9.165	261356.645
Instance5272.4	8.954	261492.358

Table 42 Log replication I/O performance

MSExchange Database ==> Instances	I/O Log Reads/sec	I/O Log Reads Average Bytes
Instance5272.1	0.435	169366.458
Instance5272.2	0.426	165361.480
Instance5272.3	0.436	169740.258
Instance5272.4	0.432	167853.166

Table 43 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
Instance5272.1	15.347	0.755	47.424	20.434	77147.450	36938.931	8.482	0.712	0.435	5.279	169366.458	19324.718
Instance5272.2	15.669	0.760	47.583	20.296	76977.513	36869.036	8.118	0.712	0.426	5.180	165361.480	19281.011
Instance5272.3	15.547	0.768	47.361	20.422	77288.557	36900.954	8.055	0.711	0.436	5.274	169740.258	19352.989
Instance5272.4	16.365	0.773	47.079	20.173	76511.065	36929.261	8.231	0.712	0.432	5.232	167853.166	19389.380

Table 44 Host system performance

Counter	Average	Minimum	Maximum
% Processor Time	0.281	0.056	0.516
Available MBytes	126803.430	126796.000	126886.000
Free System Page Table Entries	12297484.081	12296889.000	12297755.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	143721559.649	143646720.000	143859712.000
Pool Paged Bytes	319583926.781	319569920.000	319598592.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

A.4.2 Test log

5/19/2017 10:23:07 AM -- Preparing for testing ...
5/19/2017 10:23:11 AM -- Attaching databases ...
5/19/2017 10:23:11 AM -- Preparations for testing are complete.
5/19/2017 10:23:11 AM -- Starting transaction dispatch ..
5/19/2017 10:23:11 AM -- Database cache settings: (minimum: 128.0 MB, maximum: 1.0 GB)
5/19/2017 10:23:11 AM -- Database flush thresholds: (start: 10.2 MB, stop: 20.5 MB)
5/19/2017 10:23:16 AM -- Database read latency thresholds: (average: 20 msec/read, maximum: 100 msec/read).
5/19/2017 10:23:16 AM -- Log write latency thresholds: (average: 10 msec/write, maximum: 100 msec/write).
5/19/2017 10:23:18 AM -- Operation mix: Sessions 6, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
5/19/2017 10:23:18 AM -- Performance logging started (interval: 15000 ms).
5/19/2017 10:23:18 AM -- Attaining prerequisites:
5/19/2017 10:29:15 AM -- \MSExchange Database(JetstressWin)\Database Cache Size, Last: 966451200.0 (lower bound: 966367600.0, upper bound: none)
5/19/2017 12:29:16 PM -- Performance logging has ended.
5/19/2017 12:30:56 PM -- JetInterop batch transaction stats: 13087, 13087, 13086 and 13086.
5/19/2017 12:30:56 PM -- Dispatching transactions ends.
5/19/2017 12:30:58 PM -- Shutting down databases ...
5/19/2017 12:31:00 PM -- Instance5272.1 (complete), Instance5272.2 (complete), Instance5272.3 (complete) and Instance5272.4 (complete)
5/19/2017 12:31:00 PM -- C:\Program Files\Exchange Jetstress\Performance_2017_5_19_10_23_16.blg has 502 samples.
5/19/2017 12:31:01 PM -- Creating test report ...
5/19/2017 12:31:04 PM -- Instance5272.1 has 15.3 for I/O Database Reads Average Latency.
5/19/2017 12:31:04 PM -- Instance5272.1 has 0.7 for I/O Log Writes Average Latency.
5/19/2017 12:31:04 PM -- Instance5272.1 has 0.7 for I/O Log Reads Average Latency.
5/19/2017 12:31:04 PM -- Instance5272.2 has 15.7 for I/O Database Reads Average Latency.
5/19/2017 12:31:04 PM -- Instance5272.2 has 0.7 for I/O Log Writes Average Latency.
5/19/2017 12:31:04 PM -- Instance5272.2 has 0.7 for I/O Log Reads Average Latency.
5/19/2017 12:31:04 PM -- Instance5272.3 has 15.5 for I/O Database Reads Average Latency.
5/19/2017 12:31:04 PM -- Instance5272.3 has 0.7 for I/O Log Writes Average Latency.
5/19/2017 12:31:04 PM -- Instance5272.3 has 0.7 for I/O Log Reads Average Latency.
5/19/2017 12:31:04 PM -- Instance5272.4 has 16.4 for I/O Database Reads Average Latency.
5/19/2017 12:31:04 PM -- Instance5272.4 has 0.7 for I/O Log Writes Average Latency.
5/19/2017 12:31:04 PM -- Instance5272.4 has 0.7 for I/O Log Reads Average Latency.
5/19/2017 12:31:04 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.
5/19/2017 12:31:04 PM -- The test has 0 Database Page Fault Stalls/sec samples higher than 0.
5/19/2017 12:31:04 PM -- C:\Program Files\Exchange Jetstress\Performance_2017_5_19_10_23_16.xml has 478 samples queried.

B Technical support and resources

Dell.com/support is focused on meeting customer needs with proven services and support.

Dell TechCenter is an online technical community where IT professionals have access to numerous resources for Dell EMC software, hardware, and services.

Storage Solutions Technical Documents on Dell TechCenter provide expertise that helps to ensure customer success on Dell EMC storage platforms.

Related resources:

- Dell EMC SC Series SC5020 Storage Array specifications sheet
- Microsoft ESRP Program web site
- *Sizing and Best Practices for Deploying Microsoft Exchange Server 2013 with Dell SC Series Storage Arrays*