ESG Lab Spotlight

Reduxio HX550: Simple, Efficient, Hybrid Flash Storage

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Abstract: *ESG Lab validated the Reduxio HX550 hybrid flash array with a focus on ease of use and performance. The HX550's innovative architecture can bring the performance advantages of flash to more of your workloads; in addition, the Backdating feature serves as an enterprise-class "time machine," enabling instant restore to one-second recovery points without using snapshots.*

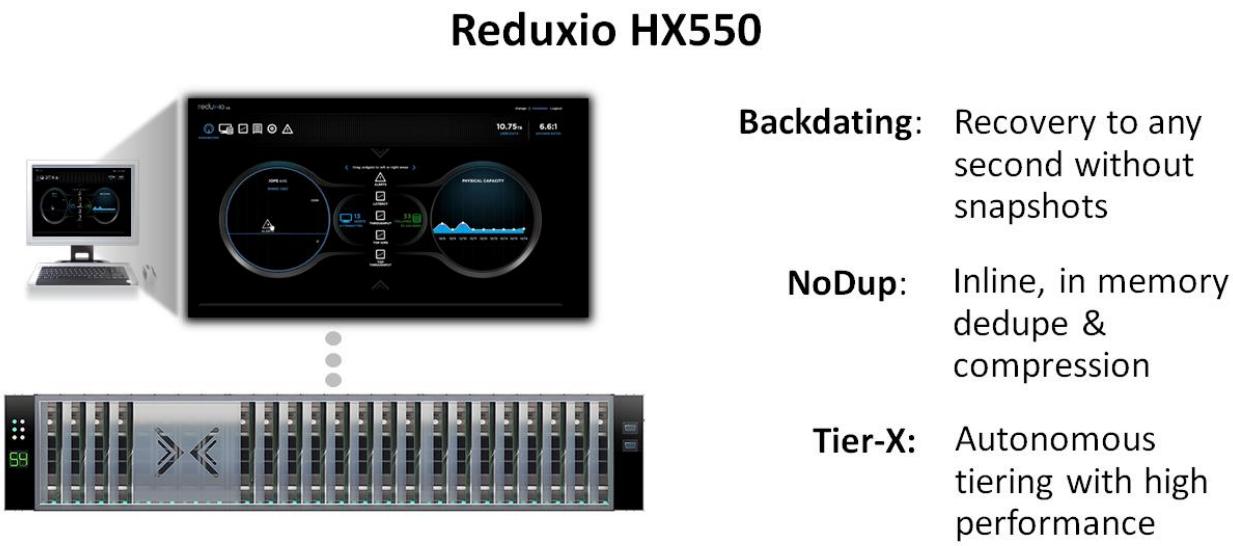
The Challenges

There is no room for compromise when you're talking about data storage, protection, and access. Data drives every business process, from R&D through production applications to analytics that help design your future. Unfortunately, many storage solutions force a tradeoff: performance vs. cost savings; protection vs. capacity; features vs. simplicity. Flash technology can dramatically improve performance, but the cost of all-flash arrays can be prohibitive. Snapshots can provide recovery points, but cannot be taken often enough to ensure a full recovery; they also take up growing amounts of storage space and management effort. New storage features can be helpful, but many organizations fail to take advantage of them because they add complexity.

The Solution: Reduxio HX550

Reduxio offers a hybrid flash array that can eliminate the tradeoffs. The HX550 was built for both performance and efficiency. Reduxio's TimeOS storage operating system makes it extremely simple to manage, with automated efficiency and performance features that are always on and don't require configuration. Volumes are thin provisioned, so storage space is consumed only as needed.

Figure 1. Reduxio HX550



Source: Enterprise Strategy Group, 2016.

Reduxio's storage systems can be managed by CLI or using the web-based Reduxio Storage Manager from any desktop, laptop, or mobile device, and the interface is touch-ready. The GUI is extremely simple to use, and was built by designers from the video game industry. By dragging and dropping from the center icons, administrators can create a dashboard tailored to display numerous metrics such as storage capacity, performance, alerts, etc. The figure at left shows a capacity chart in the right-side circle, and the administrator's pointer in the process of dragging the ***Alerts*** icon for display in the left-side circle. Note that the numbers of connected hosts and assigned volumes are also displayed in the center of the dashboard.

