

## Leil Partners with Western Digital to Deliver an HDD-native On-Premise Data Storage Software Enabling Host-Managed SMR at Petabyte Scale



### Highlights

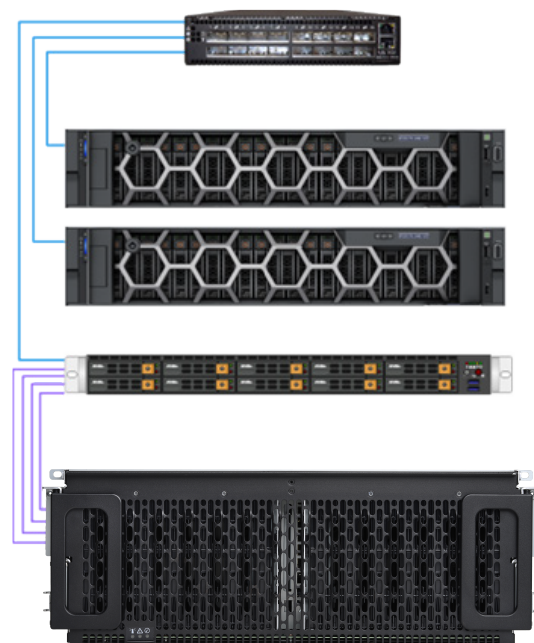
- **Cost-Effective Storage:** Utilizing SMR and CMR HDDs for high-density, cost-efficient storage with Ultrastar Data60 and Data102.
- **Proven Performance for SMR drives** to deliver strong sequential workload performance, comparable to CMR drives.
- **Enhanced Reliability:** IsoVibe and ArcticFlow technologies boost Ultrastar Data60 and Data102 drive performance and longevity.
- **Data Integrity and Efficiency:** Leil 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.

### Solution

Powering Western Digital Storage Platforms with Leil delivers large-capacity, high-performance and 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 offer 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 extends support to host-managed SMR drives, delivering a unique scale-out, software-defined storage solution that enables Western Digital SMR drives on-premises, meticulously designed to revolutionize your storage solutions by offering unmatched efficiency, security, and redundancy. At its core, Leil provides a distributed file system primarily written in C++, inspired by the pioneering concepts introduced by public cloud providers.



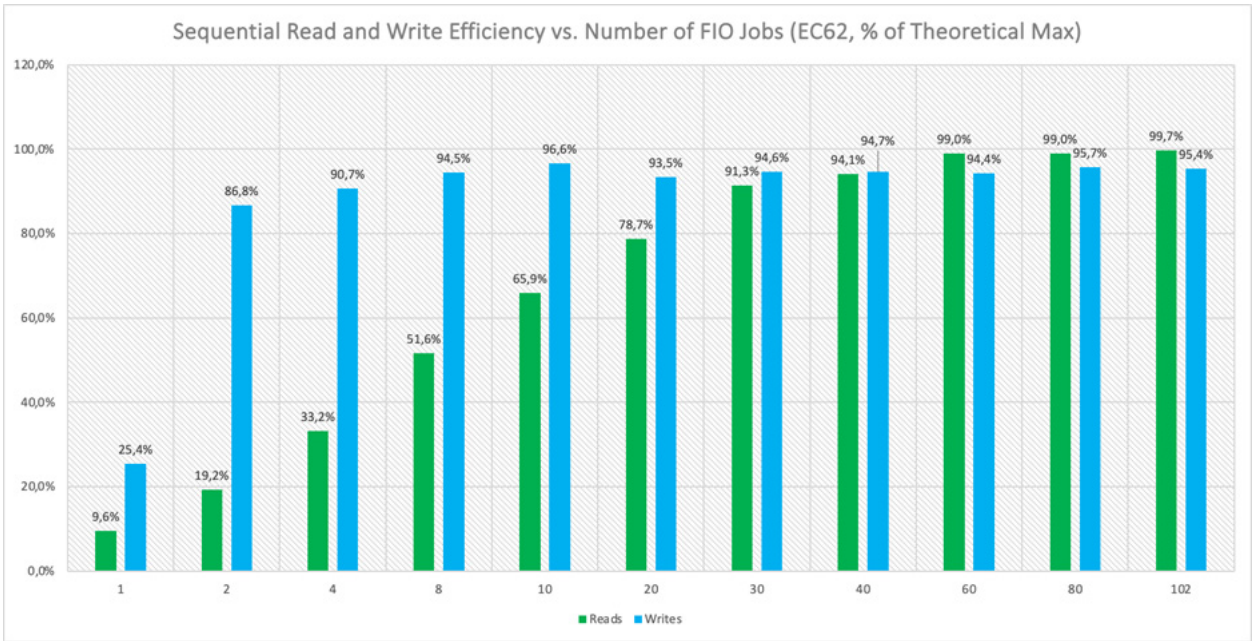
### Large Scale Storage Challenges

- **Actionable Data Needs:** Raw data archives now often require fast access and rapid processing for immediate use, e.g. for AI training.
- **Lack of Efficient Active Archive Storage:** Tape is too slow, and flash is too costly for most (active) 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.

