Enterprise iSCSI Flash Storage with BackDating™ and In-line, In-memory Deduplication and Compression

Reduxio delivers flash storage solutions based on Intel® Xeon® Processor E5-2600 v3 family that reduce complexity while increasing performance and keeping costs down.

"We do lots of in-house application development. When databases failed, it used to take hours to get them back to work. Now, with Reduxio, it’s immediate. The fact that we don’t need to use snapshots anymore sealed the deal for us."

Logan Lemming, Senior Director of IT, EDCOE

Unprecedented Storage Performance Powered by Intel® Xeon® Processors

New trends in enterprise IT are transforming customer requirements. As a direct result, the storage market responded by introducing new, flash-based solutions. While these new storage solution offerings provide many benefits, existing approaches to storage force customers to either compromise cost or performance.

Built using the Intel Xeon processor, the Reduxio HX550 enterprise flash storage system—based on the TimeOS™ architecture—is, for the first time, able to perform in-line, in-memory deduplication and compression and real-time tiering between media types. The HX550 accelerates application performance and increases storage efficiency, and Reduxio’s revolutionary BackDating™ technology recovers data to any second.

Reduxio’s Tier-X™ continuous tiering capability is ideally positioned to benefit from new media types such as the new Intel® Optane™, based on the 3D XPoint™ memory technology, to provide breakthrough performance and efficiency, and new data management capabilities beyond what is available today.

New Dimensions to Storage Challenges

The constant increase in demand for storage capacity has fueled the growth of the external storage market since its inception. But satisfying capacity requirements alone is no longer sufficient. As compute, storage, and networking resources become increasingly consolidated and virtualized, customers must look for storage solutions that can:

- **Accelerate Application Performance**
  
  Consolidation of many applications and virtual machines onto a single storage platform results in a highly randomized workload, creating a bottleneck for legacy systems. Increasing performance in these systems requires adding or upgrading hardware. Application performance must be able to increase without a proportional increase in the cost of storage infrastructure.
• **Reduce Application Recovery Times**
  Traditional storage snapshots only provide a limited number of recovery points, leaving applications at risk most of the time. Applications and data should be recovered in a shorter time and with finer granularity, reducing the overall downtime.

• **Store More Data within Existing Stagnant Budgets**
  Growing data storage requirements are only made worse by the fact that data is copied multiple times (virtual machine clones, application copies, etc.). Storing such a vast number of copies is wasteful and can become an administrative nightmare. To overcome this challenge, data should be stored more efficiently on storage systems by storing only the most accessed data and using data reduction techniques—without compromising performance.

**Transforming the Storage Market with Flash Arrays**
These challenges have not gone unnoticed by the industry. The adoption of flash as the new primary media in enterprise storage systems has alleviated some of these challenges and has been a driver of change in the storage market.

In other words, a massive shift is occurring—from disk-based architectures to architectures optimized for flash. According to research from International Data Corporation (IDC), the emergence of more robust storage solutions—that can handle a wide range of complex workloads—helped boost the global flash-based array market to USD 11.4 billion in 2014 alone.

However, not all flash-based systems are alike. In fact, different architectures have been designed to leverage flash.

**Typical Challenges**
• **All-flash arrays** are designed to support a single type of media. Systems using all-flash architectures provide high performance but typically provide only a limited capacity.

• **Post-process tiering hybrid systems** are retrofitted to incorporate flash by examining IO patterns over a period of time, and heuristically moving data on a scheduled basis, based on the estimate. Since the system only tiers data periodically, and is basically guessing what data will be hot in the future, often the hot data ends up on disk and cold data on flash. The result is that these systems deliver only marginal performance improvements over disk-based systems.

• **Caching hybrids** use flash as a cache for a pool of disks, either as a read and write cache or solely as a read cache. Performance is higher than post-process tiering systems. However, because flash is used as cache, rather than storage, it does not contribute to the overall capacity of the system, making these caching hybrid systems more expensive than post-process tiering hybrid systems. In addition, the caching architecture is not the optimal architecture for systems that have tiers of different solid-state media, or for a system that has more than two tiers.

To summarize, existing approaches to implementing flash require enterprise customers to compromise on either cost or performance. In addition, storage efficiency and data management challenges are often overlooked. A new approach is needed.

