QNAP

Application Notes
January 2016

Using ES (Enterprising Storage) NAS for

Microsoft Exchange Server

History (Document history is QNAP internal, please remove it when converting formal pdf)

Date	Version	Author	Description
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Notices

This user manual provides detailed instructions of using the QNAP Enterprise Storage NAS. Please read carefully and start to enjoy the powerful functions of the Enterprise Storage NAS.

- The QNAP Enterprise Storage NAS is hereafter referred to as the ES NAS or the NAS.
- This manual provides the description of all the functions of the ES NAS. The product you purchased may not support certain functions dedicated to specific models.

Legal Notices

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Overview

This document provides solution with QNAP ES1640DC enterprise storage for Microsoft Exchange Server. We prepared Windows Server 2012 R2 virtual machine (VM) installed Exchange Server 2013 and test by Microsoft JetStress Utility to see IO performance.

Each Windows Server 2012 R2 VM has attached 4 iSCSI LUNs provided by QNAP ES1640DC to store databases and its' logs. In addition, each Exchange Server has been set up Multipath I/O (MPIO) to have failover and load balancing capability during the messaging operation.

Infrastructure Components
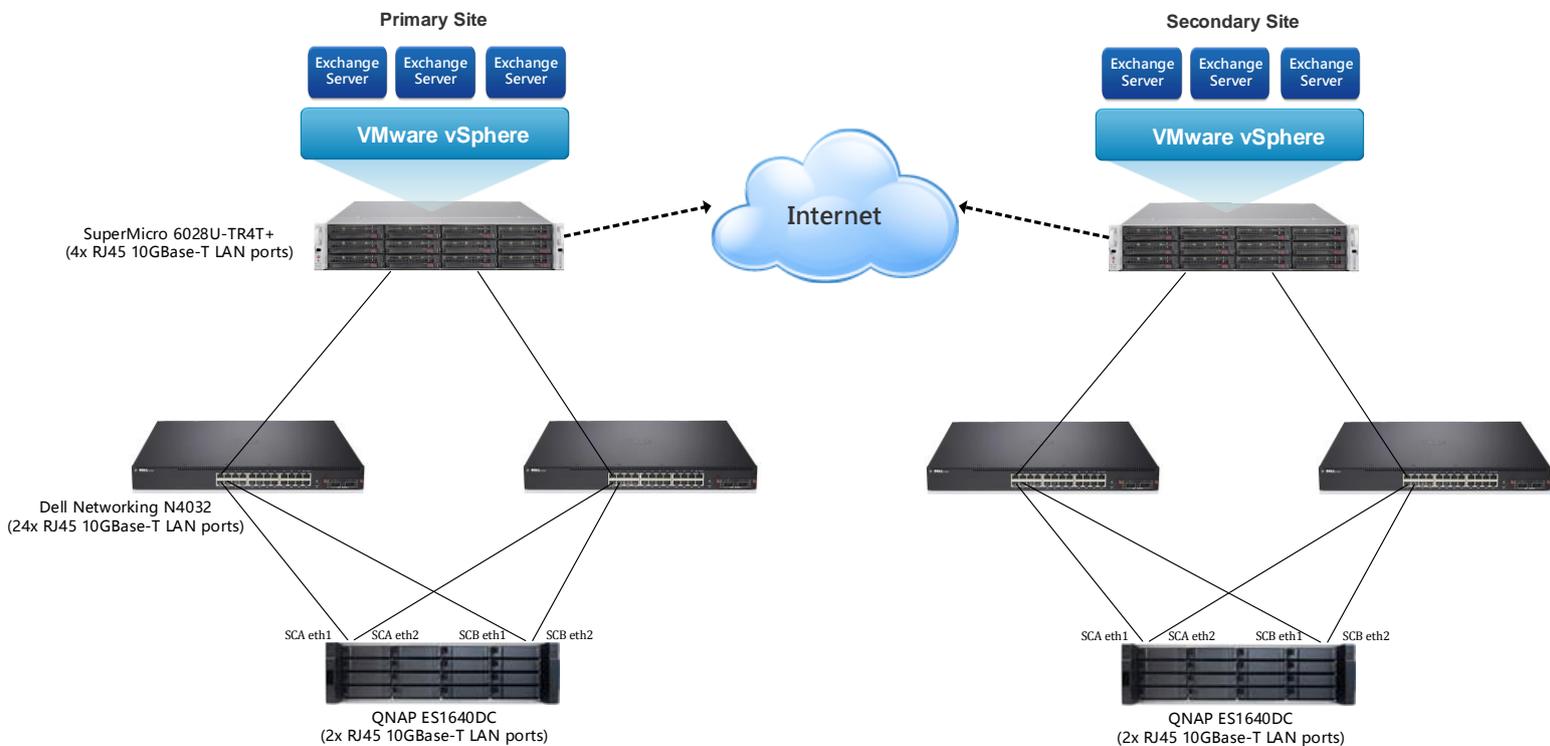
System Network Configuration

