Dell EMC PowerVault ME4024 8,000 Mailbox Exchange 2016 Resiliency Storage Solution using 10K drives

Microsoft ESRP 4.0

Abstract

This document describes the Dell EMC™ PowerVault™ ME4024 solution for Microsoft® Exchange Server, based on the Microsoft Exchange Solution Reviewed Program (ESRP) – Storage program, with 8,000 mailboxes in two ME4024 arrays containing 10K 1.2 TB drives.

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1 Introduction

This document describes the Dell EMC™ PowerVault™ ME4024 solution for Microsoft® Exchange Server, based on the Microsoft Exchange Solution Reviewed Program (ESRP) – Storage program.

This document details the performance characteristics of ME4024 arrays in a fully hardware-redundant configuration running Microsoft Exchange Server 2016. The solution includes 8,000 typical mailbox users running on two 2U ME4024 arrays with 24 10K (10,000 rpm) 1.2 TB hard drives. The results show the ME4024 provides more than enough I/O performance while keeping latencies low.

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

1.1 Simulated environment

The solution presented in this document is designed to simulate a moderate 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 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 ME4024 array. This is to simulate one half of the solution running the storage load in a failure scenario.

The number of users simulated was 8,000 concurrent users with 2,000 users per server. The mailbox size was 1 GB per user. Each server was configured with five databases, with one local copy simulating replication to a second copy. The scenario simulates a full-redundant solution from both a hardware and software perspective.

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

The testing environment consisted of one ME4024 array with redundant controllers, each with two 10Gb iSCSI ports. All ports on the ME4024 are active with Microsoft MPIO round-robin with ALUA, ensuring best-path access. The Ethernet switches were configured in redundant networks to provide network fault tolerance.

The storage utilized the internal 24-drive-bay enclosure on the ME4024. All drives used were 2.5-inch 10K rpm 12Gb SAS hard drives. For data protection, the drives were configured with ME4 Series ADAPT RAID technology. This provides fault tolerance with distributed sparing and the ability to expand the storage with zero downtime. Because this is a redundant solution, databases and logs are stored together on the same volumes.

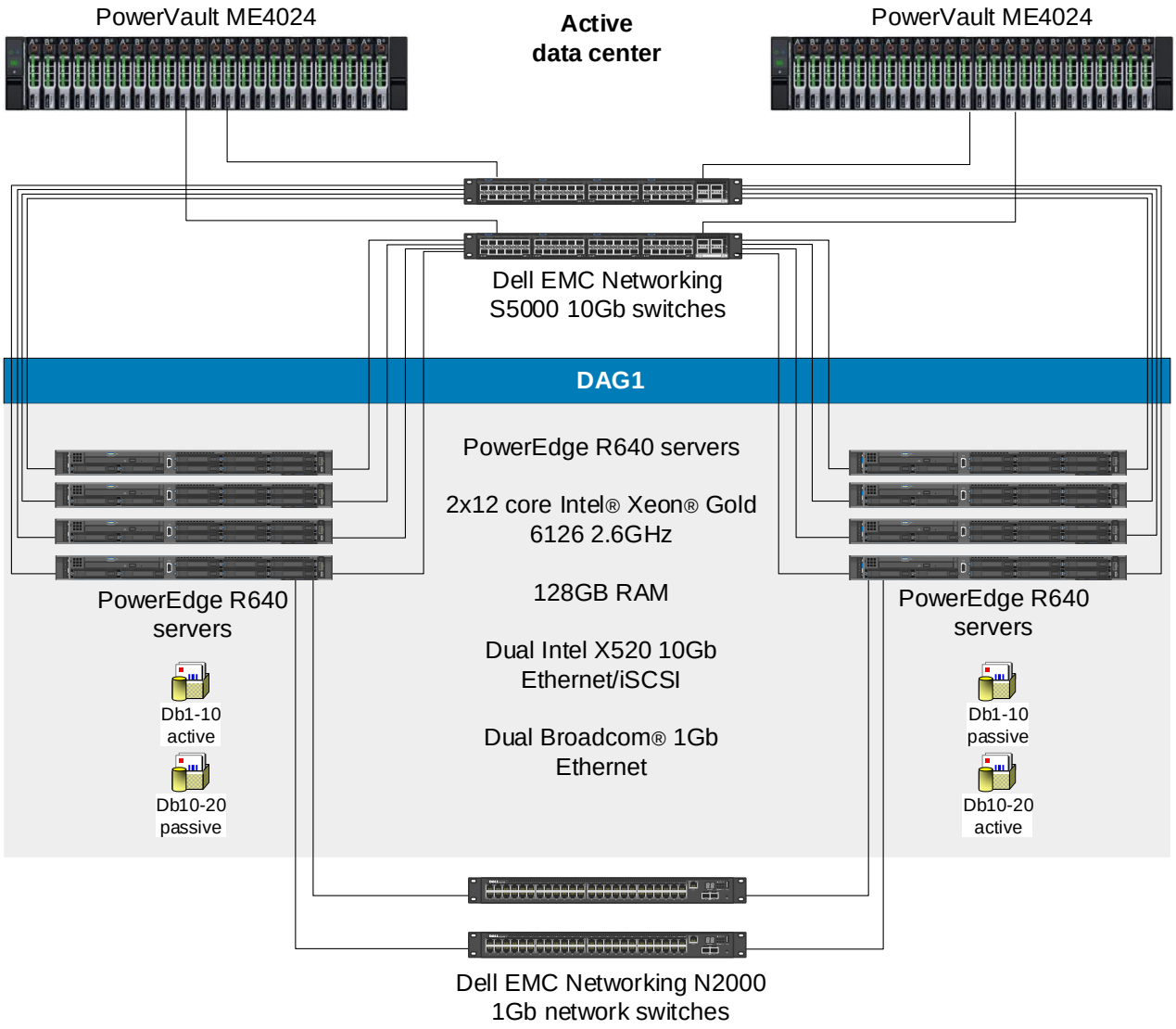

Figure 1 Highly available data center design

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. There are two networks for redundancy for both front-end and iSCSI traffic.

