



SSD Hybrid Array Whitepaper

WHITEPAPER



With data performance demands growing at a phenomenal rate, it is becoming equally difficult for IT professionals to determine the correct solution for their performance needs. While solid-state drives (SSDs) have been available in the storage industry for years to provide high performance, their traditionally high cost and uncertainty in correct implementation has made them difficult to justify in many IT infrastructures.

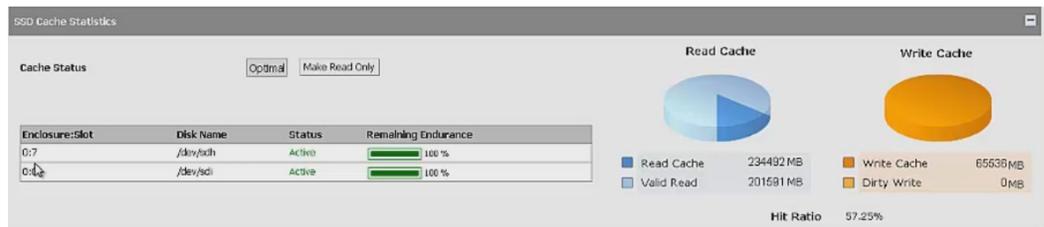
However, SSD Hybrid Arrays, such as the StorTrends 3500i, can alleviate many of the typical financial and implementation concerns by providing both solid-state drives and hard disk drives in the same array to allow for high performance, capacity and more economy than ever before. While several storage vendors offer SSD hybrid arrays, typically with either SSD Caching or SSD Tiering, The StorTrends 3500i combines the two to generate unparalleled performance.

SSD Caching

The StorTrends 3500i incorporates both read and write caching to SSDs to accelerate the overall performance of the array. With many companies moving toward Virtual Desktop Infrastructures (VDI), the need for higher performance data becomes greatly accentuated. VDI environments must prepare for numerous users simultaneously accessing the storage server. This occurrence, called a “boot storm,” creates a heavy I/O load that can easily overburden traditional spinning-disk arrays that lack SSD caching. While write caching allows for acceleration in all incoming I/O, the read cache stores the most frequently accessed data from the application to accelerate all outgoing I/O.

Since all incoming I/O is initially only residing on the write cache layer, the 3500i mirrors the write cache to another SSD drive to avoid the possibility of data loss. The 3500i also efficiently flushes the write cache to spinning disk to maintain capacity for additional incoming I/O. To achieve this, the StorTrends 3500i provides an ample amount of SSD cache capacity, as well as an intelligent algorithm that selectively migrates write cache data to spinning disks during less-active times to avoid deteriorating the array’s overall performance.

Since data in the read cache is also residing elsewhere on the 3500i, the read cache does not require the same level of protection as the write cache. While the 3500i will mirror data in the write cache for total redundancy, the read cache will contain zero data duplication in order to maximize the capacity of the SSDs.



SSD Cache Statistics Panel in the ManageTrends™ GUI

SSD Tiering

In addition to SSD caching, the StorTrends 3500i contains an SSD tier for unmatched functionality. Although several SSD hybrid array vendors do not support SSD tiering, it is an advantageous component for users looking to effectively tier their data. This is because the SSD tier allows for auto-tiering to migrate the user’s most critical data to the highly reliable, higher performance SSDs. As with SSD caching, the 3500i leverages an intelligent auto-tiering algorithm that promotes and demotes data between tiers during off-peak times to avoid depreciating the performance of the SSDs.

By combining SSD Caching with SSD Tiering within the 3500i, all incoming writes, frequently accessed data, and critical volumes will realize SSD performance – dramatically increasing overall performance and user experience. Although users will benefit from an SSD tier because of its role with auto-tiering between the SSD and HDD layers, perhaps the most compelling advantage of the 3500i SSD tier is its compatibility with the Automatically Tuned Volumes (ATV) feature.



Automatically Tuned Volumes

The StorTrends Automatically Tuned Volumes (ATV) feature – a subset of automated data tiering – allows users to customize the tiers on which their individual data volumes reside. For highly critical and frequently accessed data, an entire volume may reside on the SSD tier. However, to more efficiently maximize SSD capacity, users can allocate specific portions of each critical volume to reside on the SSD tier while the remainder is stored in the spinning disk tier.

ATV leverages data access pattern algorithms to ensure that the portion of each volume that resides on the SSD tier is the data that is most frequently accessed in order to capitalize on the SSDs' performance and capacity. ATV also allows users to manually tune the 3500i to their specific performance needs while permitting auto-tiering to effectively manage the data migration on a day-to-day basis. While many storage vendors include SSDs in hybrid arrays to market their performance benefits, the StorTrends 3500i intelligently auto-tiers data at the volume level to maximize both performance and capacity from the limited SSD footprint in hybrid array configurations.



