open-e JovianDSS

Seagate Exos X24 24TB HDD (ST24000NM005H)

Certification Report

Release date: 2024.02.20

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1. INTRODUCTION

The purpose of this report is to describe in detail **the tests and the results of integrating the Seagate Exos X24 Hard Disk Drives with the Open-E JovianDSS software platform**. The report aims to demonstrate the compatibility and reliability of the tested Seagate HDDs under various operational conditions, scenarios, and applications.

Seagate Exos X24 is a series of hard disk drives that offer the highest capacity of **24TB available** for more terabytes per rack. **It is based on the fourth-generation, Helium-sealed design that reduces power consumption and increases reliability**. It is suitable for data-intensive applications such as cloud, big data, and backup.

Open-E JovianDSS is a software platform that provides data storage solutions for various industries and markets. It is based on the **ZFS file system and supports features such as data deduplication, compression, encryption, snapshots, replication, and High Availability clustering**. It is compatible with any hardware and any operating system, and it offers flexible pricing and excellent support.

Open-E conducted the certification tests under the assumption that **the drives were suitable for the data groups (data storage drives)** due to their extensive capacity and evaluated their performance in this role.

The certification scope included a series of functional and performance tests on both **Single-Node systems and High-Availability data storage clusters** to ensure compatibility and reliability under various operational conditions.

The following applications were considered during the Open-E certification process:

- **Data storage drive**

2. DEVICE UNDER TEST DESCRIPTION

Table 1. Seagate Exos X24 24TB (ST24000NM005H)

Product name	Seagate Exos X24
Model name	ST24000NM005H
Storage capacity	24 TB
Form factor	HDD 3.5”
Interface	SAS
SED	YES
Rotational speed	7200 RPM
Memory disk buffer size	512 MB
Power Supply Requirements	+12V and +5V
Power consumption	8.9W
Mean Time To Failure (MTTF)	2,500,000 hours
Power-On Hours per Year (24×7)	8760
Firmware	ET04

3. TEST ENVIRONMENT DESCRIPTION

Table 2 provides a detailed list of the hardware specifications for the environments used during the certification testing. Table 3 shows the general configuration settings for Fio, which was the tool for performance benchmarking.

Table 2. Per-Node hardware specification

System name	Supermicro SuperServer 6028U-TR4T+
Motherboard	Supermicro X9DRD-7LN4F(-JBOD)/X9DRD-EF
CPU	2x Intel® Xeon® CPU E5-2620 v2 @ 2.10GHz
RAM	64GB - 8x Kingston 8 GB 1600 MHz
Storage controller	HBA Broadcom (LSI) SAS 9400-8i8e SAS 12Gb/s
Drives	4x Seagate Exos X24 2x NVMe Intel Optane SSD P1600X Series
System	Open-E JovianDSS up30r1 54118

Table 3. Fio test tool configuration

Version	3.28
Test size	200GB
Block size	4kB (random workload); 1MB (sequential workload)
Ramp time	30s
Runtime	90s
IOengine	libaio
Direct IO	Yes

4. FUNCTIONALITY TEST

Open-E performed functional testing, shown in Table 4.

Table 4. Functional test results

Functional aspect	Result
Open-E JovianDSS system compatibility	passed
Stripe compatibility	passed
Mirror compatibility	passed
RAID-Z1 compatibility	passed
RAID-Z2 compatibility	passed
RAID-Z3 compatibility	passed
System stability	passed
Drive failure simulation with the replacement	passed
Hot-Plug support	passed
Disk activity and health monitoring	passed
Disk write-back cache management	passed
LED's management functionality	passed
Self-Encrypted Drives functionality	passed

5. HIGH AVAILABILITY NON-SHARED STORAGE CLUSTER TESTS

Open-E performed various compatibility tests to ensure the proper operation of the Seagate Exos X24 HDDs in the Open-E JovianDSS High Availability Non-Shared Storage Cluster environment.

All the essential and critical non-shared storage cluster mechanisms with the tested devices were tested. Table 5 shows the list of checked functionalities.

Table 5. Results for the HA Non-shared Storage Cluster compatibility test.