The tested portion of the solution was a single ME4024 array running a workload with 8,000 concurrent users. This demonstrates the ME4024 array can easily handle the full workload of all users in a failover scenario. In the normal state, half of the users access mailboxes from each array.

The testing shows that no users would be impacted in a failover scenario. This also allows maintenance for half of the environment without user impact.

2 PowerVault ME4024 solution overview

The PowerVault ME4 Series (including the ME4024 array) is next-generation, entry-level storage that is purpose-built and optimized for SAN and DAS virtualized workloads. Available in 2U or dense 5U base systems, the low-cost ME4 Series simplifies the challenges of server capacity expansion and small-scale SAN consolidation with up to 336 drives or 4 PB capacity. It also comes with all-inclusive software, incredible performance, and built-in simplicity with a new, web-based HTML5 management GUI, ME Storage Manager. Connecting ME4 Series storage to a Dell EMC PowerEdge™ server or to a SAN ensures that business applications will get high-speed and reliable access to their data — without compromise.

Product features include the following:

Simplicity: ME4 Series storage includes a web-based management GUI (HTML5), installs in 15 minutes, configures in 15 minutes, and easily deploys in 2U or 5U systems.

Performance: Compared to the predecessor MD3 Series, the ME4 Series packs a lot of power and scale with the Intel® Xeon® processor D-1500 product family. The ME4 Series processing power delivers incredible performance gains over the MD3 Series, as well as increased capacity, bandwidth, and drive count.

Connectivity: ME4 Series storage goes to the next level with robust and flexible connectivity starting with a 12Gb SAS back-end interface, and front-end interface options including four 16Gb FC ports per controller, four 10Gb iSCSI ports per controller (SFP+ or BaseT), or four 12Gb SAS ports per controller.

Scalability: Both 2U and 5U base systems are available, with the 2U system supporting either 12 or 24 drives and the 5U system supporting 84 drives. Each of the 2U (ME4012 and ME4024) and 5U (ME4084) base systems supports optional expansion enclosures of 12, 24, and 84 drives, allowing you to use up to 336 drives. Drive mixing is also allowed.

All-inclusive software: ME4 Series software provides volume copy, snapshots, IP/FC replication, VMware® VCenter Server® and VMware Site Recovery Manager™ integration, SSD read cache, thin provisioning, three-level tiering, ADAPT (distributed RAID), and controller-based encryption (SEDs) with internal key management.

Management: An integrated HTML5 web-based management interface (ME Storage Manager) is included.

For more information, see the ME4 Series product page.

3 Best practices overview

Use the following general steps to set up and configure an ME4024 system for Exchange Server:

1. Download and review the Exchange Mailbox role calculator, and determine the capacity and performance requirements.
2. Review the remaining sections of this document and apply the best practices that are applicable to your workload and environment. Exchange Server workloads tend to be predictable and consistent, so the solution can be planned and designed for growth.
3. Follow the deployment instructions for setting up an ME4 Series system found in the ME4 Series *Deployment Guide* on Dell.com/support.
4. Configure the ME4 Series system using the best practices document, Dell EMC PowerVault ME4 Series and Microsoft Exchange Server 2016, applying best practices for Microsoft Windows and Exchange Server as recommended by Dell EMC.

4 Volumes

All volumes were provisioned to 745 GB, with 340 GB free after database creation. This allows room for growth before additional capacity would need to be purchased.

Additional capacity can be added on demand, without downtime. The ADAPT RAID architecture allows RAID groups to be expanded without downtime. As the user count grows or mailbox sizes are increased, capacity can grow quickly and easily.

5 Tested deployment

The following tables summarize the testing environment.

5.1 Simulated Exchange configuration

Table 1 Simulated Exchange configuration

Configuration item	Value
Mailboxes simulated	8,000
DAGs	1
Servers per DAG	8
Active mailboxes per server	1,000
Databases per host	5
Copies per database	2
Mailboxes per database	200
Simulated profile (I/Os per second per mailbox)	.084 (.1 tested)
Database and log LUN size	838 GB
Total database size for testing	12.2 TB
% storage capacity used by Exchange database	81%

5.2 Primary storage hardware

Table 2 Primary storage hardware

Component	Description
Storage connectivity	iSCSI 10GbE
Storage model and OS or firmware revision	Dell EMC PowerVault ME4024 array
Number of storage controllers	2
Number of storage ports	2 active per controller
Maximum bandwidth of storage connectivity to host	40Gb/sec (20Gb/sec per controller)
Switch type, model, and firmware revision	Dell EMC Networking S5000; software version: 9.10(0.1P5)
HBA model and firmware	Intel® X520 Dual Port 10Gb
Number of HBAs per host	1 Intel X520
Host server type	Dell EMC PowerEdge R640, 2 x Intel Xeon 6126 Gold 12 core 2.6GHz, 128GB RAM
Total number of disks tested in solution	24
Maximum number of hard drives hosted in the storage array	336 drives using the 24 built-in bays plus external enclosures

5.3 Primary storage software

Table 3 Primary storage software

Configuration	Detail
HBA driver	Intel Ethernet 10G 2P X520, driver version: 3.12.11.1
Multipathing	Microsoft Windows Server 2016 R2 MPIO Round-Robin (in-box DSM)
Host OS	Microsoft Windows Server 2016, Datacenter Edition with desktop
ESE.dll file version	15.01.1034.026
Replication solution name and version	Microsoft Exchange Server 2016 DAG replication

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

Table 1 Primary storage disk configuration

Configuration	Detail
Disk type, speed, and firmware revision	SAS 10K 1.2 TB
Number of physical disks in test	20 (+4 hot spares, 2-pool storage pool) = 24 drives
Total raw storage capacity (GB)	28.8 TB
RAID level	ADAPT RAID, N+2
Total formatted capacity	17.8 TB
Storage capacity utilization	81%
Total database size used for testing	12TB

6 Test results summary

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

6.1 Reliability

Several reliability tests were run for 24 hours to verify the storage can handle a 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:

- 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 the backup or restore processes.

6.1 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 following data is the sum of all logical disk I/Os and average of all the logical disk I/O latency in the two-hour test duration. The test results for each server are listed in appendix A.