Primary Site Storage Network Settings		
Role	IP	Description
SCA Management	192.168.200.101	Management IP in SCB
SCA Ethernet 1	10.1.1.101	10GBase-T Lan port 1 in SCA
SCA Ethernet 2	10.1.2.101	10GBase-T Lan port 2 in SCA
SCB Management	192.168.200.102	Management IP in SCB
SCB Ethernet 1	10.1.1.102	10GBase-T Lan port 1 in SCB
SCB Ethernet 2	10.1.2.102	10GBase-T Lan port 2 in SCB
Primary Site ESXi Cluster Network Settings		
Role	IP	Description
ESXi 1 Management	192.168.200.1	Management IP in ESXi 1
ESXi 1 Ethernet1	10.1.1.11	10G Data port 1 in ESXi 1
ESXi 1 Ethernet2	10.1.2.11	10G Data port 2 in ESXi 1
ESXi 2 Management	192.168.200.2	Management IP in ESXi 2
ESXi 2 Ethernet1	10.1.1.12	10G Data port 1 in ESXi 2
ESXi 2 Ethernet2	10.1.2.12	10G Data port 2 in ESXi 2
Secondary Site Storage Network Settings		
Role	IP	Description
SCA Management	192.168.201.101	Management IP in SCB
SCA Ethernet 1	10.1.3.101	10GBase-T Lan port 1 in SCA
SCA Ethernet 2	10.1.4.101	10GBase-T Lan port 2 in SCA
SCB Management	192.168.201.102	Management IP in SCB
SCB Ethernet 1	10.1.3.102	10GBase-T Lan port 1 in SCB
SCB Ethernet 2	10.1.4.102	10GBase-T Lan port 2 in SCB
Secondary Site ESXi Cluster Network Settings		
Role	IP	Description
ESXi 1 Management	192.168.201.1	Management IP in ESXi 1
ESXi 1 Ethernet1	10.1.3.11	10G Data port 1 in ESXi 1
ESXi 1 Ethernet2	10.1.4.11	10G Data port 2 in ESXi 1
ESXi 2 Management	192.168.201.2	Management IP in ESXi 2
ESXi 2 Ethernet1	10.1.3.12	10G Data port 1 in ESXi 2
ESXi 2 Ethernet2	10.1.4.12	10G Data port 2 in ESXi 2

