open-e JovianDSS

Western Digital OpenFlex Data24 4200 NVMe-oF Platform

Certification Report

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1. INTRODUCTION

Western Digital OpenFlex Data24 4200 NVMe-oF Storage Platform is a high-performance 2U 24-bay JBOD enclosure designed for NVMe SSDs, supporting PCIe Gen4 and NVMe over Fabrics (NVMe-oF) technology. It delivers ultra-low latency and high throughput, making it ideal for demanding workloads like AI, data analytics, and cloud infrastructure.

The platform features hot-swappable drives, fans, and power supplies, with a modular design and optimized thermal management to ensure reliable operation in enterprise environments.

This certification report outlines the testing and verification of OpenFlex Data24 4200 with Open-E JovianDSS, a ZFS-based data storage solution offering enterprise-grade features like data integrity, high availability, inline compression, and deduplication.

The goal of this report is to present the certification results and highlight the benefits of using OpenFlex Data24 4200 with Open-E JovianDSS. Functional tests were performed in the following configurations to validate full compatibility:

- **Single-Node**
- **High Availability Shared Storage Cluster**

2. TESTED DEVICE DESCRIPTION

During the certification process, an Western Digital OpenFlex Data24 4200 NVMe-oF Storage Platform was tested. A detailed description can be found in Table 1.

Table 1. JBOD specifications

Product name	Western Digital OpenFlex Data24 4200 NVMe-oF Storage Platform
Rack size	2U
Drive number and form factor	24x U.2 NVMe SSDs
Fabric adapter slots	12x 100 GbE ports
Drive interface	U.2 NVMe
Fabric adapters	Western Digital RapidFlex A2000 NVMe-oF Fabric Bridge ASICs
Power supply	2x 800W Titanium 100-240VAC, CRPS, Hot Plug
Front panel LED indicators	Yes
BMC	Yes
Dimensions (H x W x D)	85.5 x 491.1 x 628.65mm

3. TEST ENVIRONMENT DESCRIPTION

Hardware specifications for environments used during certification testing are included in the following tables. The configuration described in Table 2 was used for the Single-Node and High Availability Shared Storage test.

Table 2. Hardware specifications for Single-Node and HA Shared Storage Cluster tests

System name	Supermicro SYS-620U-TNR
Motherboard	Supermicro X12DPU-6
CPU	2x AMD EPYC 7542 32-Core Processor
RAM	512 GB - 16x 32GB Samsung DDR4 3200MT/s
NVMEoF Controller	Mellanox ConnectX-6 MCX653106A-HDAT
Disks in JBOD	24x DAPUSTOR 15.36TB DPRD31016TT515T3010
System	Open-E JovianDSS up32 b61585

4. FUNCTIONAL AND STABILITY TESTS

To ensure the proper operation of the tested device when used with Open-E JovianDSS software, functional testing was done for both the Single-Node and High Availability Shared Storage cluster configurations. The performed tests, along with their results, are described in Tables 3 and 4, respectively.

4.1 FUNCTIONAL AND STABILITY TEST RESULTS

Table 3. Single-Node functional tests

Tested functionality	Result
ZFS Functions and various Zpool configurations	passed
Disk failure simulation and replacement functionality	passed
Hot-plug / hot-swap and scalability functionality	passed
NVMe MPIO functionality	passed
Disk health monitoring functionality	passed
Disk activity statistics functionality	passed
Drive identification functionality (Only from BMC)	passed*
Failure recovery (power outage, cable disconnection)	passed
NVMe disk partitioning	passed
Western Digital BMC System	passed

* Original Open-E JovianDSS WEB GUI functionality for LED blinking not achieved. Successfully implemented and confirmed via JBOD BMC login.

Table 4. HA Shared Storage cluster functional and stability tests

Tested functional and non-functional aspects	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
System stability under load over extended period of time	passed

4.2 FUNCTIONAL AND STABILITY TEST CONCLUSIONS

Due to the above test results, Open-E confirms full compatibility with Open-E JovianDSS data storage software. The information provided by Tables 3 and 4 points to all the testing scenarios for the JBOD features. The Western Digital OpenFlex Data24 4200 NVMe-oF Storage Platform with Open-E JovianDSS confirmed its ability to protect data and efficiently recover in case of failures.