Dashboard

Each HX550 has dual controllers for high availability; redundant power supplies with battery backup; eight 800GB SSD drives and 16 2TB SATA drives; four 10GbE SFP+ iSCSI ports for data; and two 1GbE copper ports for system management. Several features that are built into TimeOS deliver high performance and efficiency while making the system extremely simple to use. They include:

NoDup. Reduxio calls this feature NoDup because no duplicate data is stored on any media in the system. As data enters the array, it is chunked into 8K blocks and deduplicated, and the unique blocks are compressed—all in real time. Data after deduplication and compression is stored in the system's DRAM cache. NoDup is global and always active, so no duplicate data is ever stored across SSDs or HDDs, or across volumes, clones, or historical data saved for data recovery. This makes the system extremely efficient. Because incoming host writes are immediately acknowledged and the data is deduped and compressed, more data can enjoy the performance advantage of SSDs. Reduxio reports that with its 4:1 average data reduction ratio, the 6.4TB SSD tier can hold most active enterprise data sets, which are typically around 10 TB. In addition, NoDup can eliminate the storage bottlenecks that normally occur due to the IOPS density that consolidated VMs send to disk. In the case of multiple hosts' reads to the same data, Reduxio only loads a single data copy into the memory cache because of global deduplication; other solutions load multiple copies to be read even if the data is deduped. This is a huge benefit for virtualized environments, enabling improved boot storm performance since the bulk of Reduxio reads will come from RAM, and leaving SSD and HDD free for other I/O.

Tier-X. This automated, block-level tiering across SSD and HDD is always on. Deduplicated and compressed data is stored first on SSD, and as that fills, Tier-X algorithms identify the less-used data, which is then automatically moved to HDD with no administrative intervention. Reads and writes are always "flash-first" for consistent low latency. Reduxio also optimizes writes to HDD to speed later retrieval. NoDup data reduction minimizes data movement between tiers, enhancing performance and storage media durability.

Tier-X

Backdating. Backdating leverages Reduxio's innovative metadata representation, in which the core metadata tracks location and time. This enables data recovery back to any second in the past, remaining consistent across hosts and volumes. It does this without using snapshots, which would need to be scheduled and managed, leaving vulnerability gaps and taking up storage capacity. Backdating is always on—the only setting administrators manage is retention time, so that they can balance protection and capacity needs. The HX550 keeps track of data location and timestamps, like a data recorder, so administrators can revert or clone volumes back to any point in time. Clones are independent of parents; the parent can be deleted without impacting the clone. Simple Bookmarks can be used to contextually label recovery points, such as a point in time prior to an application update.