QNAP ES1640DC Storage Configuration

- 4*200GB 2.5" SAS SSD for Cache Acceleration
- 12*1TB SAS HDD with RAID1+0 pool
- Add 4*250GB iSCSI LUNs for database, 2*64GB iSCSI LUNs for database log and enabled SSD Cache for each LUN.
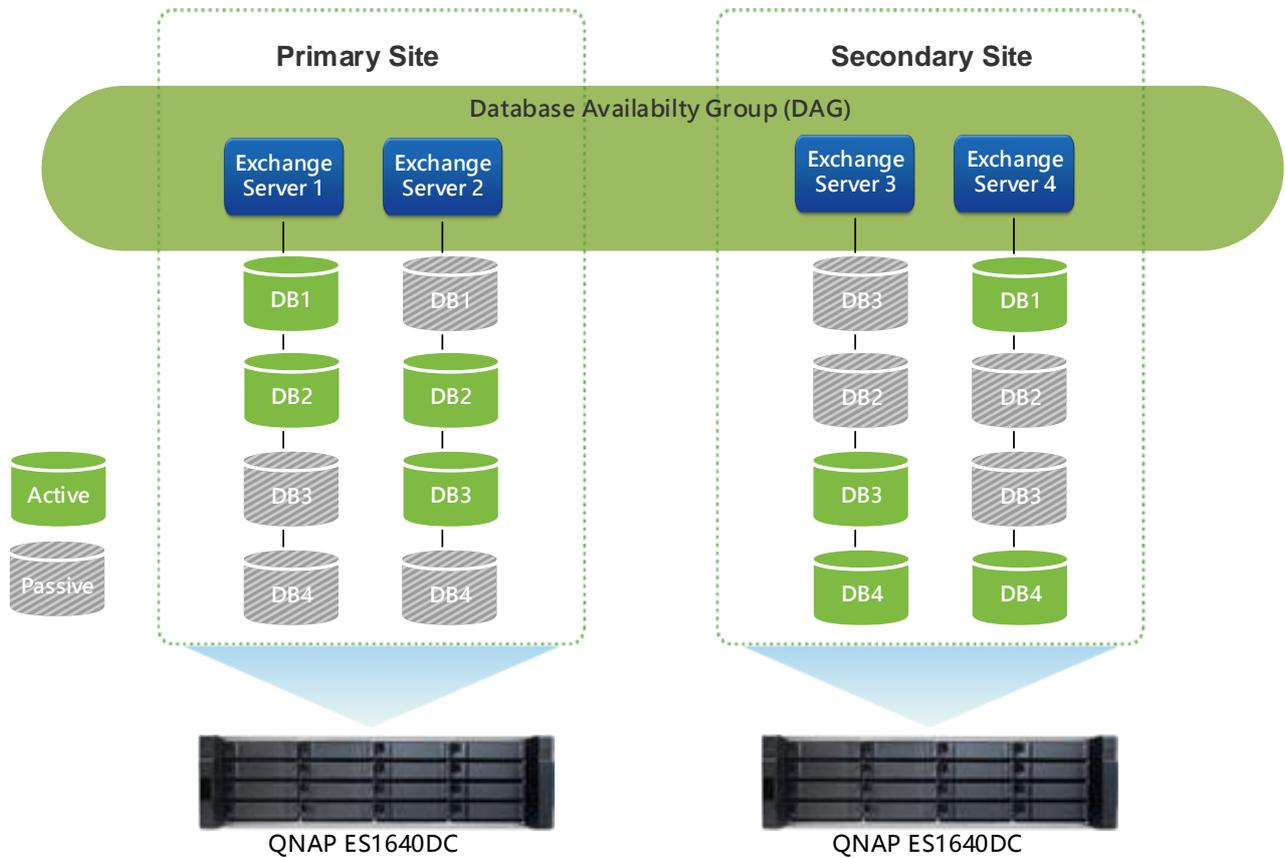
ESXi Server Configuration

- Supermicro SYS-6028U-TR4T+ with Intel® Xeon® Processor E5-2620v3 and 256GB RAM
- VMware vSphere 6.0 Update 1b (ESXi ISO Build 3380124)

Exchange Server Configuration

- Exchange 2013 drivers (ESE version 15.00.1130.002)
- Microsoft JetStress Utility (JetStress version 15.01.0318.000).
- 4*Windows 2012 R2 Virtual machines with 4 vCPU & 16 GB RAM
- Attached 4*250GB iSCSI drives for database, 2*64GB iSCSI drives for database log and formatted with 64KB allocation unit size each Exchange server node.
- Configure VM vNIC adapter to VMXNET 3 for optmimized network performance.

