



Seagate Exos[®] 2X14 Plus GRAID SupremeRAID[™] Provides Complete Data Protection At Twice the Performance

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Overview

For years hard disks have been widely used in various scenarios, but while hard disk capacity continues to increase, performance density has not improved. However, many current-day applications require both better performance and the benefits of hard disk storage.

Unfortunately, most hard disk products currently on the market can't meet the needs of such applications. Alternatively users may switch to SSDs, but at a much higher cost of acquisition.

In response to this demand, Seagate has launched Exos® 2X14 with its unique MACH.2 technology. This technology can provide twice the performance of traditional hard disks under the same hard disk volume and storage space.

Additionally when combined with GRAID SupremeRAID™, a high-speed data protection solution developed by GRAID Technology, users can fully utilize the performance of Seagate Exos® 2X14 while providing excellent data protection.

Scenarios

- Large Scale Data Centers
- Hyperscale Applications
- Content Delivery Networks
- Video Streaming or Editing
- Surveillance
- Big Data Applications
- Enterprise Mail Server
- Enterprise Data Backup

While hard disk capacity continues to increase, performance density has not improved.

However, many current-day applications require both better performance and the benefits of hard disk storage.

Seagate Exos[®] 2X14

Seagate manufactures hard drives that specifically address the needs of the hyperscale storage market. As the highest-performing hard drive in the Seagate[®] X class, the Exos[®] 2X14 enterprise dual-actuator hard drive utilizes MACH.2[™] technology enabling up to 2x the performance of an enterprise single-actuator 3.5-inch hard drive.

Highest Performance for Highest Rack Space Efficiency:

- MACH.2 technology enables up to 2x the performance of an enterprise single actuator 3.5-inch hard drive¹
- Highest 14TB hard drive performance, making it perfect for cloud data centers and massive scale-out data center applications
- 14TB of capacity available as two independently addressable, 7TB logical units
- PowerBalance[™] feature optimizes IOPS/Watt
- Helium sealed-drive design delivers lower total cost of ownership through lower power and weight
- Next-generation helium side-sealed weld technology for added handling robustness and leak protection
- Digital environmental sensors to monitor internal drive conditions for optimal operation and performance
- Latest hermetic interconnect technology supporting higher data rate heads and higher pin counts for extreme thermal conditions
- Proven enterprise-class reliability backed by 5-year limited warranty and 2.5M-hr MTBF rating

The highest-performing hard drive in the Seagate[®] X class, the Exos[®] 2X14 enterprise dual-actuator hard drive utilizes MACH.2[™] technology, enabling up to 2x the performance of an enterprise single-actuator 3.5-inch hard drive.

¹ When operating both actuators simultaneously

GRAID SupremeRAID™

While traditional RAID technology has become the bottleneck of solid state drives (SSD), GRAID Technology has developed a disruptive software plus hardware solution to unlock the performance bottleneck of RAID protection for high-speed storage devices.

GRAID SupremeRAID™ works by installing a virtual NVMe controller onto the operating system and integrating a PCIe device into the system that is equipped with a high-performance AI processor to handle all RAID operations of the virtual NVMe controller.

This solution offers many advantages:

- Take full advantage of NVMe performance – 6 million random IOPS and 100 GB/s throughput, currently the industry leading performance benchmark.
- Unlike traditional software RAID, SupremeRAID™ does not consume a large amount of CPU resources.
- Overcome the limitations of hardware RAID cards, such as compute performance, PCIe bandwidth, the number of SSDs supported and the effort of battery maintenance.
- Plug and play, even in systems without a PCIe switch. SSDs directly connected to the CPU through the PCIe bus can be protected without changing the hardware design. It simultaneously supports all types of storage device interfaces, such as SATA, SAS, U.2, M.2 and even AIC.
- SCI (Software Composable Infrastructure) compatible and can be used for external storage drives connected via iSCSI or NVMeoF.
- Highly scalable; new software functions such as compression and encryption can easily be added