5. PERFORMANCE TESTS

The following performance tests were intended to ensure that the Western Digital OpenFlex Data24 4200 NVMe-oF Storage Platform can be used as an efficient enclosure for the data storage devices:

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

The performance tests were conducted for the Single-Node scenario only, because the performance results of the High Availability Shared-Storage cluster are essentially the same as the Single-Node scenario.

Open-E JovianDSS was configured in the Single-Node architecture using the storage parameters described in Table 5. To obtain optimal test results, the JBOD was connected to the network controller with 1 path over NVMe-oF. The Fio testing tool was run locally on the Open-E JovianDSS system, as described in Table 6, for every test profile listed in Table 7.

Table 5. Storage configuration for Single-Node performance test

Zpool redundancy	Single group
ZFS zvol block size	64K
ZFS Zvol sync	always
Zvol compression	lz4
Zvol provisioning	thin
Zvol size	200 GB

Table 6. Fio parameters used for Single-Node performance test

Version	3.35
IOengine	libaio
Direct IO	Yes
Ramp time	30s
Runtime	90s
Direct IO	Yes
Threads Count	1, 4, 8, 16
Queue Depth	1, 16, 64, 128

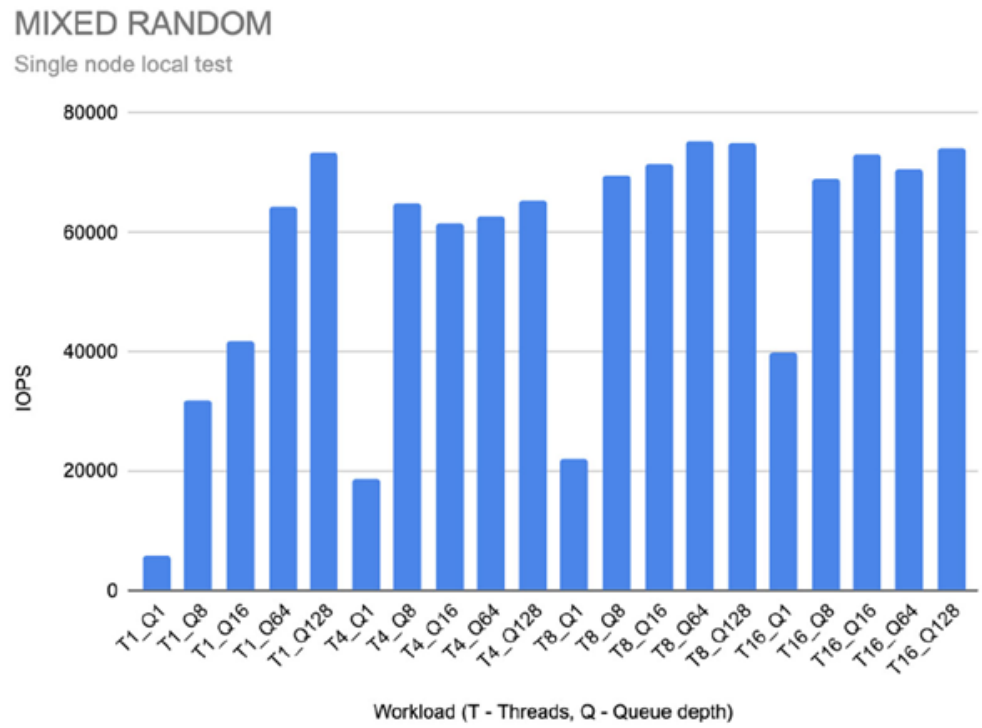
Table 7. Test profiles description for Single-Node performance test