Solution description

Exchange Server Configuration

- Number of DAG : 1
- Number of Server per DAG : 4 (2 for primary site, 2 for secondary site)
- Number of Exchange mailboxes : 4,000 mailboxes (1,000 mailboxes per server)
- Estimated IOPS per mailbox : 0.168 (250 messages sent and received per mailbox per day)
- Size of each Mailbox : 2GB
- Number of database per Exchange server : 4 (2 active and 2 passive)
- Copies of mailbox per database : 2 (2 active and 2 passive)

> **Note:**
> The Technet Blog Exchange Sizing Guide provide the table to compute the required IOPS per mailbox user (0.168) for 250 messages sent or received per mailbox per day.

Test results summary

Storage performance results

The JetStress are run in parallel across 4 VMs with 4 databases each Exchange server.

After JetStress test finished, it shows that one of Exchange Server's Target transaction I/O per second is 168, and Achieved transaction I/O per second is about 232.

Conclusion

According to JetStress reports of all Exchange Server, the total Achieved transaction I/O per second in this DAG is above 1100 IOPS for serving 4000 mailbox users.

Appendix – Exchange-Server1 Performance Test Result Report

Test Summary

Overall Test Result	**Pass**
Machine Name	JETSTRESS-TEST01
Test Description	
Test Start Time	1/18/2016 9:58:08 AM
Test End Time	1/18/2016 12:11:09 PM
Collection Start Time	1/18/2016 10:11:17 AM
Collection End Time	1/18/2016 12:10:54 PM
Jetstress Version	15.01.0318.000
ESE Version	15.00.1130.002
Operating System	Windows Server 2012 R2 Standard (6.2.9200.0)
Performance Log	C:\JetStress_Report\HDD_RAID10_MP_1000_0.168_2GB(64k+SSD)\Tuning_2016_1_18_10_3_3.blg
	C:\JetStress_Report\HDD_RAID10_MP_1000_0.168_2GB(64k+SSD)\Performance_2016_1_18_10_11_1.blg

Database Sizing and Throughput

Achieved Transactional I/O per Second	232.184
Target Transactional I/O per Second	168
Initial Database Size (bytes)	2098108301312
Final Database Size (bytes)	2098880053248
Database Files (Count)	4

Jetstress System Parameters

Thread Count	5
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

Database Configuration

Instance900.1 Log path: H:\log1

            Database: D:\Jetstress001001.edb

Instance900.2 Log path: H:\log2

            Database: E:\Jetstress002001.edb

Instance900.3 Log path: I:\log3

            Database: F:\Jetstress003001.edb

Instance900.4 Log path: I:\log4

            Database: G:\Jetstress004001.edb

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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
Instance900.1	14.404	2.363	37.194	20.644	33346.816	36932.486	0.000	1.063	0.000	5.325	0.000	20625.184
Instance900.2	14.178	2.401	37.150	20.335	33388.017	36875.070	0.000	1.085	0.000	5.254	0.000	20607.456
Instance900.3	14.044	2.423	37.402	20.907	33347.365	36822.408	0.000	1.079	0.000	5.319	0.000	20732.541
Instance900.4	13.741	2.363	37.562	20.991	33315.952	36779.894	0.000	1.046	0.000	5.350	0.000	20513.353

Background Database Maintenance I/O Performance

MSExchange Database ==> Instances	Database Maintenance IO Reads/sec	Database Maintenance IO Reads Average Bytes
Instance900.1	8.993	261223.158
Instance900.2	8.990	261295.253
Instance900.3	8.997	261166.269
Instance900.4	9.000	261228.101

Log Replication I/O Performance

MSExchange Database ==> Instances	I/O Log Reads/sec	I/O Log Reads Average Bytes
Instance900.1	0.468	179529.908
Instance900.2	0.461	179571.373
Instance900.3	0.470	181962.563
Instance900.4	0.465	180502.970

