STORAGE SWITZERLAND

Is it Time for Hybrid SSD RAID Controllers?

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Server side SSD caching solutions are popular implementation choices for performance upgrades because they allow users to put the performance right where it's needed, in the application server itself. For many of these use cases, a direct attached disk array is part of that infrastructure, which often means a RAID card is also installed on the application server.

In these implementations combining the flash and the RAID controller on the same PCIe card would seem to be a logical evolution of these technologies. LSI's Nytro MegaRAID Accelerator does exactly that, it combines a flash-based caching solution with LSI's industry-leading RAID technology to raise the bar for PCIe-based SSD solutions.

New class of RAID card

The Nytro MegaRAID Application Accelerator card is an MD2 low profile, x8 lane PCIe 3.0 RAID controller with up to 800GB of on-board NAND flash available for use as a read/write cache. It uses LSI's dual core ASIC RAID-on-Chip (ROC) controller, a proprietary technology that reduces system CPU and memory overhead while improving RAID performance and power consumption over traditional controller designs. Nytro MegaRAID provides 6Gb/s per SAS lane, supporting up to 128 devices with models ranging from 100GB of SLC up to 800GB of eMLC NAND flash per card.

LSI's flash products use the SandForce controller to provide enterprise-grade reliability and performance. It optimizes writes to the flash chips while managing wear leveling to enable the card's flash to perform writes for over 5 years, under typical loads. This distributed architecture leverages multiple on-board flash controllers to handle the garbage collection and other maintenance tasks required in flash storage devices without impacting system performance. Other non-enterprise products use a single processor for this flash management or they share the system CPU of the physical server that's hosting the application, both of which can cause performance degradation when under heavy loads.

Implemented by the card's ROC controller, caching software automatically moves hot data blocks into the on board SSD cache, improving performance in read-intensive applications up to 50x, compared with legacy, all-HDD storage systems. The Nytro MegaRAID card supports read, write-through, and write-back caching, enabling application performance improvement with an economical blend of both SSD and HDDs.

No drivers needed

There are a number of advantages that this integrated design can offer, compared with installing a flash card in a server or SSD into an existing array. First off, no special drivers are required, since the flash is behind the RAID controller. In the case of LSI, since their RAID controller is almost a de facto standard, essentially every operating system includes the supported drivers as part of the operating system distribution.

This means there's no need to qualify drivers with existing server platforms. It also simplifies implementation by eliminating the driver installation process altogether and reduces operational overhead by removing the need to update flash device drivers down the road.