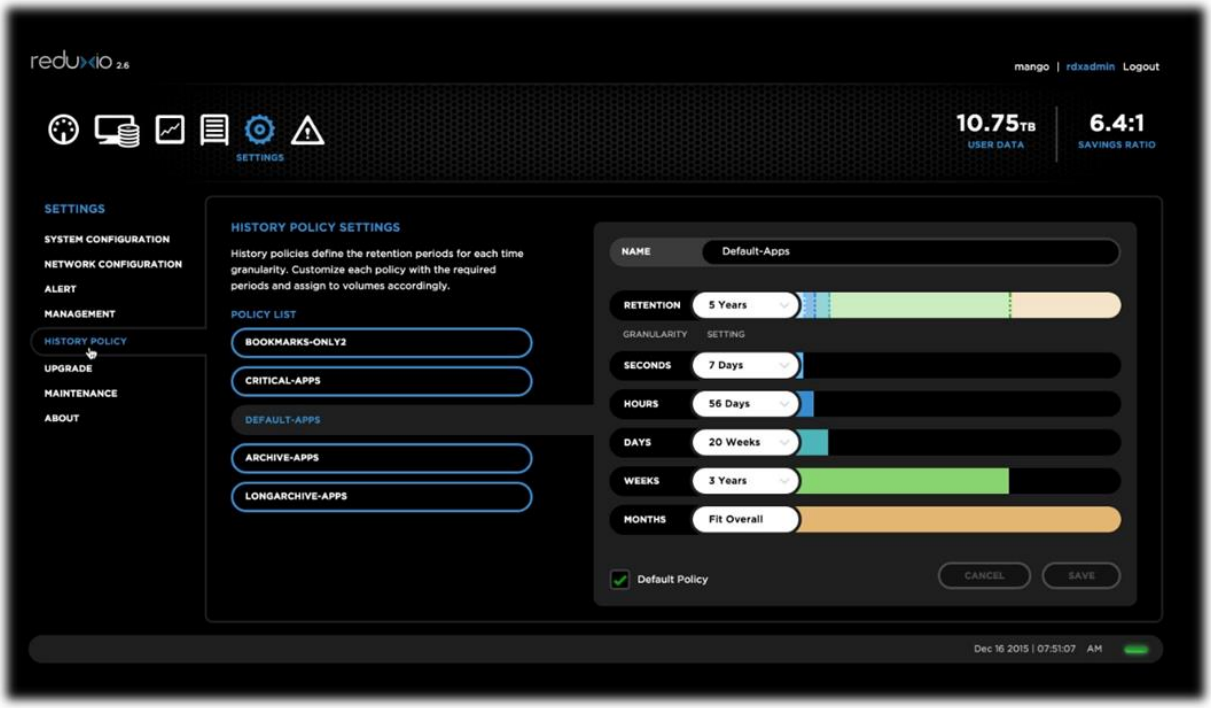
Native path failover and load balancing are supported. Reduxio also offers StorSense, a cloud-based automated service and support solution.

ESG Lab Testing

ESG Lab conducted remote testing of Reduxio HX550 management features and audited performance tests. We began with an evaluation of system ease of use, starting with the initial setup. Reduxio systems can be up and running in 15 minutes after unboxing. Setup procedures are simple, requiring basic information entry such as IP addresses on several start-up screens, and taking less than five minutes.

Next, we explored ease of management. We added a host by selecting the ***Hosts and Volumes*** icon, selecting ***Create Host***, inserting the IQN, and naming the new host *esg_host*. Next, we created a new 1TB volume and named it *esgvol1,* using the previously defined history policy named ***Default Apps***, and configured a 4K block size. Figure 2 shows the ***Default Apps*** History Policy settings. ESG Lab noted that administrators can configure the total retention time as well as the Backdating recovery point granularity by time. This example defines a five-year total retention time, plus retention of recovery points to every second for seven days, every hour for 56 days, every day for 20 weeks, every week for three years, and as many monthly recovery points as the system can store. This capability enables the flexibility to optimize recovery points as well as capacity growth on a volume basis.

Figure 2. History Policy Settings



Source: Enterprise Strategy Group, 2016.

Next, we opened *esg_host*, searched for the new *esgvol1* volume, and assigned that volume to that host by simply dragging and dropping it to the available space on the host screen (see Figure 3). The process was extremely simple, fast, and graphically intuitive, and can be executed from a desktop, laptop, or mobile device. It is notable that administrators can use mobile devices for actual management of Reduxio systems, not just monitoring.

Figure 3. Assign Volume to Host

Source: Enterprise Strategy Group, 2016.

ESG Lab also created a clone by selecting *esgvol1* from the ***Hosts and Volumes*** tab, clicking the ***Clone/Bookmark*** button, selecting a point in time from three minutes ago, naming it *esgvol1C1*, and clicking ***Clone***. Once the clone was created, clicking on the cloned volume displayed details such as when the clone was created, from what volume it was cloned, and how long it was Backdated to. ESG Lab also selected *esgvol1* (the parent of the clone) and deleted it, then validated that the clone remained intact and available.

Performance

ESG Lab audited Reduxio performance testing that was conducted using a workload generator designed to mimic real-world applications and measure storage performance (IOmeter). Metrics included I/O per second (IOPS), throughput (MB per second), and latency (average response time).