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
Instance900.1	14.404	2.363	46.187	20.644	77717.222	36932.486	2.539	1.063	0.468	5.325	179529.908	20625.1
Instance900.2	14.178	2.401	46.141	20.335	77794.607	36875.070	2.883	1.085	0.461	5.254	179571.373	20607.4
Instance900.3	14.044	2.423	46.399	20.907	77523.545	36822.408	2.720	1.079	0.470	5.319	181962.563	20732.5
Instance900.4	13.741	2.363	46.562	20.991	77368.577	36779.894	2.757	1.046	0.465	5.350	180502.970	20513.3

Host System Performance

Counter	Average	Minimum	Maximum
% Processor Time	1.121	0.572	3.695
Available MBytes	14252.779	14203.000	14292.000
Free System Page Table Entries	16485011.017	16482346.000	16490963.000
Transition Pages RePurposed/sec	0.000	0.000	0.000
Pool Nonpaged Bytes	117907960.518	93839360.000	127930368.000
Pool Paged Bytes	164860169.086	164831232.000	164884480.000
Database Page Fault Stalls/sec	0.000	0.000	0.000

Test Log 1/18/2016 9:58:08 AM -- Preparing for testing ...

1/18/2016 9:58:12 AM -- Attaching databases ...

1/18/2016 9:58:12 AM -- Preparations for testing are complete.

1/18/2016 9:58:12 AM -- Starting transaction dispatch ..

1/18/2016 9:58:12 AM -- Database cache settings: (minimum: 128.0 MB, maximum: 1.0 GB)

1/18/2016 9:58:12 AM -- Database flush thresholds: (start: 10.2 MB, stop: 20.5 MB)

1/18/2016 9:58:17 AM -- Database read latency thresholds: (average: 20 msec/read, maximum: 100 msec/read).

1/18/2016 9:58:17 AM -- Log write latency thresholds: (average: 10 msec/write, maximum: 100 msec/write).

1/18/2016 9:58:17 AM -- Attaining prerequisites:

1/18/2016 10:03:03 AM -- \MSExchange Database(JetstressWin)\Database Cache Size, Last: 968945700.0 (lower bound: 966367600.0, upper bound: none)

1/18/2016 10:03:04 AM -- Performance logging started (interval: 5000 ms).

1/18/2016 10:03:04 AM -- Automatic tuning is starting ...

1/18/2016 10:03:36 AM -- Instance900.1 has 0.00 for read latency slope.

1/18/2016 10:03:36 AM -- Instance900.2 has 0.01 for read latency slope.

1/18/2016 10:03:36 AM -- Instance900.3 has 0.02 for read latency slope.

1/18/2016 10:03:36 AM -- Instance900.4 has 0.03 for read latency slope.

1/18/2016 10:05:43 AM -- 135 batch transactions/sec and 8 sessions have 270 IOPS.

1/18/2016 10:05:43 AM -- 8 sessions have actual 270 IOPS (target IOPS: 168)

1/18/2016 10:05:43 AM -- Instance900.1 has 20.3 for I/O Database Reads Average Latency.

1/18/2016 10:05:43 AM -- Instance900.2 has 20.1 for I/O Database Reads Average Latency.

1/18/2016 10:05:43 AM -- Instance900.3 has 19.7 for I/O Database Reads Average Latency.

1/18/2016 10:05:43 AM -- Instance900.4 has 19.6 for I/O Database Reads Average Latency.

1/18/2016 10:05:43 AM -- The process has average database read latencies higher than 20.000 msec.

1/18/2016 10:05:43 AM -- Instance900.1 has 2.0 for I/O Log Writes Average Latency.

1/18/2016 10:05:43 AM -- Instance900.1 has 0.0 for I/O Log Reads Average Latency.

1/18/2016 10:05:43 AM -- Instance900.2 has 2.0 for I/O Log Writes Average Latency.

1/18/2016 10:05:43 AM -- Instance900.2 has 0.0 for I/O Log Reads Average Latency.

1/18/2016 10:05:43 AM -- Instance900.3 has 1.5 for I/O Log Writes Average Latency.

