



## Leil Storage Partners with Western Digital to Deliver a Distributed File System Enabling Host-Managed SMR at Petabyte Scale without Cloud



### Highlights

- **Cost-Effective Storage:** Utilizing SMR and CMR HDDs for high-density, cost-efficient storage with Ultrastar Data60 and Data102.
- **Proven Performance for SMR drives** to deliver strong sequential workload performance, comparable to CMR drives.
- **Enhanced Reliability:** IsoVibe and ArcticFlow technologies boost Ultrastar Data60 and Data102 drive performance and longevity.
- **Data Integrity and Efficiency:** Leil Storage provides active archive storage with instant snapshots for data protection, immutability, and SMR support for optimized storage.
- **Seamless Scalability:** Scale effortlessly and add hardware without service disruption. Mix CMR nodes with SMR nodes and utilize drives of various capacities for flexible growth.

### Active Archive Challenges

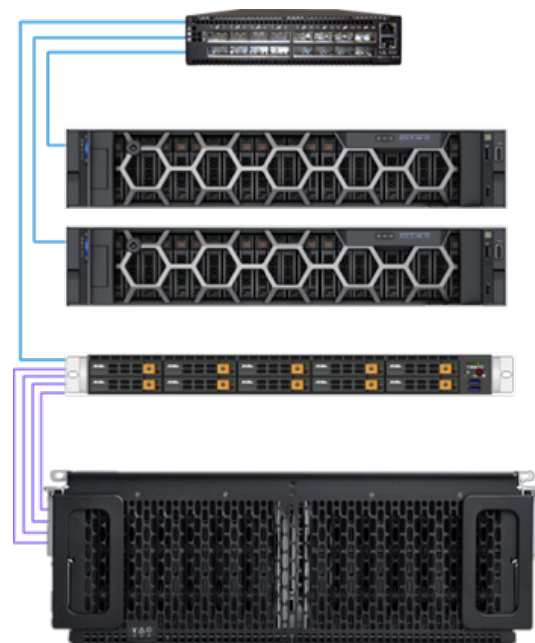
- **Actionable Data Needs:** Raw data archives now require fast access and rapid processing for immediate use.
- **Lack of Efficient Active Archive Storage:** Tape is too slow, and flash is too costly for archival storage needs.
- **High Energy Consumption:** Power demands increase with storage scale, raising costs and environmental concerns.
- **Costly, Disruptive Migrations:** Traditional storage upgrades and migrations often require downtime, risking data availability.
- **Scalability:** Expanding data volumes requires scalable storage without sacrificing performance or needing major reconfiguration.
- **Data Integrity and Immutability:** Protecting against data corruption, loss, or degradation is critical, especially in long-term storage systems.
- **Cost Management:** Large-scale storage requires balancing performance and capacity needs with budget constraints, especially when high-density storage is involved.

### Solution

Powering Western Digital Storage Platforms with Leil Storage delivers high-capacity, energy-efficient on-premises data storage solutions. From ensuring data integrity and immutability to enabling effortless hardware scalability, this solution empowers organizations to store and manage their data with confidence and agility.

Western Digital Ultrastar® Data60 and Data102 Hybrid Storage Platforms offers among the highest density HDD platforms with key hardware resiliency features such as IsoVibe™ and ArcticFlow™, and innovative usability features such as rack-mounted lid and hot swappable, toolless customer replaceable units (CRUs).

Leil Storage extends SaunaFS to support host-managed SMR drives, delivering a unique scale-out, software-defined storage solution that enables Western Digital SMR drives on-premises. SaunaFS is a robust distributed POSIX file system meticulously designed to revolutionize your storage solutions by offering unmatched efficiency, security, and redundancy. At its core, SaunaFS is a distributed file system primarily written in C++, inspired by the pioneering concepts introduced by Google File System. Leil Storage enhances SaunaFS with SMR support and greater energy efficiency for modern large-scale storage.

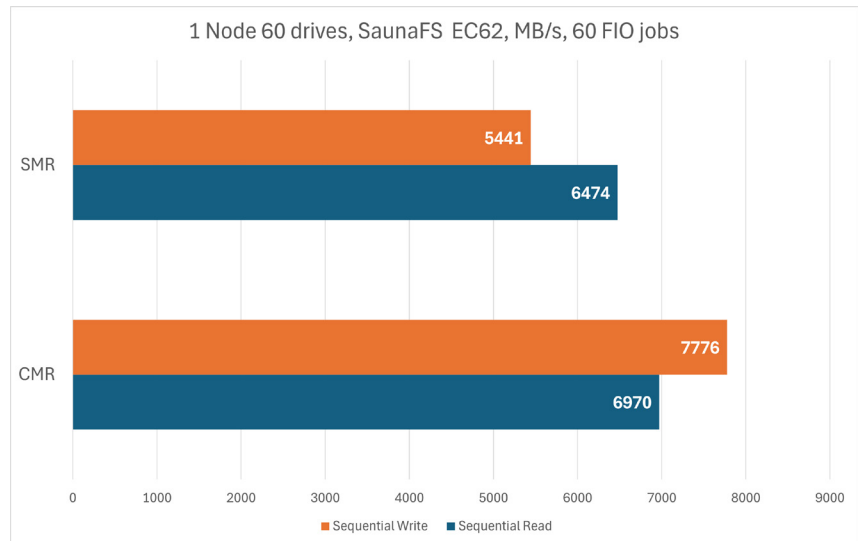


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The following graph displays the expected results for 60 FIO jobs using the following hardware:

- CMR Drives: Ultrastar HC560 (SAS)
- SMR Drives: Ultrastar HC650 (SATA)
- Platform: Ultrastar Data102 in a single IOM configuration was used for all tests

Based on the data shown, SMR drives demonstrate strong sequential workload performance, achieving results comparable to CMR drives. With sequential read speeds reaching 6474 MB/s and write speeds of 5441 MB/s, SMR proves to be an effective option for high-density storage. Although CMR drives perform higher overall, with 6970 MB/s for sequential reads and 7776 MB/s for writes, the close performance of SMR highlights its value for applications that can leverage sequential processing, making it a viable, cost-effective alternative for scalable storage needs.



The provided performance results for a single node can be extrapolated to larger setups with more drives introduced. Yield in near-linear growth in throughput and capacity for both read and write operations is expected proportionally to the number of drives and nodes added to the cluster. This predictability allows organizations to confidently project performance at larger scales based on these initial results

Leil Storage enables flexible storage configurations, allowing Ultrastar Data60 or Data102 populated exclusively with either CMR or SMR drives, to operate together within the same multi-node cluster. This flexibility is key for optimizing TCO over the cluster's lifecycle, supporting capacity expansion and seamlessly integrating the latest SMR and CMR HDDs into the existing cluster.

## SaunaFS Key Features

### Data Integrity and Efficiency

Reed-Solomon coding and data scrubbing ensure data integrity and smooth operation. SaunaFS enhances protection by adding a 4-byte CRC check to each block, safeguarding data from alteration. Regular integrity checks and advanced coding keep data safe and error-free.

Copy-on-Write Snapshots provide a historical record of your files, ensuring they remain unaltered. Snapshots allow quick, easy recovery from accidental deletions or data corruption while optimizing storage space and cost by storing only changes.

### Seamless Hardware Refresh and Addition Without Downtime

Upgrading or adding new hardware can be done seamlessly, without interrupting data operations, ensuring continuous service. This flexibility allows organizations to scale their storage infrastructure effortlessly to meet growing data demands.

This solution supports drives of varying capacities to coexist within a single node and nodes of different technologies (SMR and CMR) to exist within a single cluster. By combining CMR nodes and SMR nodes within Leil Storage clusters, organizations can achieve flexible growth while protecting their existing investments.

### UltraSMR Technology support

Western Digital UltraSMR technology extends the capacity advantage of SMR HDDs well before the same capacity is available on CMR drives.

Western Digital's UltraSMR is based on a combination of recording subsystem technologies, advanced large block encoding, increased parity formats in the recording, the addition of OptiNAND™ as an enabling technology, and proprietary firmware and algorithms to make these all work together. The result is a capacity and TCO advantage that is driving user decisions towards SMR HDDs.

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## Ultrastar Data60 and Data102 Platform Features

### Ultrastar Data60

- Up to 60 Ultrastar HDDs (SAS or SATA)
- Up to 1.92 PB<sup>1</sup> of raw HDD storage
- 4U form factor



### Ultrastar Data102

- Up to 102 Ultrastar HDDs (SAS or SATA)
- Up to 3.26<sup>1</sup> PB of raw HDD storage
- 4U form factor



## Daisy-chaining for High Capacity

Up to 4 units may be daisy-chained for a total raw capacity of 6.24 PB (Data60) or 10.6 PB (Data102)

## Innovations for Performance and Reliability

**IsoVibe:** Patented technology improves isolation of vibration propagation both to and from each individual drive to help maximize performance even in heavy workloads.

**ArcticFlow:** Improves cooling via discrete airflow channels that allow cool air to reach more components within the system, improving cooling effectiveness that can improve drive reliability.

## Flexible

- Choose dual-port SAS for high availability or single-port SATA for low cost.
- Up to 12 x 24Gb/s SAS-3 host connections<sup>2</sup>.

## Designed for Serviceability

- Enterprise-grade redundant and hot swappable PSUs, IO Modules, and fans.
- Rack-mounted top cover for quick and easy service.

## Innovations to Deliver Performance, Flexibility, and Protection

Leil Storage with Western Digital Storage Enclosures deliver hardware performance and reliability with a powerful, highly versatile file system to enable scale, growth and management of your most highly valued asset: your data.

<sup>1</sup>One terabyte (TB) is equal to one trillion bytes. Actual user capacity may be less due to operating environment.  
<sup>2</sup>This solution was tested with 12Gb/s SAS host connections.