Table 5 Summary of test results

Database I/O	**Value**
Database Disks Transfers/sec	890
Database Disks Reads/sec	586.687
Database Disks Writes/sec	303.509
Average Database Disk Read Latency (ms)	13.585
Average Database Disk Write Latency (ms)	4.433
Transaction Log I/O	**Value**
Log Disks Writes/sec	72.111
Average Log Disk Write Latency (ms)	3.198

6.2 Database backup and recovery performance

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

6.2.1 Database read-only performance

The test measures the maximum rate at which databases could be backed up using Volume Shadow Copy Services (VSS). Table 6 shows the average rate for a single database file and the total per server.

Table 6 Database read-only performance

Performance item	Detail
MB read/sec per database	65.68
MB read/sec total per server	328.413

6.2.2 Transaction log recovery/snapshot performance

This test measures the maximum rate at which the log files can be played against the databases. Table 7 shows the average rate for 500 log files played in a single database. Each log file is 1 MB in size.

Table 7 Transaction log recovery/snapshot performance

Performance item	Detail
Average time to play one Log file (sec)	2.167

7 Conclusion

The testing described in this document shows the scalability and performance of the ME4024 array.

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

This appendix shows the detailed Jetstress results of the concurrent two-hour performance on all servers in the test study.

A.1 Server 1

A.1.1 Test results

Table 8 Test summary

Parameter	Detail
Overall Test Result	Pass
Machine Name	JS1
Test Description	.1 iops 1.5GB mailbox 5 dbs/host 4 hosts 5 threads
Test Start Time	10/5/2018 6:54:15 AM
Test End Time	10/6/2018 8:27:27 AM
Collection Start Time	10/5/2018 7:02:15 AM
Collection End Time	10/6/2018 7:02:13 AM
Jetstress Version	15.01.1019.000
ESE Version	15.01.1034.026
Operating System	Windows Server 2016 Datacenter (6.2.9200.0)
Performance Log	C:\Jetstress\results\Stress_2018_10_5_6_54_27.blg

Table 9 Database sizing and throughput

Performance counter	Value
Achieved Transactional I/O per Second	220.546
Target Transactional I/O per Second	200
Initial Database Size (bytes)	3221225472000
Final Database Size (bytes)	3229043654656
Database Files (Count)	5

Table 10 Jetstress system parameters

Performance counter	Value
Thread Count	5
Minimum Database Cache	160.0 MB
Maximum Database Cache	1280.0 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 11 Database configuration

Performance counter	Value
Instance7460.1	Log path: C:\EX16\db1\logs Database: C:\EX16\db1\db\Jetstress001001.edb
Instance7460.2	Log path: C:\EX16\db2\logs Database: C:\EX16\db2\db\Jetstress002001.edb
Instance7460.3	Log path: C:\EX16\db3\logs Database: C:\EX16\db3\db\Jetstress003001.edb
Instance7460.4	Log path: C:\EX16\db4\logs Database: C:\EX16\db4\db\Jetstress004001.edb
Instance7460.5	Log path: C:\EX16\db5\logs Database: C:\EX16\db5\db\Jetstress005001.edb

Table 12 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
Instance7460.1	14.154	4.803	29.078	14.971	34199.184	36265.267	0.000	3.650	0.000	3.756	0.000	19434.861
Instance7460.2	13.854	4.013	29.095	15.012	34222.786	36260.618	0.000	2.858	0.000	3.766	0.000	19487.399
Instance7460.3	13.287	4.896	29.080	14.945	34213.241	36271.412	0.000	3.332	0.000	3.756	0.000	19518.317
Instance7460.4	13.883	3.991	29.124	15.062	34220.526	36273.539	0.000	3.207	0.000	3.763	0.000	19446.368
Instance7460.5	13.394	4.943	29.112	15.066	34215.348	36253.272	0.000	3.330	0.000	3.774	0.000	19505.952

Table 13 Background database maintenance I/O performance

MSExchange Database ==> Instances	Database Maintenance I/O Reads/sec	Database Maintenance I/O Reads Average Bytes
Instance7460.1	9.013	261457.261
Instance7460.2	9.034	261452.446
Instance7460.3	9.013	261401.168
Instance7460.4	9.037	261440.480
Instance7460.5	9.011	261442.736

Table 14 Log replication I/O performance

MSExchange Database ==> Instances	I/O Log Reads/sec	I/O Log Reads Average Bytes
Instance7460.1	0.310	120555.495
Instance7460.2	0.311	121094.604
Instance7460.3	0.310	120434.885
Instance7460.4	0.311	120770.984
Instance7460.5	0.312	121367.717

Table 15 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
Instance7460.1	14.154	4.803	38.091	14.971	87970.877	36265.267	1.373	3.650	0.310	3.756	120555.495	19434.861
Instance7460.2	13.854	4.013	38.128	15.012	88058.753	36260.618	1.295	2.858	0.311	3.766	121094.604	19487.399
Instance7460.3	13.287	4.896	38.093	14.945	87966.661	36271.412	1.335	3.332	0.310	3.756	120434.885	19518.317
Instance7460.4	13.883	3.991	38.161	15.062	88027.754	36273.539	1.276	3.207	0.311	3.763	120770.984	19446.368
Instance7460.5	13.394	4.943	38.124	15.066	87925.389	36253.272	1.407	3.330	0.312	3.774	121367.717	19505.952

Table 16 Host system performance

Counter	Average	Minimum	Maximum
% Processor Time	0.191	0.000	1.373
Available MBytes	125989.227	125670.000	126179.000
Free System Page Table Entries	12288565.587	12287756.000	12288925.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	217972250.638	212570112.000	225284096.000
Pool Paged Bytes	321685111.648	319651840.000	328867840.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