Tested functionality	Result
Manual Failover	passed
Remote disk support	passed
Automatic Failover triggered after network failure	passed
Automatic Failover triggered after system shutdown	passed
Automatic Failover triggered after system reboot	passed
Automatic Failover triggered after system power-off	passed
Automatic Failover triggered after I/O failure	passed
Failover operations under heavy load (stress test)	passed
Failover operations - Self-Encrypted Drives support	passed

6. HIGH AVAILABILITY SHARED STORAGE CLUSTER TESTS

Since tested HDDs have an SAS interface, Open-E performed various compatibility tests to ensure the proper operation of the Seagate Exos X24 HDDs in the Open-E JovianDSS High Availability Shared Storage Cluster environment.

All the essential and critical shared storage cluster mechanisms with the tested devices were tested. Table 6 shows the list of checked functionalities.

Table 6. Results for the HA Shared Storage Cluster compatibility test.

Tested functionality	Result
Manual Failover	passed
Automatic Failover triggered after network failure	passed
Automatic Failover triggered after system shutdown	passed
Automatic Failover triggered after system reboot	passed
Automatic Failover triggered after system power-off	passed
Automatic Failover triggered after I/O failure	passed
Failover operations under heavy load (stress test)	passed
Failover operations - Self-Encrypted Drives support	passed

7. PERFORMANCE TEST

The test cases are described in Table 7. Open-E applied every combination of thread numbers (1, 4, 8, 16) and queue depths (1, 16, 64, 128) to the Fio test tool in all instances. All tests were performed locally on the Open-E JovianDSS system.

Table 7. Test cases description

Test case	IO pattern	Read to write %	Block size
Mixed	random	70/30	4 kB
Random read	random	100/0	4 kB
Random write	random	0/100	4 kB
Sequential read	sequential	100/0	1 MB
Sequential write	sequential	0/100	1 MB

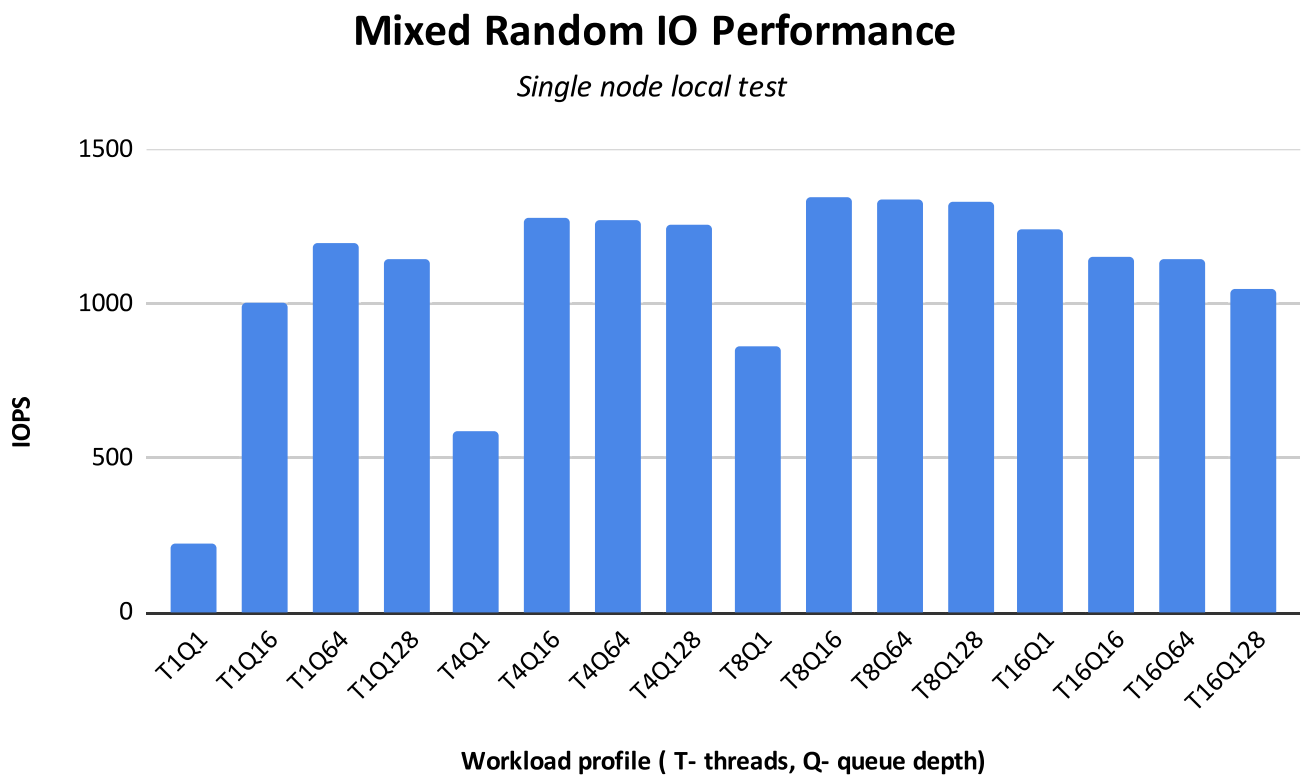
The table 8 below presents the ZFS configuration used for testing.