We performed a thorough analysis of numerous tests focused on workloads such as file and web servers, online transactional processing (OLTP), Exchange, log files, virtual desktop infrastructure, and backup. While an in-depth accounting of the results is beyond the scope of this paper, a few details are worth pointing out. First, we validated more than 126K read IOPS from cache and as high as 114K IOPS when performing random 4k reads from the SSD tier. In addition, we validated more than 88K IOPS for a mixed read/write OLTP workload profile. IOPS and throughput scaled as expected for all workloads.

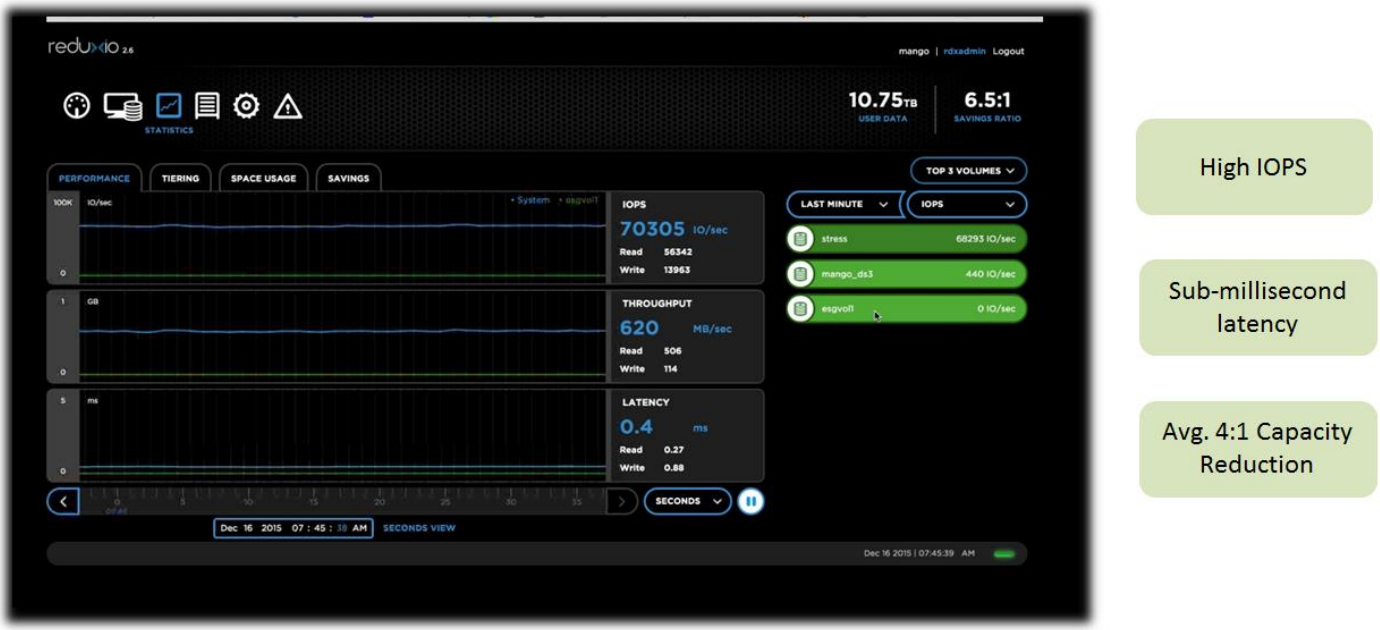
ESG Lab's experience has provided us with a good understanding of storage performance for a wide range of solutions. Based on our analysis, the Reduxio HX550 was able to far exceed the performance capabilities of traditional midrange and hybrid flash storage solutions. In addition, the 126K IOPS of the Reduxio solution is close to being on par with all-flash arrays for certain workloads.

While IOPS is a helpful metric, perhaps the most important one is latency, which measures the application performance that users experience. Our analysis revealed consistent low latency with the Reduxio HX550, in most cases less than one millisecond (ms). At this level, users would experience no delays in application performance. (For a comparative example, Microsoft recommends acceptable performance for Exchange at less than 20 ms to ensure that users experience no delays.)