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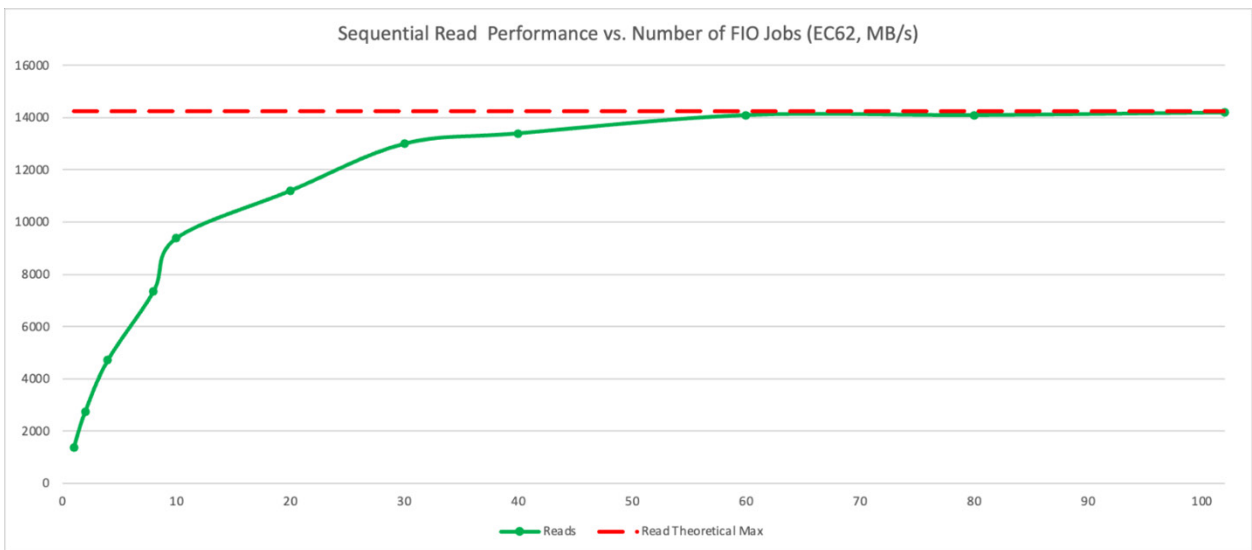
The following graph displays the performance results of various FIO jobs using the following hardware:

- SMR Drives: 30TB Ultrastar DC HC690<sup>1</sup> (SATA)
- Platform: Ultrastar Data102 in a single IOM configuration was used for all tests

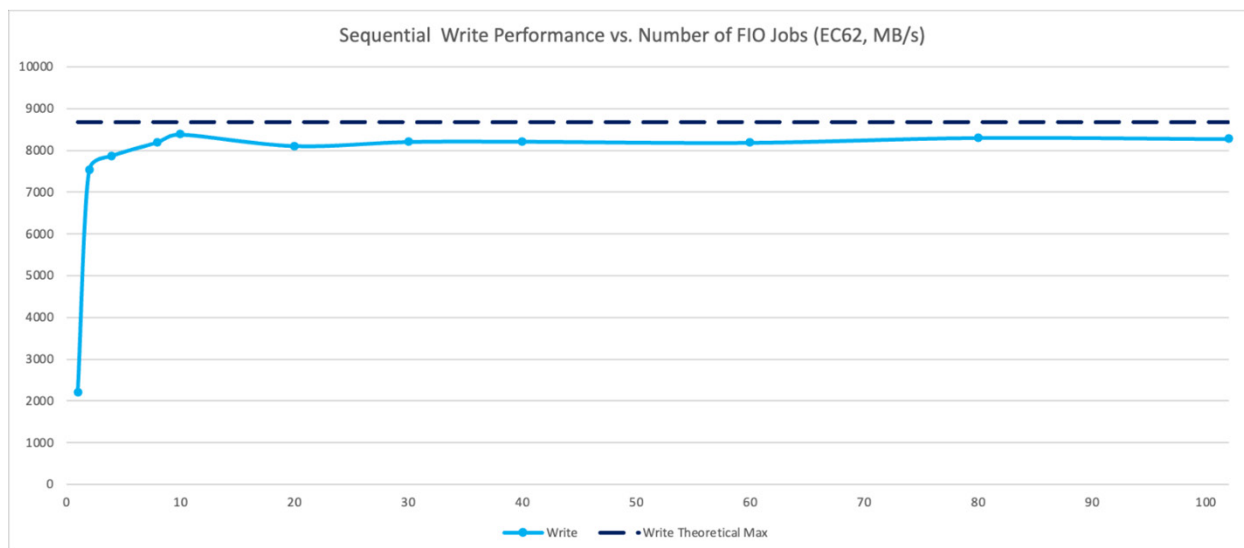


The data shows the efficiency of sequential read and write tests based on a given number of FIO jobs at a percentage of the theoretical maximum that can be produced. The more FIO jobs created, the more efficiently the system is able to perform, showing how having up to one job per drive is able to reach 99.7% of the theoretical maximum in reads and 95.4% in writes.