Table 8. Tested pool configuration

Zpool configuration	RAID-Z2
Write log	Yes (NVMe Intel Optane SSD P1600X Series)
Read Cache	Yes (NVMe Intel Optane SSD P1600X Series)
Zvol size	200 GB
Sync	Always
Provisioning	Thin
Compression	lz4
Zvol initialization	Zvol was initialized by writing data to it before tests began.

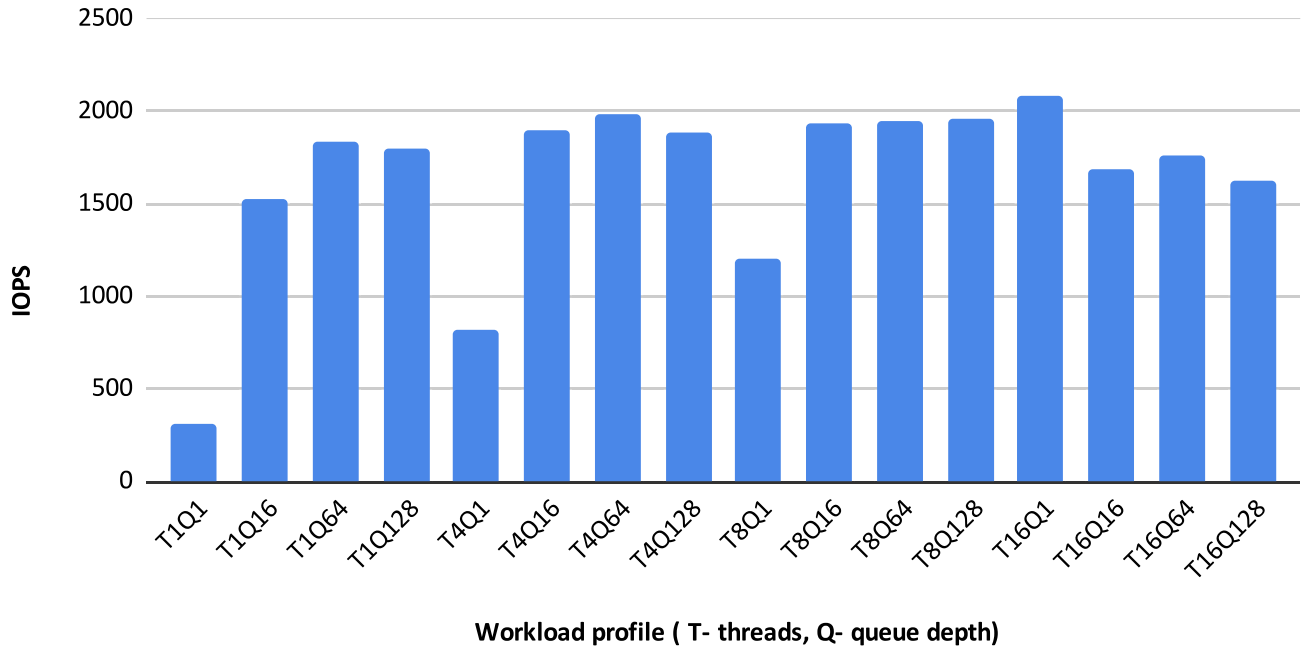
The charts below present the following performance results:

- **Mixed Random IO Performance**
- **Random Read IO Performance**
- **Random Write IO Performance**
- **Sequential Read MB/s Performance**
- **Sequential Write MB/s Performance**



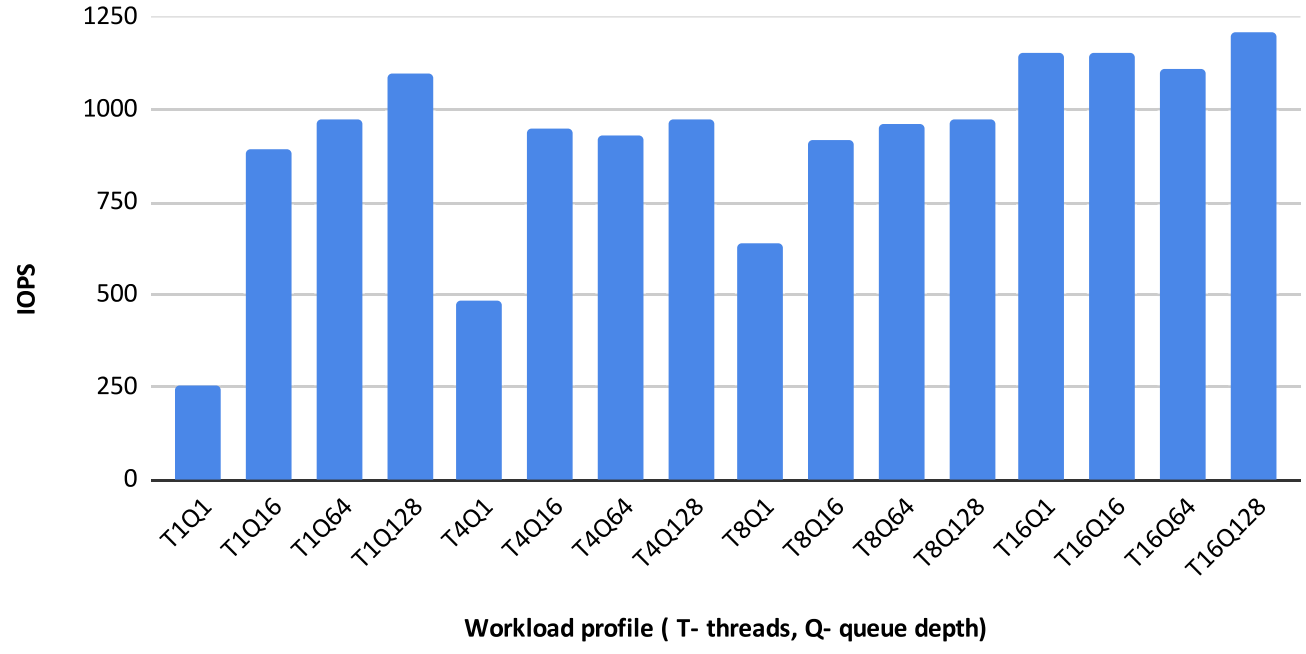
Random Read IO Performance

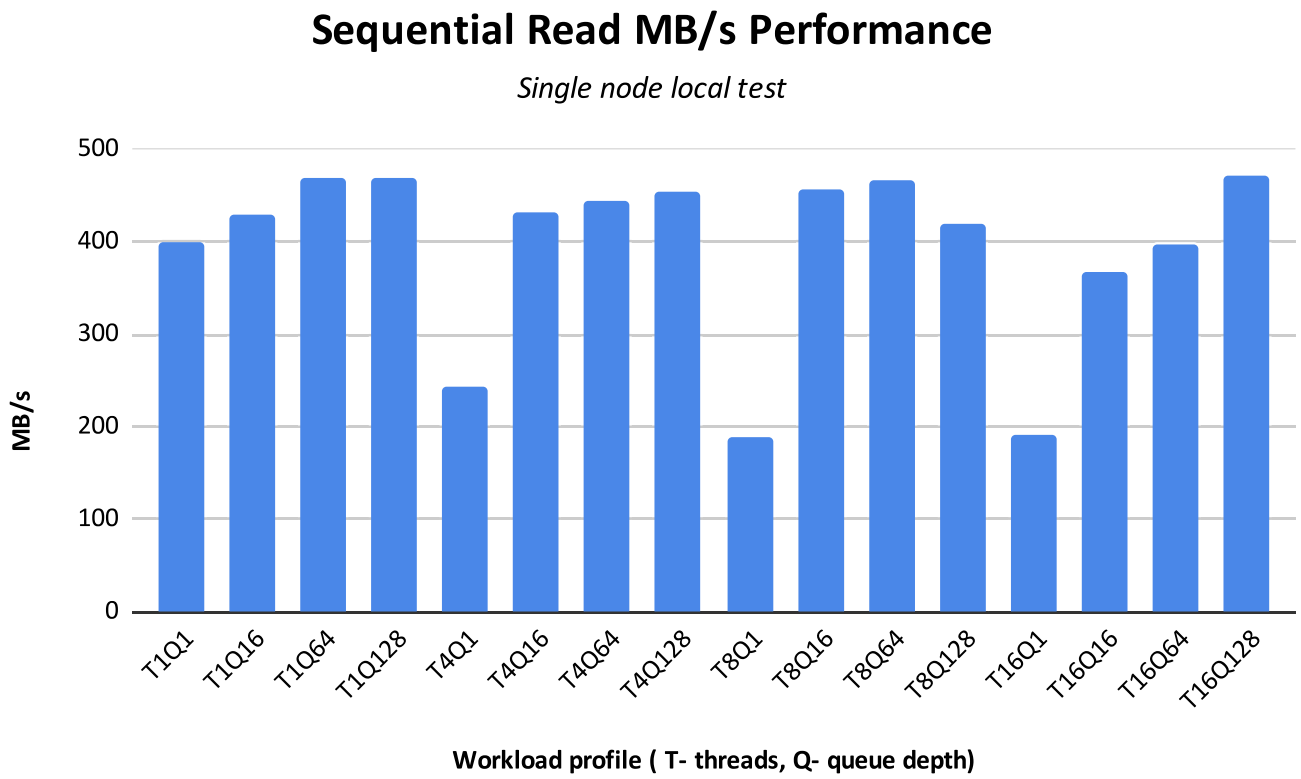
Single node local test

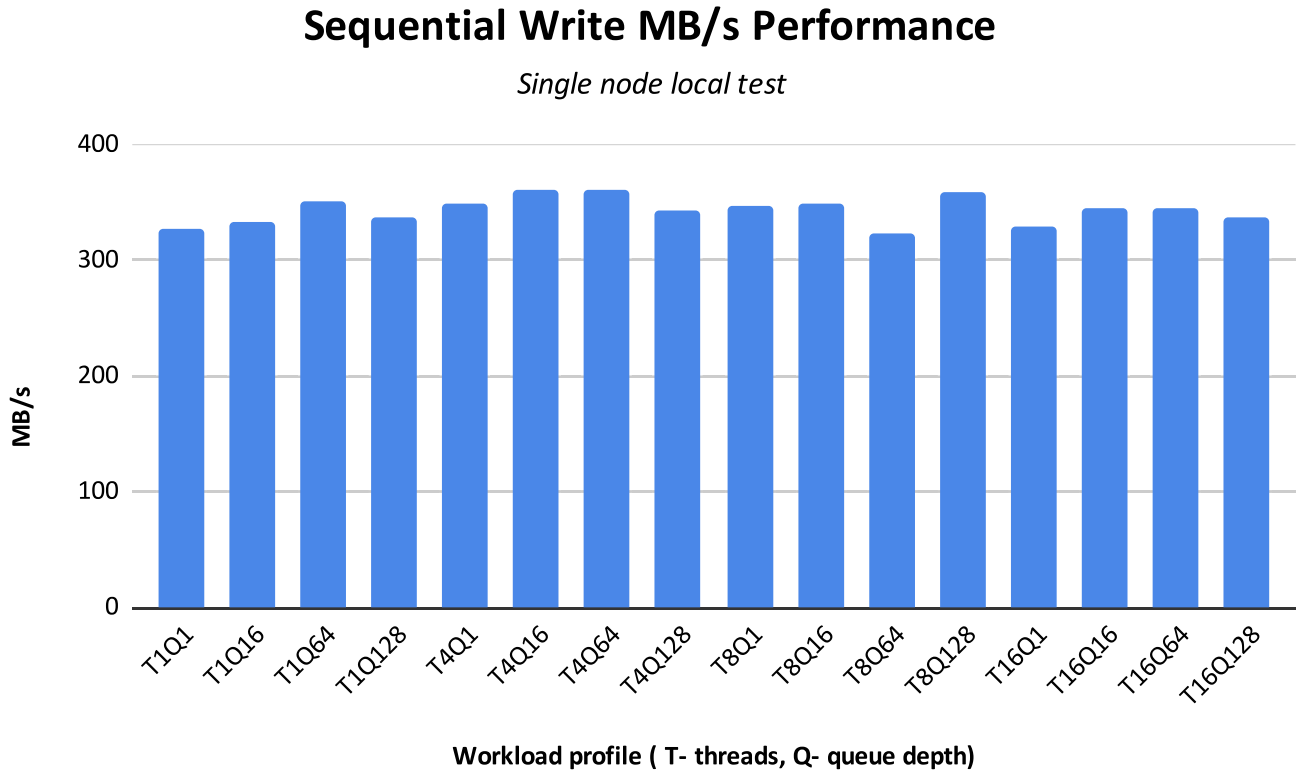


Random Write IO Performance

Single node local test




Sequential Read MB/s Performance
Single node local test
MB/s
500
400
300
200
100
0
T1Q1
T1Q16
T1Q64
T1Q128
T4Q1
T4Q16
T4Q64
T4Q128
T8Q1
T8Q16
T8Q64
T8Q128
T16Q1
T16Q16
T16Q64
T16Q128
Workload profile (T- threads, Q- queue depth)


Sequential Write MB/s Performance
Single node local test
MB/s
400
300
200
100
0
T1Q1
T1Q16
T1Q64
T1Q128
T4Q1
T4Q16
T4Q64
T4Q128
T8Q1
T8Q16
T8Q64
T8Q128
T16Q1
T16Q16
T16Q64
T16Q128