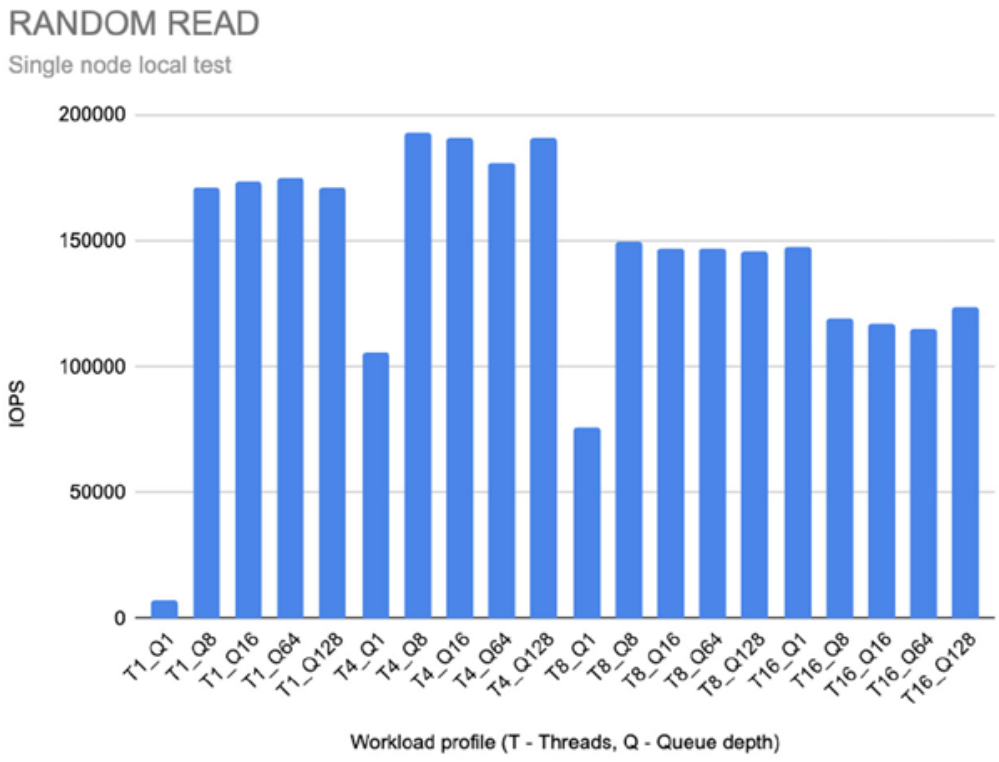
Test case	IO pattern	Read to write %	Block size
Mixed	random	70/30	4 kB
Random read	random	100/0	4 kB
Random write	random	0/100	4 kB
Sequential read	sequential	100/0	1 MB
Sequential write	sequential	0/100	1 MB