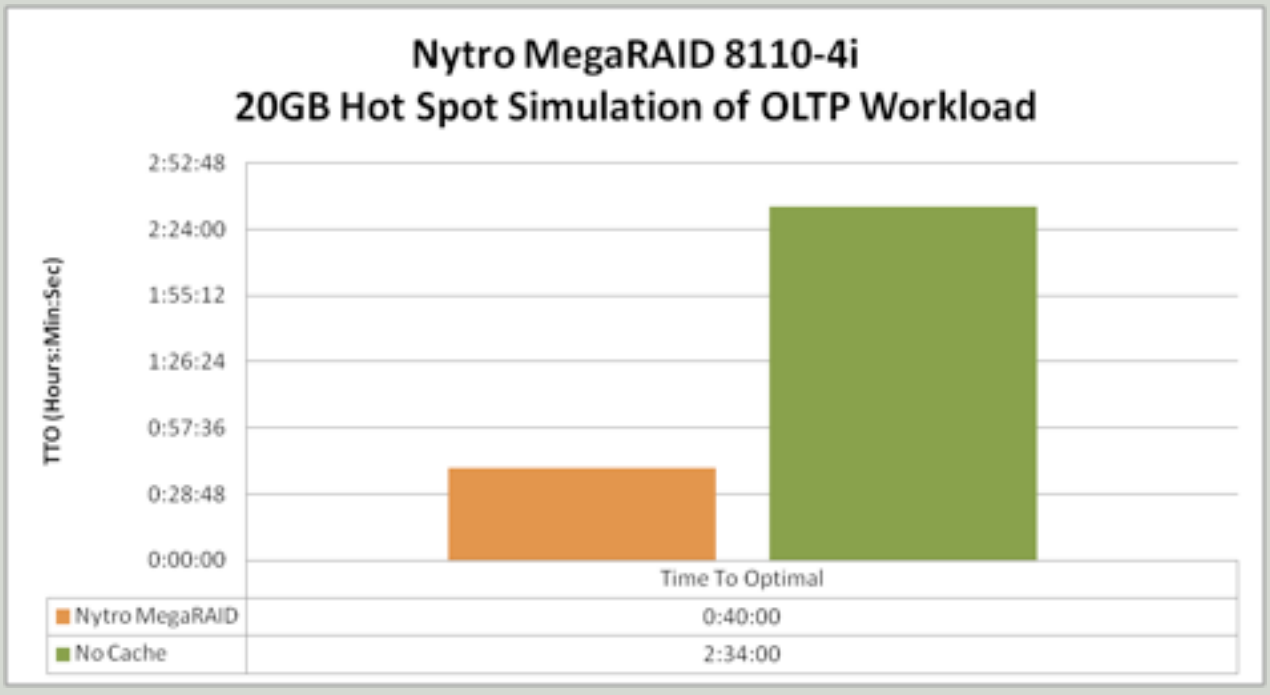
Caching reduces latency and increases TCO

SSDs are the favored technology to accelerate storage performance, a critical factor in enabling applications to be more responsive to users. Moving all data from HDDs to SSD is expensive, and often unnecessary. Most applications have "hot spots" of frequently accessed data. By caching only these areas on flash-based storage, HDDs can be retained for an economical storage solution.

Developing a robust and intelligent caching implementation is not an easy task. LSI has had several years of experience from its CacheCade product. Caching on flash is expected to mature and become pervasive, reminiscent of the evolution of deduplication. Picking a vendor with staying power is important.

Rapid RAID Rebuilds

When relying on storage to provide fast, dependable response to applications, a performance drop from an HDD failure and rebuild can be devastating. With multiple terabyte capacity drives, these rebuilds can go on literally for days, and all the while data on the array is vulnerable. With flash capacity available on the RAID card, Nytro MegaRAID can significantly improve the rebuild times by servicing most I/O requests out of the flash-based cache, reducing contention on the disk drives which are busy with the rebuild process. In a recent test, Nytro MegaRAID showed an almost 4:1 improvement in RAID rebuild time over the same workload and configuration without a cache. *(see Figure 1 below)*



Single vendor solution

With the same manufacturer for the RAID controller, the SSD card, the flash controller and the caching software, Nytro MegaRAID customers have a single contact for any problems that may come up with its implementation or use. This simplifies support issues and reduces potential down time, which can be critical in enterprise applications that depend on SSD performance to meet challenging performance service level agreements. Other manufacturers only provide part of this solution, which can leave the end user with final 'system responsibility' to make everything work together.

Enterprise expectations

NAND flash technologies first appeared in consumer products where the requirements for reliability and long life aren't as stringent as they are with enterprise storage. Enterprise users have a set of expectations that are quite different from the consumers who buy camera memory and thumb drives. They expect manufacturers to deliver well-designed products that are reliable and completely supported. LSI has been in the storage subsystem business for 25 years. They have the track record and resources to effectively integrate SSD, cache and RAID technologies and produce a solution like the Nytro MegaRAID Accelerator that meets the expectations of users in the enterprise space.

Storage Swiss Take

SSDs are becoming the industry-standard for accelerating performance, and caching solutions are emerging as a popular implementation of this technology to reduce TCO. Combining SSDs, caching software and the RAID controller on a single PCIe card is a logical evolution of these storage functions. To deliver this class of products and marry these technologies takes a company like LSI that's deep in storage technology at the subsystem level.