1/18/2016 10:05:43 AM -- Instance900.3 has 0.0 for I/O Log Reads Average Latency.

1/18/2016 10:05:43 AM -- Instance900.4 has 1.4 for I/O Log Writes Average Latency.

1/18/2016 10:05:43 AM -- Instance900.4 has 0.0 for I/O Log Reads Average Latency.

1/18/2016 10:05:43 AM -- Operation mix: Sessions 4, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.

1/18/2016 10:06:15 AM -- Instance900.1 has 0.07 for read latency slope.

1/18/2016 10:06:15 AM -- Instance900.2 has 0.03 for read latency slope.

1/18/2016 10:06:15 AM -- Instance900.3 has 0.13 for read latency slope.

1/18/2016 10:06:15 AM -- Instance900.4 has 0.06 for read latency slope.

1/18/2016 10:08:22 AM -- 76 batch transactions/sec and 4 sessions have 166 IOPS.

1/18/2016 10:08:22 AM -- 4 sessions have actual 166 IOPS (target IOPS: 168)

1/18/2016 10:08:22 AM -- Instance900.1 has 15.5 for I/O Database Reads Average Latency.

1/18/2016 10:08:22 AM -- Instance900.2 has 15.3 for I/O Database Reads Average Latency.

1/18/2016 10:08:22 AM -- Instance900.3 has 15.7 for I/O Database Reads Average Latency.

1/18/2016 10:08:22 AM -- Instance900.4 has 15.1 for I/O Database Reads Average Latency.

1/18/2016 10:08:22 AM -- Instance900.1 has 1.2 for I/O Log Writes Average Latency.

1/18/2016 10:08:22 AM -- Instance1900.1 has 0.0 for I/O Log Reads Average Latency.

1/18/2016 10:08:22 AM -- Instance900.2 has 1.1 for I/O Log Writes Average Latency.

1/18/2016 10:08:22 AM -- Instance900.2 has 0.0 for I/O Log Reads Average Latency.

1/18/2016 10:08:22 AM -- Instance900.3 has 0.8 for I/O Log Writes Average Latency.

1/18/2016 10:08:22 AM -- Instance900.3 has 0.0 for I/O Log Reads Average Latency.

1/18/2016 10:08:22 AM -- Instance900.4 has 0.9 for I/O Log Writes Average Latency.

1/18/2016 10:08:22 AM -- Instance900.4 has 0.0 for I/O Log Reads Average Latency.

1/18/2016 10:08:22 AM -- Operation mix: Sessions 5, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.

1/18/2016 10:08:53 AM -- Instance900.1 has 0.08 for read latency slope.

1/18/2016 10:08:53 AM -- Instance900.2 has 0.20 for read latency slope.

1/18/2016 10:08:53 AM -- Instance900.3 has 0.04 for read latency slope.

1/18/2016 10:08:53 AM -- Instance900.4 has 0.16 for read latency slope.

1/18/2016 10:11:01 AM -- 96 batch transactions/sec and 5 sessions have 196 IOPS.

1/18/2016 10:11:01 AM -- 5 sessions have actual 196 IOPS (target IOPS: 168)

1/18/2016 10:11:01 AM -- Instance900.1 has 15.9 for I/O Database Reads Average Latency.

1/18/2016 10:11:01 AM -- Instance900.2 has 15.2 for I/O Database Reads Average Latency.

1/18/2016 10:11:01 AM -- Instance900.3 has 15.2 for I/O Database Reads Average Latency.

1/18/2016 10:11:01 AM -- Instance900.4 has 15.4 for I/O Database Reads Average Latency.

1/18/2016 10:11:01 AM -- Instance900.1 has 1.2 for I/O Log Writes Average Latency.

1/18/2016 10:11:01 AM -- Instance900.1 has 0.0 for I/O Log Reads Average Latency.

1/18/2016 10:11:01 AM -- Instance900.2 has 1.2 for I/O Log Writes Average Latency.