The read and write performance ceilings become more obvious individually with the following graphs.



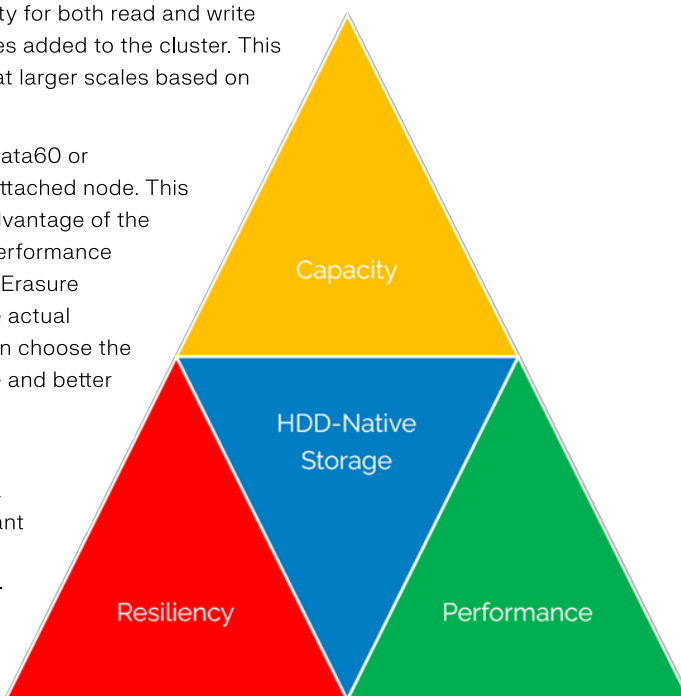
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The provided performance results for a single node can be extrapolated to larger setups with more drives introduced. Yield in near-linear growth in throughput and capacity for both read and write operations is expected proportionally to the number 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 enables large SMR storage configurations, allowing the Ultrastar Data60 or Data102 to operate nearly to the theoretical maximum with a singular attached node. This performance is key for utilizing SMR drives full potential, fully taking advantage of the cost- and capacity advantage they have over CMR drives. The lower performance numbers on sequential writes compared to reads are due to the use of Erasure Coding which results in additional data (erasures) written to drives. The actual number of bits written to the drive is higher. With Leil Storage, users can choose the code rate of Erasure Coding to balance between better capacity usage and better data resilience.

Leil supports all capacities of HM-SMR drives, including drives with variable capacities. It also supports the use of CMR drives, as well as a mix of CMR and SMR drives and mixed capacities. It incorporates instant copy-on-write snapshots to ensure immutability and integrity of data while also optimizing storage space by only storing changes with copy-on-write mechanism. Leil supports NFS and SMB and comes with a native Windows® and Linux® client. The next release provide an S3-compatible object storage interface designed for scalability, resilience, and simplicity. It enables organizations to store, manage, and access unstructured data using the familiar Amazon S3 API, ensuring seamless integration with backup, analytics, and other applications. In the future, additional features such as Autonomous Drive Regeneration (ADR) / RDP (Repurposing Depopulation) will be supported to reduce system downtime due to maintenance, enhance the life cycle of drives, and decrease the risk of data loss. Leil will also allow drives to be powered off if they contain cold and not often accessed data to reduce the power consumption. An open-source version with reduced feature set and support for CMR drives only is available as well.



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## Ultrastar Data60 and Data102 Platform Features

### Ultrastar Data60<sup>2</sup>

- Up to 60 Ultrastar HDDs (SAS or SATA)
- Up to 1.8 PB<sup>3</sup> of raw HDD storage
- 4U form factor



### Ultrastar Data102<sup>4</sup>

- Up to 102 Ultrastar HDDs (SAS or SATA)
- Up to 3.06<sup>3</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 7.2 PB (Data60) or 12.24 PB (Data102)

## Innovations for Performance and Reliability

**IsoVibe:** Patented technology improves isolation of vibration propagation both to and from each individual drive to help maintain 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>5</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 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> 30TB Ultrastar DC HC690 SMR HDDs were used in the configuration of these enclosures.

<sup>2</sup> For more information related to Ultrastar Data60 see: <https://www.westerndigital.com/products/data-center-platforms/ultrastar-data60-platform?sku=data60-one-pt-eight-pb>.

<sup>3</sup> One terabyte (TB) is equal to one trillion bytes and one petabyte (PB) is equal to 1,000 TB. Actual user capacity may be less due to operating environment.

<sup>4</sup> For more information related to Ultrastar Data102 see: <https://www.westerndigital.com/products/data-center-platforms/ultrastar-data102-platform?sku=data102-three-point-zero-six-pb>.

<sup>5</sup> The solution was tested with 12Gb/s SAS host connections.