A.1.2 Test log

10/5/2018 6:54:15 AM -- Preparing for testing ...
10/5/2018 6:54:21 AM -- Attaching databases ...
10/5/2018 6:54:21 AM -- Preparations for testing are complete.
10/5/2018 6:54:21 AM -- Starting transaction dispatch ..
10/5/2018 6:54:21 AM -- Database cache settings: (minimum: 160.0 MB, maximum: 1.2 GB)
10/5/2018 6:54:21 AM -- Database flush thresholds: (start: 12.8 MB, stop: 25.6 MB)
10/5/2018 6:54:27 AM -- Database read latency thresholds: (average: 20 msec/read, maximum: 200 msec/read).
10/5/2018 6:54:27 AM -- Log write latency thresholds: (average: 10 msec/write, maximum: 200 msec/write).
10/5/2018 6:54:28 AM -- Operation mix: Sessions 5, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
10/5/2018 6:54:28 AM -- Performance logging started (interval: 15000 ms).
10/5/2018 6:54:28 AM -- Attaining prerequisites:
10/5/2018 7:02:15 AM -- \MSExchange Database(JetstressWin)\Database Cache Size, Last: 1209266000.0 (lower bound: 1207960000.0, upper bound: none)
10/6/2018 7:02:16 AM -- Performance logging has ended.
10/6/2018 8:27:15 AM -- JetInterop batch transaction stats: 112642, 112642, 112641, 112641 and 112641.
10/6/2018 8:27:15 AM -- Dispatching transactions ends.
10/6/2018 8:27:16 AM -- Shutting down databases ...
10/6/2018 8:27:27 AM -- Instance7460.1 (complete), Instance7460.2 (complete), Instance7460.3 (complete), Instance7460.4 (complete) and Instance7460.5 (complete)
10/6/2018 8:27:27 AM -- C:\Jetstress\results\Stress_2018_10_5_6_54_27.blg has 5778 samples.
10/6/2018 8:27:27 AM -- Creating test report ...
10/6/2018 8:27:58 AM -- Instance7460.1 has 14.2 for I/O Database Reads Average Latency.
10/6/2018 8:27:58 AM -- Instance7460.1 has 3.6 for I/O Log Writes Average Latency.
10/6/2018 8:27:58 AM -- Instance7460.1 has 3.6 for I/O Log Reads Average Latency.
10/6/2018 8:27:58 AM -- Instance7460.2 has 13.9 for I/O Database Reads Average Latency.
10/6/2018 8:27:58 AM -- Instance7460.2 has 2.9 for I/O Log Writes Average Latency.
10/6/2018 8:27:58 AM -- Instance7460.2 has 2.9 for I/O Log Reads Average Latency.
10/6/2018 8:27:58 AM -- Instance7460.3 has 13.3 for I/O Database Reads Average Latency.
10/6/2018 8:27:58 AM -- Instance7460.3 has 3.3 for I/O Log Writes Average Latency.
10/6/2018 8:27:58 AM -- Instance7460.3 has 3.3 for I/O Log Reads Average Latency.
10/6/2018 8:27:58 AM -- Instance7460.4 has 13.9 for I/O Database Reads Average Latency.
10/6/2018 8:27:58 AM -- Instance7460.4 has 3.2 for I/O Log Writes Average Latency.
10/6/2018 8:27:58 AM -- Instance7460.4 has 3.2 for I/O Log Reads Average Latency.
10/6/2018 8:27:58 AM -- Instance7460.5 has 13.4 for I/O Database Reads Average Latency.
10/6/2018 8:27:58 AM -- Instance7460.5 has 3.3 for I/O Log Writes Average Latency.
10/6/2018 8:27:58 AM -- Instance7460.5 has 3.3 for I/O Log Reads Average Latency.
10/6/2018 8:27:58 AM -- Test has 0 Maximum Database Page Fault Stalls/sec.
10/6/2018 8:27:58 AM -- The test has 0 Database Page Fault Stalls/sec samples higher than 0.
10/6/2018 8:27:58 AM -- C:\Jetstress\results\Stress_2018_10_5_6_54_27.xml has 5746 samples queried.

A.2 Server 2

A.2.1 Test results

Table 17 Test summary

Parameter	Detail
Overall Test Result	Pass
Machine Name	JS2
Test Description	.1 iops 1.5GB mailbox 5 dbs/host 4 hosts 5 threads
Test Start Time	10/5/2018 6:54:18 AM
Test End Time	10/6/2018 8:27:12 AM
Collection Start Time	10/5/2018 7:02:04 AM
Collection End Time	10/6/2018 7:02:01 AM
Jetstress Version	15.01.1019.000
ESE Version	15.01.1034.026
Operating System	Windows Server 2016 Datacenter (6.2.9200.0)
Performance Log	C:\Jetstress\results\Stress_2018_10_5_6_54_30.blg

Table 18 Database sizing and throughput

Performance counter	Value
Achieved Transactional I/O per Second	220.634
Target Transactional I/O per Second	200
Initial Database Size (bytes)	3242566090752
Final Database Size (bytes)	3249939677184
Database Files (Count)	5

Table 19 Jetstress system parameters

Performance counter	Value
Thread Count	5
Minimum Database Cache	160.0 MB
Maximum Database Cache	1280.0 MB
Insert Operations	40%
Delete Operations	20%

Performance counter	Value
Replace Operations	5%
Read Operations	35%
Lazy Commits	70%
Run Background Database Maintenance	True
Number of Copies per Database	2

Table 20 Database configuration

Performance counter	Value
Instance5788.1	Log path: C:\EX16\db6\logs Database: C:\EX16\db6\db\Jetstress001001.edb
Instance5788.2	Log path: C:\EX16\db7\logs Database: C:\EX16\db7\db\Jetstress002001.edb
Instance5788.3	Log path: C:\EX16\db8\logs Database: C:\EX16\db8\db\Jetstress003001.edb
Instance5788.4	Log path: C:\EX16\db9\logs Database: C:\EX16\db9\db\Jetstress004001.edb
Instance5788.5	Log path: C:\EX16\db10\logs Database: C:\EX16\db10\db\Jetstress005001.edb

Table 21 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
Instance5788.1	14.521	5.030	29.097	15.042	34197.716	34746.046	0.000	3.225	0.000	3.510	0.000	19525.782
Instance5788.2	13.214	3.994	29.108	15.055	34249.718	34741.650	0.000	3.079	0.000	3.511	0.000	19535.549
Instance5788.3	13.706	5.161	29.085	15.021	34192.926	34731.823	0.000	3.340	0.000	3.505	0.000	19527.509
Instance5788.4	13.224	3.977	29.080	15.023	34266.404	34740.411	0.000	3.193	0.000	3.499	0.000	19568.697
Instance5788.5	13.868	5.197	29.085	15.038	34186.443	34742.778	0.000	3.521	0.000	3.509	0.000	19508.868