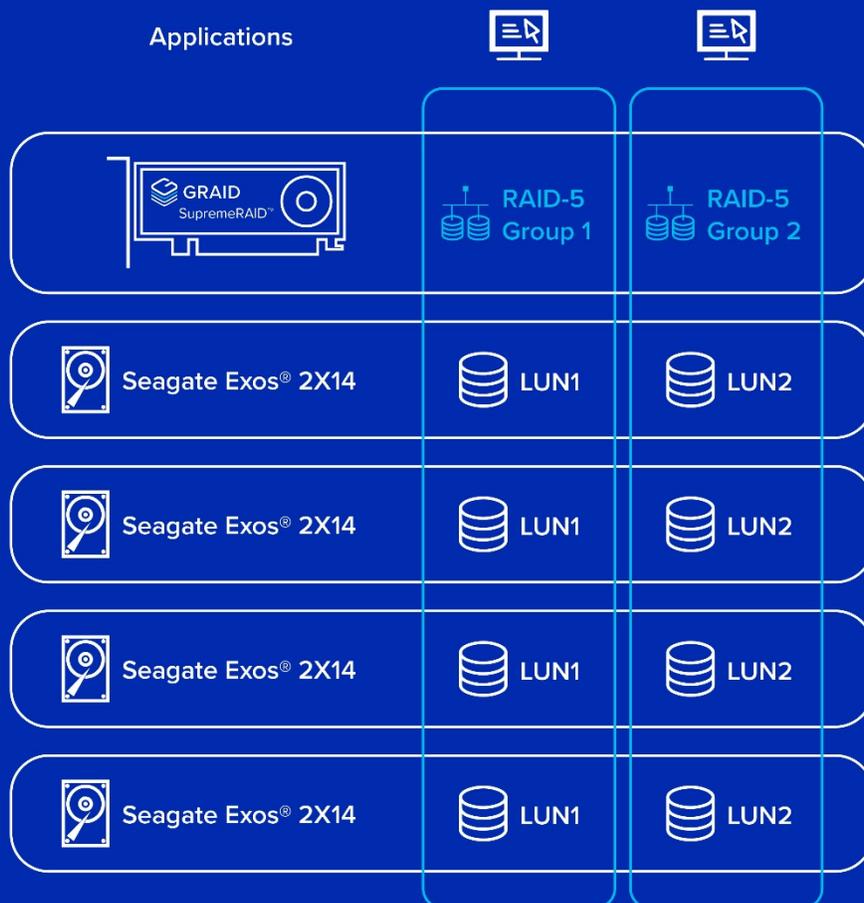
GRAID Technology has developed a disruptive software plus hardware solution to unlock the performance bottleneck of RAID protection for high-speed storage devices—the world's first to deliver 100% SSD performance.

Test Plans

This white paper will use 4 Seagate Exos® 2X14 drives and a GRAID SupremeRAID™ adapter to test performance in two common application scenarios:

- 8 logical sectors of 4 Seagate Exos® 2X14 are built as one RAID-0 group, providing 56TB of free space
- 8 logical sectors of 4 Seagate Exos® 2X14 are built as 2 RAID-5 groups with independent failure domains, providing 42TB of free space and allowing one hard drive to fail.

The composition diagram is as follows:

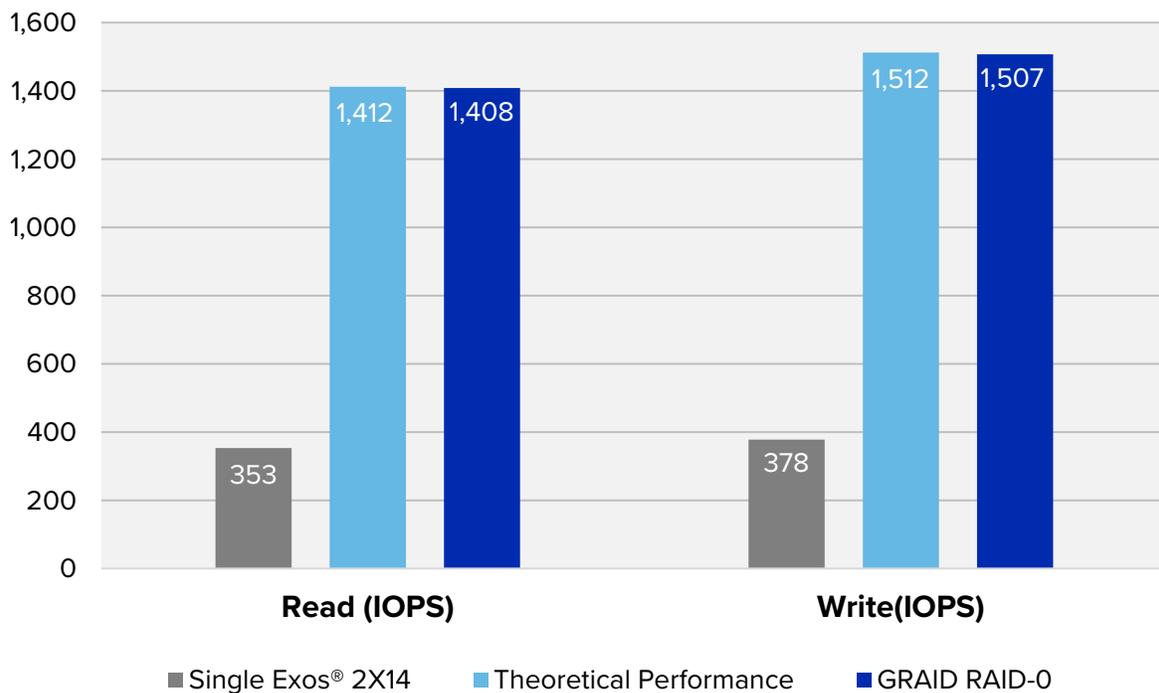


Test Results

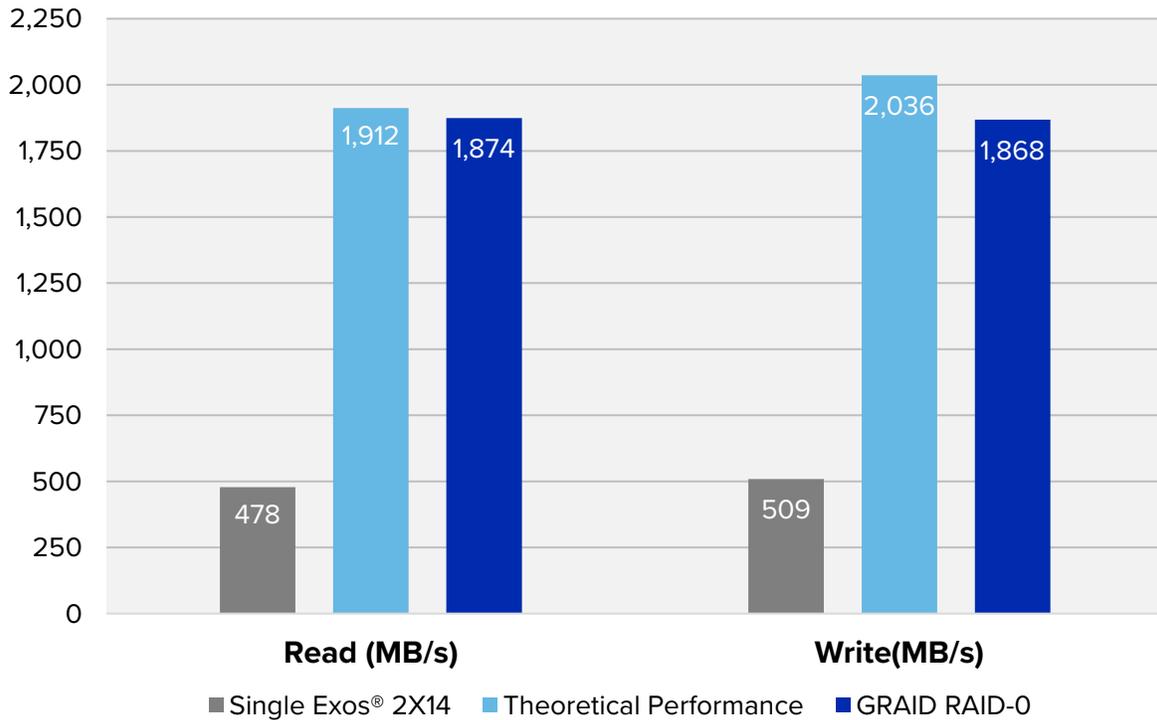
For the test we will use The **Flexible I/O Tester (FIO)** which is an I/O performance benchmarking utility for Linux. We will setup 4k random workloads, a RAID-0 group composed of four Seagate Exos® 2X14 which can provide 1,408 IOPS random read and 1,507 IOPS random write. We will also use 1M sequential workloads, which can provide 1,874 MB/s of read throughput and 1,868 MB/s of write throughput.