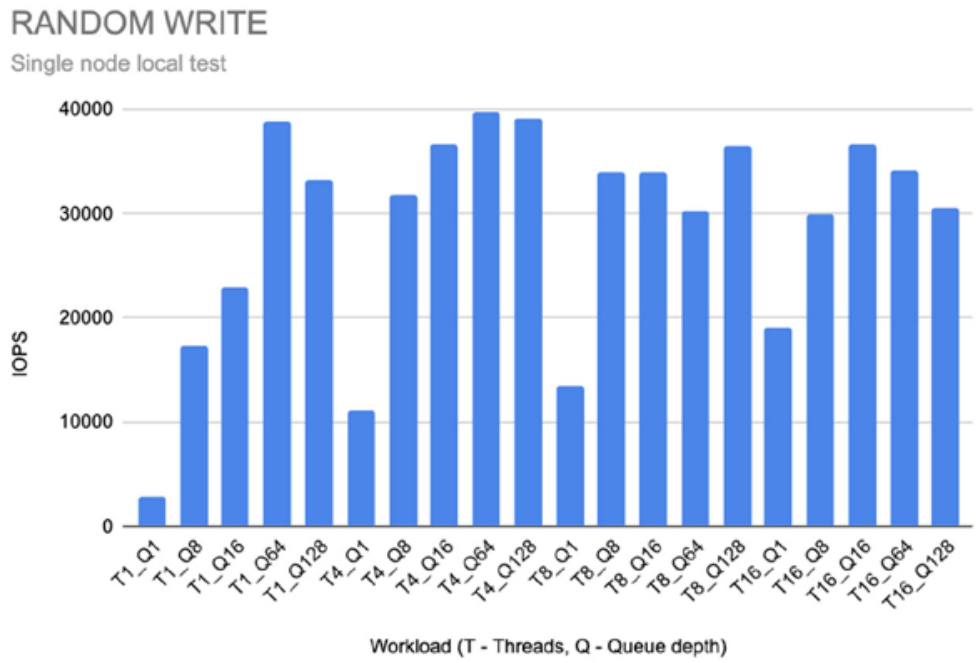
5.1 PERFORMANCE TEST RESULTS

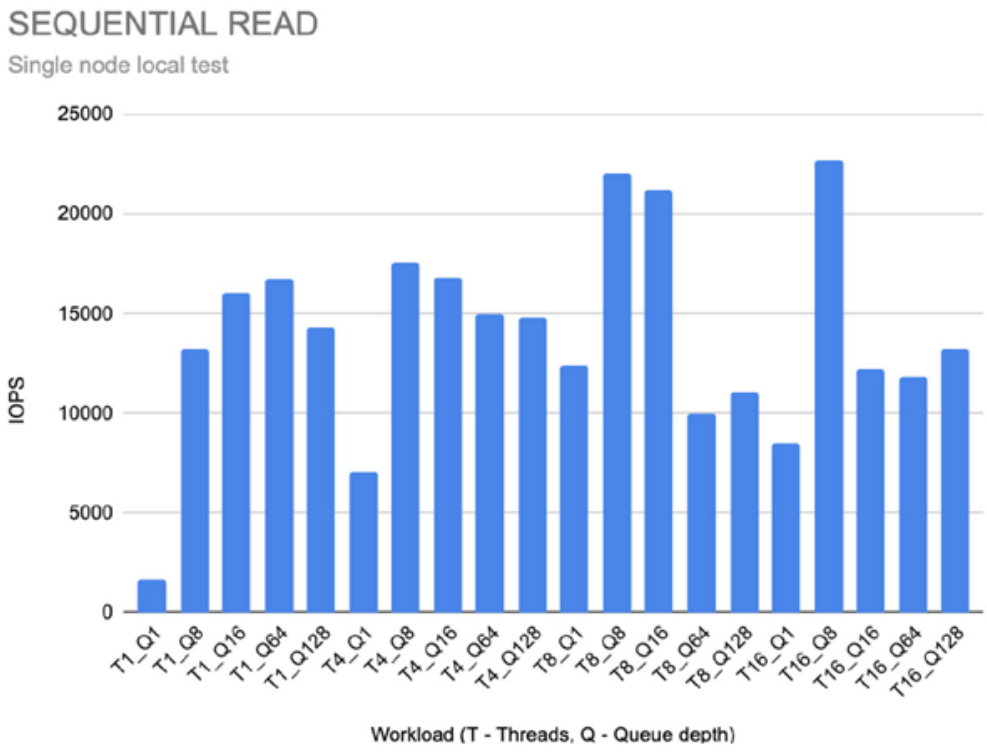
The charts below present the following performance results:

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


MIXED RANDOM
Single node local test
IOPS
80000
60000
40000
20000
0
T1_Q1
T1_Q8
T1_Q16
T1_Q64
T1_Q128
T4_Q1
T4_Q8
T4_Q16
T4_Q64
T4_Q128
T8_Q1
T8_Q8
T8_Q16
T8_Q64
T8_Q128
T16_Q1
T16_Q8
T16_Q16
T16_Q64
T16_Q128
Workload (T - Threads, Q - Queue depth)


RANDOM READ
Single node local test
IOPS
200000
150000
100000
50000
0
T1_Q1
T1_Q8
T1_Q16
T1_Q64
T1_Q128
T4_Q1
T4_Q8
T4_Q16
T4_Q64
T4_Q128
T8_Q1
T8_Q8
T8_Q16
T8_Q64
T8_Q128
T16_Q1
T16_Q8
T16_Q16
T16_Q64
T16_Q128
Workload profile (T - Threads, Q - Queue depth)


RANDOM WRITE
Single node local test
IOPS
40000
30000
20000
10000
0
T1_Q1
T1_Q8
T1_Q16
T1_Q64
T1_Q128
T4_Q1
T4_Q8
T4_Q16
T4_Q64
T4_Q128
T8_Q1
T8_Q8
T8_Q16
T8_Q64
T8_Q128
T16_Q1
T16_Q8
T16_Q16
T16_Q64
T16_Q128
Workload (T - Threads, Q - Queue depth)