Workload profile (T- threads, Q- queue depth)

8. TEST CONCLUSIONS

The Seagate Exos X24 HDD has shown good performance in a comprehensive suite of tests, proving its reliability as a data storage solution. The disks have good endurance, speed, and consistency, making them a great choice for environments that need high data integrity, capacity, availability, and the highest level of safety.

The testing regimen, which included stress tests, read/write operations, and long-term reliability assessments, has confirmed that this HDD model is a high-quality, enterprise device. The results show that the Seagate Exos X24 HDD can handle the demanding workloads of both Single-Node and High-Availability configurations in Open-E JovianDSS systems.

The Seagate Exos X24 HDD is a good choice for those who value high storage capacity, consistent performance, safety and reliability in a hard disk drive.

Based on the test results, and the drive specification, Open-E recommends using the certified model in:

- Massive Enterprise-Scale Storage Infrastructures
- Business-Critical Servers, and Data Storage
- File and Block Data Storage Solutions
- Backup Solutions
- CCTV Recording

After passing the certification tests, Open-E added the Seagate Exos X24 to the Hardware Certification List and granted it the “Certified by Open-E” status.

9. DISCLAIMER

Due to the large capacity of the single disk, which leads to a longer replacement time in case of its failure, we recommend using data groups with at least two disks of redundancy. For this purpose, the best group is the RAID-Z2, which we tested above, or at least a 3-way mirror if you use mirror groups.