1/18/2016 10:11:01 AM -- Instance900.2 has 0.0 for I/O Log Reads Average Latency.

1/18/2016 10:11:01 AM -- Instance900.3 has 1.5 for I/O Log Writes Average Latency.

1/18/2016 10:11:01 AM -- Instance900.3 has 0.0 for I/O Log Reads Average Latency.

1/18/2016 10:11:01 AM -- Instance900.4 has 1.3 for I/O Log Writes Average Latency.

1/18/2016 10:11:01 AM -- Instance900.4 has 0.0 for I/O Log Reads Average Latency.

1/18/2016 10:11:01 AM -- Performance logging has ended.

1/18/2016 10:11:01 AM -- Automatic tuning succeeded.

1/18/2016 10:11:02 AM -- Operation mix: Sessions 5, Inserts 40%, Deletes 20%, Replaces 5%, Reads 35%, Lazy Commits 70%.

1/18/2016 10:11:02 AM -- Performance logging started (interval: 15000 ms).

1/18/2016 10:11:02 AM -- Attaining prerequisites:

1/18/2016 10:11:02 AM -- \MSExchange Database(JetstressWin)\Database Cache Size, Last: 1050984000.0 (lower bound: 966367600.0, upper bound: none)

1/18/2016 12:11:03 PM -- Performance logging has ended.

1/18/2016 12:11:03 PM -- JetInterop batch transaction stats: 22851, 22851, 22850 and 22850.

1/18/2016 12:11:03 PM -- Dispatching transactions ends.

1/18/2016 12:11:03 PM -- Shutting down databases ...

1/18/2016 12:11:09 PM -- Instance900.1 (complete), Instance900.2 (complete), Instance900.3 (complete) and Instance900.4 (complete)

1/18/2016 12:11:09 PM -- C:\JetStress_Report\HDD_RAID10_MP_1000_0.168_2GB(64k+SSD)\Performance_2016_1_18_10_11_1.blg has 479 samples.

1/18/2016 12:11:09 PM -- Creating test report ...

1/18/2016 12:11:13 PM -- Instance900.1 has 14.4 for I/O Database Reads Average Latency.

1/18/2016 12:11:13 PM -- Instance900.1 has 1.1 for I/O Log Writes Average Latency.

1/18/2016 12:11:13 PM -- Instance900.1 has 1.1 for I/O Log Reads Average Latency.

1/18/2016 12:11:13 PM -- Instance900.2 has 14.2 for I/O Database Reads Average Latency.

1/18/2016 12:11:13 PM -- Instance900.2 has 1.1 for I/O Log Writes Average Latency.

1/18/2016 12:11:13 PM -- Instance900.2 has 1.1 for I/O Log Reads Average Latency.

1/18/2016 12:11:13 PM -- Instance900.3 has 14.0 for I/O Database Reads Average Latency.

1/18/2016 12:11:13 PM -- Instance900.3 has 1.1 for I/O Log Writes Average Latency.

1/18/2016 12:11:13 PM -- Instance900.3 has 1.1 for I/O Log Reads Average Latency.

1/18/2016 12:11:13 PM -- Instance900.4 has 13.7 for I/O Database Reads Average Latency.

1/18/2016 12:11:13 PM -- Instance900.4 has 1.0 for I/O Log Writes Average Latency.

1/18/2016 12:11:13 PM -- Instance900.4 has 1.0 for I/O Log Reads Average Latency.

1/18/2016 12:11:13 PM -- Test has 0 Maximum Database Page Fault Stalls/sec.

1/18/2016 12:11:13 PM -- The test has 0 Database Page Fault Stalls/sec samples higher than 0.

1/18/2016 12:11:13 PM -- [C:\JetStress_Report\HDD_RAID10_MP_1000_0.168_2GB(64k+SSD)\Performance_2016_1_18_10_11_1.xml](C:\JetStress_Report\HDD_RAID10_MP_1000_0.168_2GB(64k+SSD)\Performance_2016_1_18_10_11_1.xml) has 478 samples queried.