SEQUENTIAL READ
Single node local test
IOPS
25000
20000
15000
10000
5000
0
T1_Q1
T1_Q8
T1_Q16
T1_Q64
T1_Q128
T4_Q1
T4_Q8
T4_Q16
T4_Q64
T4_Q128
T8_Q1
T8_Q8
T8_Q16
T8_Q64
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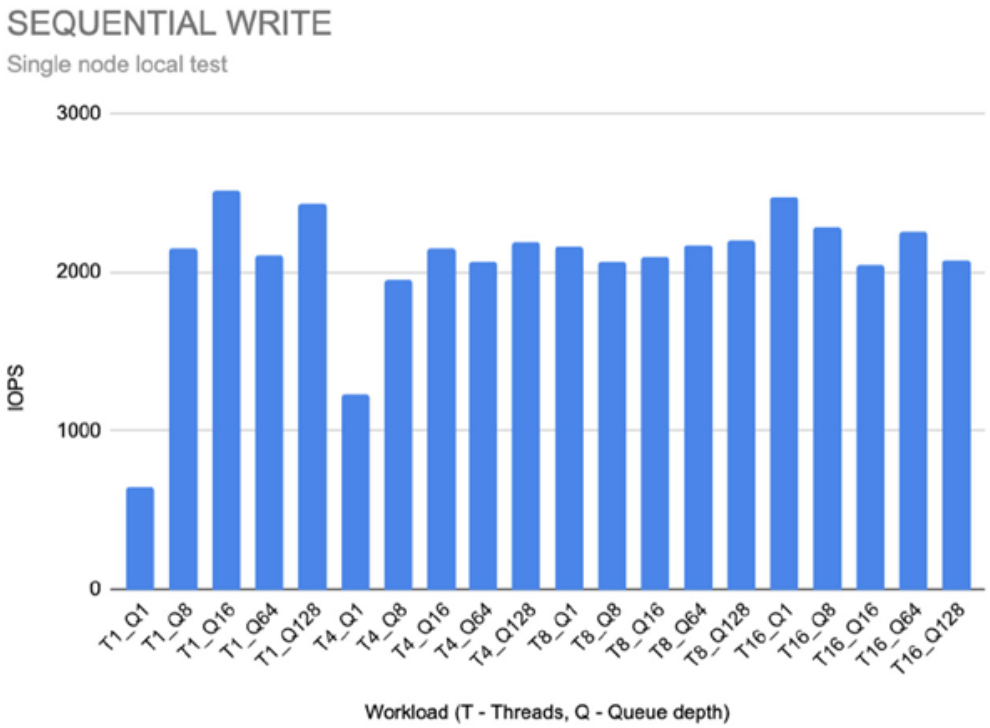
T16_Q8
T16_Q16
T16_Q64
T16_Q128
Workload (T - Threads, Q - Queue depth)



5.2 PERFORMANCE TEST CONCLUSIONS

The Western Digital OpenFlex Data24 4200 NVMe-oF Storage Platform can be seamlessly integrated with Open-E JovianDSS software. Both hardware and software worked harmoniously, ensuring data storage system stability and consistency.

During in-system performance assessments using Open-E JovianDSS, the Fio tool conducted sequential read tests and achieved a throughput of approximately 15 GB/s. The sequential write tests reached a peak throughput of around 2.5 GB/s, which is satisfactory for most operations.

The software fully harnesses the device's performance during storage device operations, affirming the system's efficacy in resource utilization. **These findings demonstrate the advantages of the Western Digital OpenFlex Data24 4200 NVMe-oF Storage Platform and Open-E JovianDSS solution in various scenarios and configurations.**

6. CERTIFICATION SUMMARY

Open-E is pleased to announce that **the Western Digital OpenFlex Data24 4200 NVMe-oF Storage Platform has successfully passed the certification process with Open-E JovianDSS software**. The solution demonstrated full compatibility, stability, and efficiency in various scenarios and configurations. The solution meets the standards of data storage system reliability and performance.

The Western Digital OpenFlex Data24 4200 NVMe-oF Storage Platform is an efficient solution for customers who require medium storage capacity, consistent performance, and reliability. The device offers a flexible and scalable design, and can be easily integrated with other devices and systems.

Based on the certification test results, Open-E recommends using the certified model in the following applications:

- **Virtualizations:** to handle multiple virtual machines and workloads with high availability and fault tolerance.
- **Artificial intelligence:** to support advanced artificial intelligence applications that require high-performance computing.
- **Research & Development:** to support complex and innovative projects that require flexible data storage resources.
- **High-performance Computing:** to support systems for high-speed data processing and analysis with low latency and high throughput.
- **Testing Environments:** to provide a reliable and secure environment for testing and debugging software and hardware products.
- **Distributed Solutions:** to support data sharing and collaboration across multiple locations and devices.
- **Collaborative Work:** to facilitate teamwork and communication among different users and groups.

After passing the certification tests, Open-E added **the Western Digital OpenFlex Data24 4200 NVMe-oF Storage Platform** to the Hardware Certification List and granted it the “Certified by Open-E” status. This status confirms that the solution meets the highest quality and performance standards of Open-E and its partners.