3PAR’s New Adaptive Optimization is like Butter

The initial hype around solid state drives (SSDs) is starting to settle down. The performance benefits, costs, “gotcha’s” and use cases of SSDs are now better documented which is resulting in new implementations of SSDs that emphasize their benefits while mitigating their drawbacks. A prime example of this is today’s announcement from 3PAR that adds support for SSDs to its InServ Storage Servers but more importantly provides users with a means to optimally and simply take advantage of them.

A recent trend (the last 3 – 6 months) in the implementation of SSDs is a move away from exclusively deploying SSDs as a permanent repository for application data. The reason behind this is simple. The majority of application data (90% to as high as 99%) does not require the performance of SSDs nor can businesses absorb the high cost associated with putting all of this data on SSDs.

This is leading to SSDs being deployed and managed as a cache within storage systems. Utilizing SSDs in this fashion only the most active application data is stored on SSD while less frequently accessed data is stored on more economical SATA, SAS or FC hard disk drives (HDDs). (I refer to FC and SAS as “more economical” in the context of being compared to SSD.)

This approach sounds appealing but the problems associated with deploying SSDs solely as a cache without any corresponding intelligence that controls data placement are numerous. These challenges include:

- Identifying and moving the most active application data from current HDDs to the SSD.
- Moving this data back off of the SSD to the HDDs as the
data becomes inactive.
- Scaling the SSD solution up as requirements change.
- Automating this data movement so it occurs without human intervention
- Providing overrides and policies so that some data movement is subject to human control.

In other words, implementing SSDs as a cache is fairly easy; **implementing SSDs so applications can effectively use them, costs are kept down, and performance is expedited for the widest range of applications is more difficult.**

It is these multiple concerns that 3PAR addresses with today’s announcement of the addition of SSDs and adaptive optimization feature to its InServ Storage Servers. Of the two announcements, it is 3PAR’s adaptive optimization feature that merits the most attention from end-users.

Adaptive optimization is to SSDs what butter is to lobster. You can certainly eat lobster without butter but butter is what gives lobster its succulent taste. Those deploying SSDs in a 3PAR system without adaptive optimization will have a similar experience – you cannot realize the full benefits of SSD.
optimization builds upon 3PAR's existing chunklets, dynamic optimization, regions and wide striping technologies.

- Chunklets are little, virtual pieces of physical disk.
- Regions are a narrow stripe of capacity across many chunklets and are assigned to logical disks that are used to create volumes.
- Wide striping takes advantage of these underlying “chunklets” and “regions” by spreading them across multiple disk drives in the 3PAR storage server to improve overall application performance even when lower performing disk drives are used.
- Dynamic optimization then moves regions associated with an entire volume to an appropriate tier of disk based upon their applications’ access patterns and usage.

Adaptive optimization builds upon these four technologies. Adaptive optimization monitors the I/O rates and activities of each specific region. The real advancement that adaptive optimization delivers is that it manages regions independently instead of as a group associated with a single volume.

This advancement enables 3PAR to place move data associated with a specific region on any tier of disk (SSD, FC or SATA) to a different tier according to that region’s performance characteristics. This creates the following new possibilities:

- **Availability of SSD to all application data on 3PAR volumes.** Because all 3PAR volumes are made up of regions, as soon as SSDs are placed in a 3PAR system and the adaptive optimization is turned on, all 3PAR volumes can be associated with the Adaptive Optimization profile and have access to the SSD drives.

- **Selective allocation.** Just because SSDs are installed on the InServ Storage Server and adaptive optimization is turned on does not mean a volume gets unfettered access to the SSDs. Administrators can set up policies that
control when and how much application data on a volume can reside on the SSD and they can even prohibit certain volumes from storing any data on the SSDs at all.

- **Controlled data movement.** Using SSDs as a cache sounds appealing until one considers all of the data movement that needs to occur between these different tiers of disk and the overhead that this can introduce on the storage system.

To minimize this, adaptive optimization supports the creation of profiles that consist of specific tiers which have policies associated with them. These policies control when data movement occurs between tiers for specific volumes such that if a region of data that normally experiences minimal activity suddenly gets busy, that region does not immediately get placed on SSD. Rather it stays on SATA or FC for a defined period of time until it passes a certain threshold.

Conversely, if an extremely active region that resides on SSD goes abnormally dormant for a period of time, 3PAR does not automatically migrate that data to SATA disk. Instead it again leaves the data there until it crosses a specified threshold before it vacates it from the SSD disk.

3PAR has also introduced a feature called QoS Gradients which allows an administrator to bias volumes toward performance or cost resources, depending upon the application service level objectives. A performance gradient would be used for an application with a high SLA or a cyclical application that demands rapid response to a spike in activity. In contrast a cost gradient would be used where cost is the primary objective and an application with have a SATA-stickiness associated with it.

- **Reduced total cost of ownership.** Of course, maybe the message that will resonate most with end-users is that adaptive optimization actually lowers storage costs.
Using adaptive optimization, 3PAR can recognize the most active regions of data within volumes and move them to SSD while placing inactive regions of data on lower cost SATA disk. This flexibility gives organizations new found flexibility to start to consider SSD-FC-SATA storage system configurations that look something like 5% SSD, 15% FC and 80% SATA even for their production application workloads.

This combination should serve to minimize the amount of SSD needed, decrease the number of FC drives needed, and increase the usage of SATA drives that will ultimately serve to drive down storage costs by 20% or more.

One final item of note regarding the introduction of SSDs in the 3PAR InServ Storage Server: 3PAR is able to use STEC’s new Mach 8 IOPS 50 GB drive in lieu of its Zeus IOPS drives. While these Mach 8 drives are about 1/3 of the capacity of 147 GB Zeus IOPS drives, they are also 1/10th the price so organizations can add SSD on a more granular basis to the 3PAR system at a lower price point.

Today’s announcement of 3PAR’s support for SSD on its InServ Storage Servers and its complementary Adaptive Optimization feature is a perfect illustration of how the hype surrounding SSD is coming to an end and the reality associated with implementing SSDs is coming into focus. Companies want SSD performance for their applications but they want it without the huge financial outlays.

Right now SSDs are sizzling but adaptive optimization is what make SSDs palatable to the corporate taste buds. 3PAR’s combination of adaptive optimization and SSDs give users get the performance they want, the cost savings they need and the simplicity of implementation and management that continue to set the 3PAR InServ Storage Servers apart from others in this
tier of storage.