**The Reduxio TimeOS™**
Reduxio’s storage systems are based on the revolutionary TimeOS that combines fine-grained continuous and automatic tiering. Plus, they are equipped with a real-time, in-line, in-memory data reduction engine, with an innovative metadata format that delivers unparalleled performance, and storage efficiency with innovative data management capability.

**NoDup™**
NoDup provides global always-on, in-line deduplication and compression across all media tiers in a system. Data reduction is applied the instant data comes off the wire and works across volumes, clones, and history. This results in unparalleled storage efficiency and density. Storage cache is deduped and compressed, while subsequent storage on tiers and movement of data between tiers in the system also occurs in optimized form. Overall, Reduxio TimeOS maximizes the utilization of flash by storing only the most-accessed parts of the data in optimized form.

**Tier-X™**
Tier-X provides the cost benefits of tiering and the performance benefits of caching. Fine-grained, continuous, and autonomous tiering of optimized data ensures that the system is reactive to the changing needs of applications. Multi-tier support and media awareness ensure that the system can efficiently leverage multiple media types, letting it stay relevant as new media types become available in the future.
BackDating™

9:26:03  
9:26:04  
9:26:05

BackDating obsoletes legacy snapshot technology and allows users to instantly recover applications and data to any second, consistently across all hosts and volumes. BackDating works like a continuous data recorder, providing history that is always available for recovery, and space consumption is kept to a minimum since data and history are globally deduped and compressed. BackDating provides administrative peace of mind, with data protection that is always there when you need it, without the management overhead that’s typically required by backup and other recovery solutions.

Intel Xeon Processor E5–A Breakthrough in Storage Capabilities

Performing deduplication and compression of data blocks in real time for random workloads is highly resource-intensive. Large amounts of processing power and memory space are required to process incoming data within a split second, while delivering submillisecond response times for host requests. Until recently, it was impossible to build such a storage system cost effectively.

The introduction of the Intel Xeon Processor E5–2600 v3, in its various generations, offers Reduxio tremendous processing power that enables the Reduxio HX550 to achieve wire-speed low latency IOPS that compete with traditional and all-flash systems alike in a cost-effective way.

Intel’s unique microarchitecture—including large on-die L1, L2, and L3 caches and highly optimized branch prediction and memory bandwidth—enables the Reduxio NoDup engine to calculate hashes and compress data in-line and in-memory and analyze the heat of data blocks in real time. More specifically, the new Intel® Advanced Vector Extensions (AVX) instruction set with wide integer operations is used to accelerate the secure hash implementation that is core to the Reduxio NoDup technology. In addition, Intel® SSE3 extension is used to accelerate the media redundancy calculations.

Leveraging power efficiency technologies such as the Intel® Turbo Boost, the Reduxio solution is able to provide a very low watts-per-IO rating compared to other disk-based, hybrid, or all-flash systems in the market.

An optimizing software stack cannot be developed without a comprehensive code optimization software. Intel® VTune™ Amplifier 2016 is used in ongoing tuning to increase the Reduxio TimeOS performance while further lowering the latency.

The Reduxio HX550 Delivers a Great Value for Customers

The Reduxio HX550, based on the TimeOS and the Intel Xeon Processor E5–2600 v3 product family, is an iSCSI-based enterprise flash storage that combines both solid-state and cost-effective disk drives, and provides groundbreaking performance, efficiency, and data management capabilities. The Reduxio HX550 provides great value for enterprise customers:

- It accelerates application performance by up to 3x, compared to similarly priced systems in the market.
- It provides up to 4x more effective capacity than comparable solutions.
- It lets users recover VMs and databases from any second in the past without the capacity, performance, and management overhead of creating and managing traditional snapshots, schedules, and consistency groups.
- It eliminates complexity: Fabric, capacity, snapshot, and consistency group management are no longer needed.
- Installed and operational in 15 minutes, Reduxio Storage eliminates much of the complexity in managing a storage system.
- It provides automated, remote service and support with a cloud-based proactive storage management and monitoring infrastructure that automatically collects and processes data reported from Reduxio systems and predicts and detects customer issues.

To find out more about Reduxio’s unique technology and products, visit reduxio.com.

To learn more, visit intel.com/storage.