Table 22 Background database maintenance I/O performance

MSExchange Database ==> Instances	Database Maintenance I/O Reads/sec	Database Maintenance I/O Reads Average Bytes
Instance5788.1	9.011	261239.875
Instance5788.2	9.054	261207.540
Instance5788.3	9.010	261257.354
Instance5788.4	9.051	261247.733
Instance5788.5	9.010	261216.385

Table 23 Log replication I/O performance

MSExchange Database ==> Instances	I/O Log Reads/sec	I/O Log Reads Average Bytes
Instance5788.1	0.290	112937.588
Instance5788.2	0.290	112942.444
Instance5788.3	0.290	112647.390
Instance5788.4	0.290	112639.495
Instance5788.5	0.290	112899.140

Table 24 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
Instance5788.1	14.521	5.030	38.108	15.042	87883.716	34746.046	1.268	3.225	0.290	3.510	112937.588	19525.782
Instance5788.2	13.214	3.994	38.161	15.055	88094.046	34741.650	1.167	3.079	0.290	3.511	112942.444	19535.549
Instance5788.3	13.706	5.161	38.095	15.021	87898.400	34731.823	1.258	3.340	0.290	3.505	112647.390	19527.509
Instance5788.4	13.224	3.977	38.131	15.023	88142.129	34740.411	1.134	3.193	0.290	3.499	112639.495	19568.697
Instance5788.5	13.868	5.197	38.095	15.038	87880.471	34742.778	1.323	3.521	0.290	3.509	112899.140	19508.868

Table 25 Host system performance

Counter	Average	Minimum	Maximum
% Processor Time	0.206	0.000	1.231
Available MBytes	126037.714	125796.000	126235.000
Free System Page Table Entries	12289032.755	12287867.000	12289432.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	211079852.924	205623296.000	217882624.000
Pool Paged Bytes	311363652.065	308834304.000	318840832.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

A.2.2 Test log

10/5/2018 6:54:18 AM -- Preparing for testing ...
10/5/2018 6:54:24 AM -- Attaching databases ...
10/5/2018 6:54:24 AM -- Preparations for testing are complete.
10/5/2018 6:54:24 AM -- Starting transaction dispatch ..
10/5/2018 6:54:24 AM -- Database cache settings: (minimum: 160.0 MB, maximum: 1.2 GB)
10/5/2018 6:54:24 AM -- Database flush thresholds: (start: 12.8 MB, stop: 25.6 MB)
10/5/2018 6:54:30 AM -- Database read latency thresholds: (average: 20 msec/read, maximum: 200 msec/read).
10/5/2018 6:54:30 AM -- Log write latency thresholds: (average: 10 msec/write, maximum: 200 msec/write).
10/5/2018 6:54:31 AM -- Operation mix: Sessions 5, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
10/5/2018 6:54:31 AM -- Performance logging started (interval: 15000 ms).
10/5/2018 6:54:31 AM -- Attaining prerequisites:
10/5/2018 7:02:04 AM -- \MSExchange Database(JetstressWin)\Database Cache Size, Last: 1210458000.0 (lower bound: 1207960000.0, upper bound: none)
10/6/2018 7:02:05 AM -- Performance logging has ended.
10/6/2018 8:27:09 AM -- JetInterop batch transaction stats: 105336, 105336, 105336, 105336 and 105335.
10/6/2018 8:27:09 AM -- Dispatching transactions ends.
10/6/2018 8:27:09 AM -- Shutting down databases ...
10/6/2018 8:27:12 AM -- Instance5788.1 (complete), Instance5788.2 (complete), Instance5788.3 (complete), Instance5788.4 (complete) and Instance5788.5 (complete)
10/6/2018 8:27:12 AM -- C:\Jetstress\results\Stress_2018_10_5_6_54_30.blg has 5777 samples.
10/6/2018 8:27:12 AM -- Creating test report ...
10/6/2018 8:27:40 AM -- Instance5788.1 has 14.5 for I/O Database Reads Average Latency.
10/6/2018 8:27:40 AM -- Instance5788.1 has 3.2 for I/O Log Writes Average Latency.
10/6/2018 8:27:40 AM -- Instance5788.1 has 3.2 for I/O Log Reads Average Latency.
10/6/2018 8:27:40 AM -- Instance5788.2 has 13.2 for I/O Database Reads Average Latency.
10/6/2018 8:27:40 AM -- Instance5788.2 has 3.1 for I/O Log Writes Average Latency.
10/6/2018 8:27:40 AM -- Instance5788.2 has 3.1 for I/O Log Reads Average Latency.
10/6/2018 8:27:40 AM -- Instance5788.3 has 13.7 for I/O Database Reads Average Latency.
10/6/2018 8:27:40 AM -- Instance5788.3 has 3.3 for I/O Log Writes Average Latency.
10/6/2018 8:27:40 AM -- Instance5788.3 has 3.3 for I/O Log Reads Average Latency.
10/6/2018 8:27:40 AM -- Instance5788.4 has 13.2 for I/O Database Reads Average Latency.
10/6/2018 8:27:40 AM -- Instance5788.4 has 3.2 for I/O Log Writes Average Latency.
10/6/2018 8:27:40 AM -- Instance5788.4 has 3.2 for I/O Log Reads Average Latency.
10/6/2018 8:27:40 AM -- Instance5788.5 has 13.9 for I/O Database Reads Average Latency.
10/6/2018 8:27:40 AM -- Instance5788.5 has 3.5 for I/O Log Writes Average Latency.
10/6/2018 8:27:40 AM -- Instance5788.5 has 3.5 for I/O Log Reads Average Latency.
10/6/2018 8:27:40 AM -- Test has 0 Maximum Database Page Fault Stalls/sec.
10/6/2018 8:27:40 AM -- The test has 0 Database Page Fault Stalls/sec samples higher than 0.
10/6/2018 8:27:40 AM -- C:\Jetstress\results\Stress_2018_10_5_6_54_30.xml has 5746 samples queried.