All results are very close to the theoretical performance of RAID-0 composed of 4 Seagate Exos® 2X14.

**Comparison Chart:
Random Workloads Performance and Theoretical Value
In RAID-0 Group Composed of 4 Exos® 2X14**

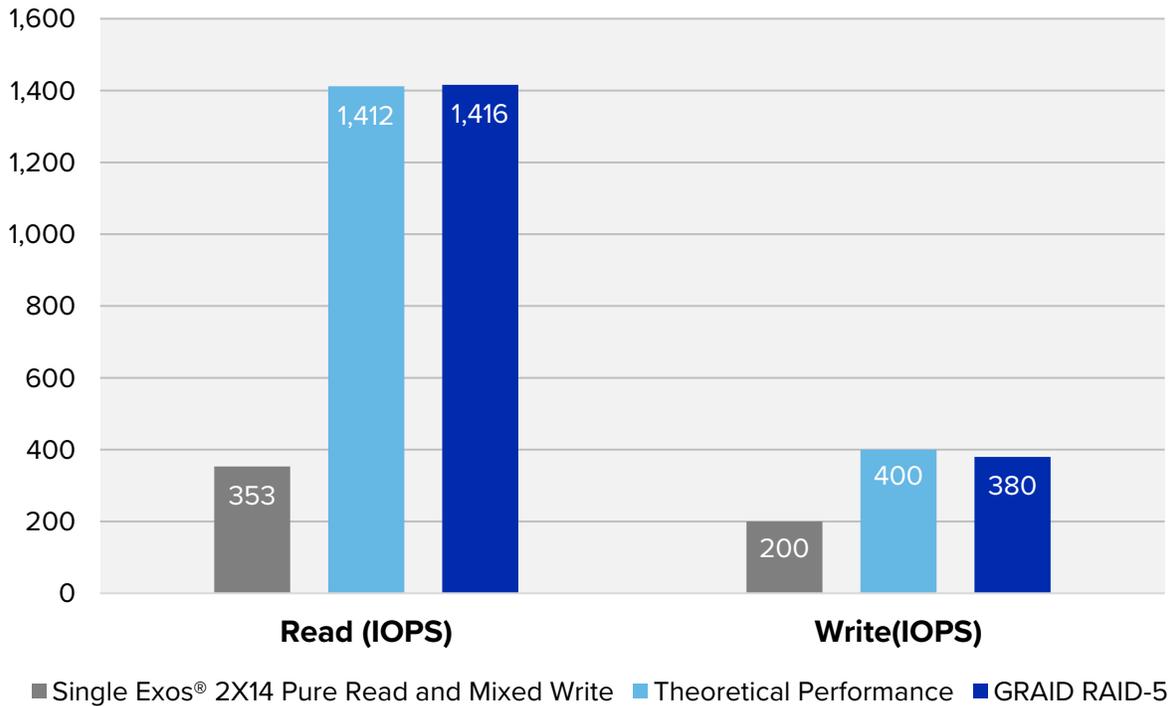


**Comparison Chart:
Sequential Workloads Performance and Theoretical Value
In RAID-0 Group Composed of 4 Exos® 2X14**



In addition, four Seagate Exos® 2X14 form 2 RAID-5 groups, which can provide 4k random read at 1,416 IOPS and 4k random write at 380 IOPS. Considering the write penalty effect of RAID-5, you can see the performance of RAID-5 is also very close to the theoretical value.

**Comparison Chart:
Random Workloads Performance and Theoretical Value
In 2 RAID-5 Groups Composed of 4 Exos® 2X14**



Conclusion

GRAID SupremeRAID™ is the first-generation high-speed data protection solution developed by GRAID Technology. Through innovative software and hardware integration technology, it can be easily combined with Seagate Exos® 2X14. From the test results, you can see that compared with other commercially available 14TB hard drives and RAID solutions, GRAID SupremeRAID™ combined with Seagate Exos® 2X14 can provide users with twice the read and write performance under the same space and protection level.

GRAID Technology Inc. is headquartered in Silicon Valley, California with an R&D center in Taipei, Taiwan, and is composed of a dedicated team of experts with decades of experience in the SDS, ASIC and storage industries. Contact us to learn more: call 1 (866) GRAID-10, email info@graidtech.com, or visit graidtech.com today.