In summary, ESG Lab validated consistent low latency and high IOPS based on Reduxio's performance testing, as well as sufficient headroom to support activity bursts without interruption.

The Reduxio HX550 GUI enables administrators to view performance very clearly. Figure 4 shows the ***Performance*** tab under the ***Statistics*** icon from a portion of our demo. This view shows overall system readings of more than 70K IOPs, 620MB/sec throughput, and overall latency of 0.4 ms. Separate read and write statistics are listed as well. In addition, listed in the upper right corner are the current amount of user data (10.75 GB) and the current capacity savings ratio (6.5:1).

Figure 4. Performance Tab



Source: Enterprise Strategy Group, 2016.

Why This Matters

The Reduxio HX550 offers excellent performance. Testing using simulated workloads demonstrated high IOPS along with low latency for the typical target workloads such as OTLP, file servers, and web servers. While performance metrics are workload-dependent, ESG Lab validated greater than 126K IOPS and sub-ms latency for real-world workloads. It should be noted that HDD latency will also improve as the HX550 learns the workloads in play and promotes data to SSD.

It is important to note that not all IOPS are the same. Reduxio delivers space-efficient, fully protected IOPS, due to the always-on NoDup capacity reduction and the ability to recover to one-second granularity. For an accurate comparison, another system would need to report IOPS while also running deduplication and taking snapshots continuously. In the final analysis, Reduxio offers fast performance for real-world workloads with capacity efficiency and simple management—customers gain the benefits of saving money, time, and capacity.

The Bigger Truth

Storage tiering is a great way to balance high performance and cost efficiency. Few organizations have the need—or the money—to run *all* of their workloads on SSD, so regardless of its improving economics, SSD will continue to share the stage with spinning disk. There are plenty of hybrid arrays out there, so what makes Reduxio's solution different?

First, the architecture. The Reduxio HX550 is a hybrid flash array built from the ground up for solid-state, instead of bolting SSD onto a traditional array. Also, SSD is not limited to usage as a cache; instead, all SSDs and HDDs make up the usable capacity, with the TimeOS operating system continually and automatically moving data between the tiers.

Second, the features that TimeOS and the metadata enable. These features are always on and require no configuration, dramatically simplifying management.

- *Backdating* turns data recovery management upside down—administrators don't have to worry about protection until they actually need to recover data; they simply "clean up the past" instead of having to plan for the future. It's like having space-efficient, continuous data protection and instant restore without the complexity and overhead. There are no snapshots to create and manage, and all hosts and volumes are consistent to a point in time, so administrators don't worry about dependencies or troubleshooting because of inconsistent snapshot schedules.
- *NoDup* is designed for active, primary data, bringing users both high performance and low latency. In contrast, some storage solutions offer deduplication and compression only for non-primary data because of the performance hit they create.
- *Tier-X* is continuous tiering that moves colder data to HDD automatically. The size of the SSD tier combined with capacity reduction enables most enterprise workloads to remain within SSD, delivering fast performance.

All-flash arrays are expensive, and adding small amounts of flash for only portions of your data reduces its benefit. But if you are in the market for a midrange array or a caching hybrid, Reduxio is well worth a look. The amount of additional hardware you would need with a caching hybrid to get the IOPS and latency that Reduxio delivers makes the difference very clear. With the Reduxio hybrid array, the combination of NoDup and Tier-X effectively expands your SSD tier, delivering "flash-first" performance for the vast majority of your data at the cost point of a hybrid array.

ESG Lab was impressed with the HX550. We validated consistent low latency and high IOPS, the tremendous benefits of Backdating, NoDup, and Tier-X, very simple management, and a slick GUI. It's early for Reduxio, as this is its first product, and some enhanced features are not yet available—such as a REST API for application integration, multi-system management, and support for external storage tiers. But that doesn't take away from the core benefits that the HX550 provides: great performance, lower cost, and data recovery to any second without snapshots. If you are looking for high performance along with cost, time, and management reduction, Reduxio may just be the right solution or you.