A.3 Server 3

A.3.1 Test results

Table 26 Test summary

Parameter	Detail
Overall Test Result	Pass
Machine Name	JS3
Test Description	.1 iops 1.5GB mailbox 5 dbs/host 4 hosts 5 threads
Test Start Time	10/5/2018 6:54:21 AM
Test End Time	10/6/2018 8:27:05 AM
Collection Start Time	10/5/2018 7:02:05 AM
Collection End Time	10/6/2018 7:02:03 AM
Jetstress Version	15.01.1019.000
ESE Version	15.01.1034.026
Operating System	Windows Server 2016 Datacenter (6.2.9200.0)
Performance Log	C:\Jetstress\results\Stress_2018_10_5_6_54_32.blg

Table 27 Database sizing and throughput

Performance counter	Value
Achieved Transactional I/O per Second	222.232
Target Transactional I/O per Second	200
Initial Database Size (bytes)	3242851303424
Final Database Size (bytes)	3250291998720
Database Files (Count)	5

Table 28 Jetstress system parameters

Performance counter	Value
Thread Count	5
Minimum Database Cache	160.0 MB
Maximum Database Cache	1280.0 MB
Insert Operations	40%
Delete Operations	20%

Performance counter	Value
Replace Operations	5%
Read Operations	35%
Lazy Commits	70%
Run Background Database Maintenance	True
Number of Copies per Database	2

Table 29 Database configuration

Performance counter	Value
Instance2940.1	Log path: C:\EX16\db11\logs Database: C:\EX16\db11\db\Jetstress001001.edb
Instance2940.2	Log path: C:\EX16\db12\logs Database: C:\EX16\db12\db\Jetstress002001.edb
Instance2940.3	Log path: C:\EX16\db13\logs Database: C:\EX16\db13\db\Jetstress003001.edb
Instance2940.4	Log path: C:\EX16\db14\logs Database: C:\EX16\db14\db\Jetstress004001.edb
Instance2940.5	Log path: C:\EX16\db15\logs Database: C:\EX16\db15\db\Jetstress005001.edb

Table 30 Transactional I/O performance

MSExchange Database ==> Instances	I/O Database Reads Average Latency (msec)	I/O Database Writes Average Latency (msec)	I/O Database Reads/ sec	I/O Database Writes/ sec	I/O Database Reads Average Bytes	I/O Database Writes Average Bytes	I/O Log Reads Average Latency (msec)	I/O Log Writes Average Latency (msec)	I/O Log Reads/ sec	I/O Log Writes/ sec	I/O Log Reads Average Bytes	I/O Log Writes Average Bytes
Instance2940.1	14.132	4.923	29.293	15.189	34134.498	34728.837	0.000	3.061	0.000	3.548	0.000	19472.804
Instance2940.2	13.750	4.114	29.308	15.221	34180.239	34726.905	0.000	3.119	0.000	3.542	0.000	19551.661
Instance2940.3	13.202	5.055	29.267	15.128	34165.926	34731.454	0.000	3.165	0.000	3.530	0.000	19528.942
Instance2940.4	13.711	4.090	29.260	15.198	34203.498	34749.829	0.000	3.137	0.000	3.551	0.000	19537.630
Instance2940.5	13.271	5.102	29.230	15.137	34190.208	34761.768	0.000	3.537	0.000	3.529	0.000	19616.581

Table 31 Background database maintenance I/O performance

MSExchange Database ==> Instances	Database Maintenance I/O Reads/sec	Database Maintenance I/O Reads Average Bytes
Instance2940.1	9.018	261270.011
Instance2940.2	9.040	261258.245
Instance2940.3	9.019	261223.866
Instance2940.4	9.053	261229.175
Instance2940.5	9.017	261249.223

Table 32 Log replication I/O performance

MSExchange Database ==> Instances	I/O Log Reads/sec	I/O Log Reads Average Bytes
Instance2940.1	0.293	113824.820
Instance2940.2	0.293	113823.138
Instance2940.3	0.292	113480.496
Instance2940.4	0.294	114203.340
Instance2940.5	0.293	113979.451

Table 33 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
Instance2940.1	14.132	4.923	38.312	15.189	87600.633	34728.837	1.260	3.061	0.293	3.548	113824.820	19472.804
Instance2940.2	13.750	4.114	38.349	15.221	87710.878	34726.905	1.231	3.119	0.293	3.542	113823.138	19551.661
Instance2940.3	13.202	5.055	38.287	15.128	87653.516	34731.454	1.231	3.165	0.292	3.530	113480.496	19528.942
Instance2940.4	13.711	4.090	38.313	15.198	87849.783	34749.829	1.201	3.137	0.294	3.551	114203.340	19537.630
Instance2940.5	13.271	5.102	38.247	15.137	87723.349	34761.768	1.283	3.537	0.293	3.529	113979.451	19616.581

Table 34 Host system performance

Counter	Average	Minimum	Maximum
% Processor Time	0.206	0.010	1.337
Available MBytes	126031.403	125878.000	126235.000
Free System Page Table Entries	12289080.934	12288059.000	12289426.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	233156072.035	227475456.000	239955968.000
Pool Paged Bytes	313117082.883	312905728.000	318722048.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