Tier Policy Panel in the ManageTrends™ GUI



Compression and Deduplication

Compression and Deduplication are features utilized by several SSD hybrid array vendors to consume less capacity on the arrays. These features may appeal to some users who are conscious of their power usage or limited on rack space, since data is more effectively stored on the array which can result in a lower hardware footprint and therefore less power consumption. Although compression and deduplication certainly provide benefits for lower power consumption and more efficient space utilization, they can also prove to be detrimental to performance metrics.

Because inline deduplication immediately processes the incoming data, this can result in overall system overhead as the CPU and memory have additional processes to execute. When deduplicated or compressed data is accessed, the data must be rehydrated, which also creates further process overhead. Because of the consequential performance degradation associated with compression and deduplication, the StorTrends 3500i does not support them in order to provide maximum user experience.

Wear Leveling and TRIM Support

Along with SSDs have come several supplemental technologies to help increase the performance and durability of the individual drives. Most notable among these technologies is Wear Leveling and TRIM Support. Since NAND flash – the storage component of SSDs – inherently tolerates a certain range of writes, it is essential to have a wear leveling algorithm that evenly distributes the writes among the cells to increase the overall life of the drive.

Dynamic Wear Leveling, the most basic form of wear leveling, selects cleared cells with the least amount of erases for the drive's next write. Static Wear Leveling, however, selects the cell with the overall lowest amount of writes, regardless of whether or not it currently contains data. This additional step ensures that stale (or static) data cells are written to evenly among the SSD to significantly increase the lifespan of the drive. The StorTrends 3500i supports static wear leveling to maximize the lifespan of the SSDs and provide



customers with a lower total cost of ownership (TCO).

While wear leveling plays a crucial part in increasing the overall life of an SSD, TRIM is used to enhance the SSD's overall performance. Similar to HDDs, data that is 'deleted' is not actually erased from the drive, but is rather 'marked' for deletion by the operating system. The data that is marked for deletion is only deleted when the drive needs to write new data to that area. This can cause performance degradation on SSDs since a new data block that is attempting to write over a cell which is marked for deletion must first perform actions to delete the cell before the new data is written.

To resolve this issue, the TRIM command works with the operating system and is used to proactively erase data that is marked for deletion. More recently, some SSD vendors have embedded TRIM support within the SSD to avoid burdening the operating system. The StorTrends 3500i supports TRIM, and also utilizes it during off-peak times in order to create more capacity on the drive while eliminating latency during essential write cycles.

Cost

Price is intrinsically the common denominator in any evaluation of an SSD hybrid array's value. Since hybrid arrays employ SSDs to boost performance, they are typically more expensive than traditional spinning-disk arrays. However, the increasing supply of SSDs on the market continues to drive prices down, making it easier for SMBs and SMEs to justify purchasing a hybrid array through their sheer performance benefits.

While the capital expenditures (CAPEX) for hybrid arrays tend to be higher than traditional HDD arrays, they offer lower operating expenditures (OPEX) through decreased power consumption, rack space, and management hours. For example, a VDI environment that requires 30,000 IOPS could easily suit their needs with a single 3500i array, while it would take over one hundred 15k SAS drives in multiple arrays to meet the same need through HDDs alone.

Proposing the performance benefits of an SSD hybrid array alongside the



cost savings from lower operating expenditures is an important step when justifying one's implementation. However, perhaps the most thorough method of validating an SSD hybrid array is through a Proof of Concept (POC) unit.

While nearly every SSD hybrid vendor offers POC units in some form or fashion, many incorporate obligations to purchase or hefty installation fees. StorTrends offers zero-obligation POC units for prospective customers to prove effectiveness in the user's environment before spending any capital.

Conclusion

With multiple hybrid array vendors in the market today, it is important to understand the traits and characteristics that are unique to hybrid arrays – as well as the benefits they provide. While some products are mutually exclusive in their feature set, others offer a fully-inclusive architecture. StorTrends' storage architecture, called iTX, is embedded on all units and supports the all-inclusive feature-set, including ATV, Automated Data Tiering, Advanced Snapshots, WAN Optimization, and various other enterprise-class features.

While there are many hybrid array options on the market today, there are also many differentiators in the benefits that they generate. Ultimately, the StorTrends 3500i Hybrid Array – combining the astonishing performance of SSD caching and tiering with inclusive enterprise-class features – proves to be one of the most cost-effective and highest performing SSD hybrid models in the industry to date.



To Learn More

The StorTrends 3500i Hybrid SSD Array is an extremely cost-effective solution that provides increased reliability, efficiency, and performance, together with features that enable users to leverage the true potential of SSD technology.

American Megatrends provides services that range from no-cost, no-obligation storage needs analysis to the design and implementation of a custom storage solution incorporating a powerful and efficient hybrid SSD array. For more information on StorTrends solutions or to schedule a live demonstration, visit www.StorTrends.com or contact a StorTrends Sales Representative by calling 770-246-8600, or toll-free at 1-800-828-9264.