A.3.2 Test log

10/5/2018 6:54:21 AM -- Preparing for testing ...
10/5/2018 6:54:26 AM -- Attaching databases ...
10/5/2018 6:54:26 AM -- Preparations for testing are complete.
10/5/2018 6:54:26 AM -- Starting transaction dispatch ..
10/5/2018 6:54:26 AM -- Database cache settings: (minimum: 160.0 MB, maximum: 1.2 GB)
10/5/2018 6:54:26 AM -- Database flush thresholds: (start: 12.8 MB, stop: 25.6 MB)
10/5/2018 6:54:32 AM -- Database read latency thresholds: (average: 20 msec/read, maximum: 200 msec/read).
10/5/2018 6:54:32 AM -- Log write latency thresholds: (average: 10 msec/write, maximum: 200 msec/write).
10/5/2018 6:54:33 AM -- Operation mix: Sessions 5, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
10/5/2018 6:54:33 AM -- Performance logging started (interval: 15000 ms).
10/5/2018 6:54:33 AM -- Attaining prerequisites:
10/5/2018 7:02:05 AM -- \MSExchange Database(JetstressWin)\Database Cache Size, Last: 1209827000.0 (lower bound: 1207960000.0, upper bound: none)
10/6/2018 7:02:06 AM -- Performance logging has ended.
10/6/2018 8:27:02 AM -- JetInterop batch transaction stats: 105950, 105950, 105950, 105949 and 105949.
10/6/2018 8:27:02 AM -- Dispatching transactions ends.
10/6/2018 8:27:03 AM -- Shutting down databases ...
10/6/2018 8:27:05 AM -- Instance2940.1 (complete), Instance2940.2 (complete), Instance2940.3 (complete), Instance2940.4 (complete) and Instance2940.5 (complete)
10/6/2018 8:27:05 AM -- C:\Jetstress\results\Stress_2018_10_5_6_54_32.blg has 5777 samples.
10/6/2018 8:27:05 AM -- Creating test report ...
10/6/2018 8:27:36 AM -- Instance2940.1 has 14.1 for I/O Database Reads Average Latency.
10/6/2018 8:27:36 AM -- Instance2940.1 has 3.1 for I/O Log Writes Average Latency.
10/6/2018 8:27:36 AM -- Instance2940.1 has 3.1 for I/O Log Reads Average Latency.
10/6/2018 8:27:36 AM -- Instance2940.2 has 13.8 for I/O Database Reads Average Latency.
10/6/2018 8:27:36 AM -- Instance2940.2 has 3.1 for I/O Log Writes Average Latency.
10/6/2018 8:27:36 AM -- Instance2940.2 has 3.1 for I/O Log Reads Average Latency.
10/6/2018 8:27:36 AM -- Instance2940.3 has 13.2 for I/O Database Reads Average Latency.
10/6/2018 8:27:36 AM -- Instance2940.3 has 3.2 for I/O Log Writes Average Latency.
10/6/2018 8:27:36 AM -- Instance2940.3 has 3.2 for I/O Log Reads Average Latency.
10/6/2018 8:27:36 AM -- Instance2940.4 has 13.7 for I/O Database Reads Average Latency.
10/6/2018 8:27:36 AM -- Instance2940.4 has 3.1 for I/O Log Writes Average Latency.
10/6/2018 8:27:36 AM -- Instance2940.4 has 3.1 for I/O Log Reads Average Latency.
10/6/2018 8:27:36 AM -- Instance2940.5 has 13.3 for I/O Database Reads Average Latency.
10/6/2018 8:27:36 AM -- Instance2940.5 has 3.5 for I/O Log Writes Average Latency.
10/6/2018 8:27:36 AM -- Instance2940.5 has 3.5 for I/O Log Reads Average Latency.
10/6/2018 8:27:36 AM -- Test has 0 Maximum Database Page Fault Stalls/sec.
10/6/2018 8:27:36 AM -- The test has 0 Database Page Fault Stalls/sec samples higher than 0.
10/6/2018 8:27:36 AM -- C:\Jetstress\results\Stress_2018_10_5_6_54_32.xml has 5746 samples queried.

A.4 Server 4

A.4.1 Test results

Table 35 Test summary

Parameter	Detail
Overall Test Result	Pass
Machine Name	JS4
Test Description	.1 iops 1.5GB mailbox 5 dbs/host 4 hosts 5 threads
Test Start Time	10/5/2018 6:54:24 AM
Test End Time	10/6/2018 8:26:57 AM
Collection Start Time	10/5/2018 7:01:54 AM
Collection End Time	10/6/2018 7:01:51 AM
Jetstress Version	15.01.1019.000
ESE Version	15.01.1034.026
Operating System	Windows Server 2016 Datacenter (6.2.9200.0)
Performance Log	C:\Jetstress\results\Stress_2018_10_5_6_54_35.blg

Table 36 Database sizing and throughput

Performance counter	Value
Achieved Transactional I/O per Second	226.786
Target Transactional I/O per Second	200
Initial Database Size (bytes)	3243069407232
Final Database Size (bytes)	3250686263296
Database Files (Count)	5

Table 37 Jetstress system parameters

Performance counter	Value
Thread Count	5
Minimum Database Cache	160.0 MB
Maximum Database Cache	1280.0 MB
Insert Operations	40%
Delete Operations	20%

Performance counter	Value
Replace Operations	5%
Read Operations	35%
Lazy Commits	70%
Run Background Database Maintenance	True
Number of Copies per Database	2

Table 38 Database configuration

Performance counter	Value
Instance6860.1	Log path: C:\EX16\db16\logs Database: C:\EX16\db16\db\Jetstress001001.edb
Instance6860.2	Log path: C:\EX16\db17\logs Database: C:\EX16\db17\db\Jetstress002001.edb
Instance6860.3	Log path: C:\EX16\db18\logs Database: C:\EX16\db18\db\Jetstress003001.edb
Instance6860.4	Log path: C:\EX16\db19\logs Database: C:\EX16\db19\db\Jetstress004001.edb
Instance6860.5	Log path: C:\EX16\db20\logs Database: C:\EX16\db20\db\Jetstress005001.edb

Table 39 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
Instance6860.1	14.514	4.884	29.893	15.484	34165.877	34736.947	0.000	3.149	0.000	3.615	0.000	19519.183
Instance6860.2	12.263	2.210	29.860	15.468	34346.075	34727.733	0.000	2.454	0.000	3.612	0.000	19551.992
Instance6860.3	13.705	5.012	29.905	15.498	34198.860	34717.038	0.000	3.549	0.000	3.614	0.000	19502.234
Instance6860.4	12.312	2.220	29.827	15.436	34347.722	34730.634	0.000	2.476	0.000	3.607	0.000	19533.779
Instance6860.5	13.741	5.052	29.900	15.515	34240.532	34738.750	0.000	3.577	0.000	3.614	0.000	19582.879

Table 40 Background database maintenance I/O performance

MSExchange Database ==> Instances	Database Maintenance I/O Reads/sec	Database Maintenance I/O Reads Average Bytes
Instance6860.1	9.010	261259.008
Instance6860.2	9.114	261222.866
Instance6860.3	9.011	261196.175
Instance6860.4	9.115	261260.466
Instance6860.5	9.010	261243.597

Table 41 Log replication I/O performance

MSExchange Database ==> Instances	I/O Log Reads/sec	I/O Log Reads Average Bytes
Instance6860.1	0.299	116123.438
Instance6860.2	0.298	116090.600
Instance6860.3	0.298	116004.223
Instance6860.4	0.299	116111.753
Instance6860.5	0.299	116368.759

Table 42 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
Instance6860.1	14.514	4.884	38.903	15.484	867680.108	34736.947	1.290	3.149	0.299	3.615	116123.438	19519.183
Instance6860.2	12.263	2.210	38.975	15.468	87402.470	34727.733	1.156	2.454	0.298	3.612	116090.600	19551.992
Instance6860.3	13.705	5.012	38.915	15.498	86759.835	34717.038	1.246	3.549	0.298	3.614	116004.223	19502.234
Instance6860.4	12.312	2.220	38.942	15.436	87457.675	34730.634	1.124	2.476	0.299	3.607	116111.753	19533.779
Instance6860.5	13.741	5.052	38.910	15.515	86804.043	34738.750	1.289	3.577	0.299	3.614	116368.759	19582.879

Table 43 Host system performance

Counter	Average	Minimum	Maximum
% Processor Time	0.197	0.000	1.374
Available MBytes	126422.903	126342.000	126580.000
Free System Page Table Entries	12289196.037	12288367.000	12289636.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	189654395.345	183762944.000	197025792.000
Pool Paged Bytes	247850936.372	245514240.000	253849600.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

A.4.2 Test log

10/5/2018 6:54:24 AM -- Preparing for testing ...
10/5/2018 6:54:29 AM -- Attaching databases ...
10/5/2018 6:54:29 AM -- Preparations for testing are complete.
10/5/2018 6:54:29 AM -- Starting transaction dispatch ..
10/5/2018 6:54:29 AM -- Database cache settings: (minimum: 160.0 MB, maximum: 1.2 GB)
10/5/2018 6:54:29 AM -- Database flush thresholds: (start: 12.8 MB, stop: 25.6 MB)
10/5/2018 6:54:35 AM -- Database read latency thresholds: (average: 20 msec/read, maximum: 200 msec/read).
10/5/2018 6:54:35 AM -- Log write latency thresholds: (average: 10 msec/write, maximum: 200 msec/write).
10/5/2018 6:54:36 AM -- Operation mix: Sessions 5, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.
10/5/2018 6:54:36 AM -- Performance logging started (interval: 15000 ms).
10/5/2018 6:54:36 AM -- Attaining prerequisites:
10/5/2018 7:01:54 AM -- \MSExchange Database(JetstressWin)\Database Cache Size, Last: 1210257000.0 (lower bound: 1207960000.0, upper bound: none)
10/6/2018 7:01:55 AM -- Performance logging has ended.
10/6/2018 8:26:55 AM -- JetInterop batch transaction stats: 108167, 108167, 108167, 108167 and 108167.
10/6/2018 8:26:55 AM -- Dispatching transactions ends.
10/6/2018 8:26:55 AM -- Shutting down databases ...
10/6/2018 8:26:57 AM -- Instance6860.1 (complete), Instance6860.2 (complete), Instance6860.3 (complete), Instance6860.4 (complete) and Instance6860.5 (complete)
10/6/2018 8:26:57 AM -- C:\Jetstress\results\Stress_2018_10_5_6_54_35.blg has 5776 samples.
10/6/2018 8:26:57 AM -- Creating test report ...
10/6/2018 8:27:26 AM -- Instance6860.1 has 14.5 for I/O Database Reads Average Latency.
10/6/2018 8:27:26 AM -- Instance6860.1 has 3.1 for I/O Log Writes Average Latency.
10/6/2018 8:27:26 AM -- Instance6860.1 has 3.1 for I/O Log Reads Average Latency.
10/6/2018 8:27:26 AM -- Instance6860.2 has 12.3 for I/O Database Reads Average Latency.
10/6/2018 8:27:26 AM -- Instance6860.2 has 2.5 for I/O Log Writes Average Latency.
10/6/2018 8:27:26 AM -- Instance6860.2 has 2.5 for I/O Log Reads Average Latency.
10/6/2018 8:27:26 AM -- Instance6860.3 has 13.7 for I/O Database Reads Average Latency.
10/6/2018 8:27:26 AM -- Instance6860.3 has 3.5 for I/O Log Writes Average Latency.
10/6/2018 8:27:26 AM -- Instance6860.3 has 3.5 for I/O Log Reads Average Latency.
10/6/2018 8:27:26 AM -- Instance6860.4 has 12.3 for I/O Database Reads Average Latency.
10/6/2018 8:27:26 AM -- Instance6860.4 has 2.5 for I/O Log Writes Average Latency.
10/6/2018 8:27:26 AM -- Instance6860.4 has 2.5 for I/O Log Reads Average Latency.
10/6/2018 8:27:26 AM -- Instance6860.5 has 13.7 for I/O Database Reads Average Latency.
10/6/2018 8:27:26 AM -- Instance6860.5 has 3.6 for I/O Log Writes Average Latency.
10/6/2018 8:27:26 AM -- Instance6860.5 has 3.6 for I/O Log Reads Average Latency.
10/6/2018 8:27:26 AM -- Test has 0 Maximum Database Page Fault Stalls/sec.
10/6/2018 8:27:26 AM -- The test has 0 Database Page Fault Stalls/sec samples higher than 0.
10/6/2018 8:27:26 AM -- C:\Jetstress\results\Stress_2018_10_5_6_54_35.xml has 5746 samples queried.

B Technical support and resources

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

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

B.1 Related resources

See the following referenced or related resources for more information:

- Microsoft ESRP Program
- Dell EMC PowerVault ME4 Series and Microsoft Exchange Server 2016