



Vendor Spotlight

New Flash Technologies Overcome Barriers to Widespread Adoption

Sponsored by: Dell

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IDC OPINION

The use of flash storage in the datacenter is proving to be one of the most disruptive technologies to shape the enterprise storage landscape.

Flash arrays entered the enterprise datacenter about six years ago with very limited adoption as organizations did not perceive the need to speed up their applications (apart from a few high-performance workloads that needed to operate in real time) and they were skeptical due to the high acquisition costs and the fact that flash arrays were available only from startup vendors. But continuing price drops, product maturity, widespread recognition, and proven benefits around performance as well as flash offerings from mainstream storage vendors have fueled flash's entry into the mainstream. In addition, its secondary economic benefits – such as lower power costs and long-term cost-efficiency – have boosted its overall growth.

Although storage vendors – selling both all-flash arrays (AFAs) and hybrid flash arrays (HFAs) – have made significant strides in maturing their offerings and targeting a much wider net of workloads, the high cost of flash remains the biggest barrier to its adoption, especially as driving down the cost of storage is a key priority for organizations. As a result, enterprises are constantly looking for ways to adopt flash in more economical ways, such as using HFAs.

The HFA market is significantly bigger than the AFA market. Toward the end of 2014, we estimated that the global HFA and AFA markets would reach \$10 billion and \$1.3 billion respectively.

Why Are HFAs So Popular Among Enterprises?

HFAs aim to optimize capacity with performance, addressing the \$/GB gap between spinning media and all-flash systems in order to be comparable with HDDs in price point and with AFAs in performance. With the blending of these two key investment criteria – price and performance – HFAs open up flash to more general-purpose workloads and to more price-sensitive but significant markets such as public sector organizations and small/medium enterprises.

Many hybrid array vendors offer their HFAs in all-flash or mixed flash-and-HDD configurations to cost-effectively cater to enterprises' growing performance needs. In conversations with enterprises, IDC is finding that the performance distinction between AFAs and all-flash configurations of HFAs is narrowing as HFA vendors such as Dell (with its SC Series) have started adding many of the flash-specific features originally found only in AFAs.

IDC believes enterprises favor HFAs that can robustly optimize capacity utilization by identifying and reallocating data based on usage to the optimally priced storage – in other words, those that offer strong tiering capabilities.

One way HFA vendors offer comparable performance is by providing some form of automated storage tiering (AST) to keep "hot" data in higher-performance tiers to reduce overall average latencies for reads. AST implementations, however, differ dramatically between vendors. Dell, for instance, offers AST features that operate continuously and at a granular level to adapt more quickly to evolving working sets, while other vendors offer static tiering which is appropriate for more static data sets.

IDC believes Dell's AST technology, called Data Progression, combined with the Dell SC Series architecture, optimizes its arrays for enterprise use at scale cost-effectively. Dell's IP and innovation around functionalities such as auto-tiering capabilities, introduction of MLC tiers, compression, and data protection features highlight its engineering progress in tiering and automation techniques.

Next Phase of Innovation in Enterprise Flash Arrays — TLC Flash

While much of the industry innovation around flash has been to optimize performance and reduce latencies, innovation to drive down the cost of flash has been comparatively slower despite cost being the biggest barrier to its adoption.

Dell is addressing the strong appetite in the market for lower-cost flash arrays by becoming the first vendor to bring TLC (triple-level cell) flash to enterprise-grade flash arrays. Dell has previously combined HDDs and flash drives, primarily single-level cell (SLC) and multilevel cell (MLC), with its tiering technologies to deliver performance at competitive prices, and it is now going further to usher in the next phase of innovation in enterprise flash arrays.

What is TLC?

TLC flash is a type of solid-state flash memory that can store three bits of data per cell of flash — more data than MLC, which is currently widely used in flash arrays. The ability to store more data in the same space makes TLC flash less expensive and therefore more attractive for consumer devices. However, its lower write endurance could be a challenge for enterprises with 24 x 7 operations.

How Dell is Making TLC Flash Enterprise-Ready

Dell addresses this problem using its AST capabilities to combine low-cost "read-intensive" TLC SSDs with more enduring "write-intensive" flash formats (MLC or SLC). The vendor's virtualized storage architecture and its Data Progression technology enable the arrays to identify data traffic and channel it appropriately into a multi-tier flash storage pool.

All incoming writes are steered to the write-intensive drives, then moved to a read-intensive tier (featuring TLC) for subsequent reads. This way, the TLC drives handle fewer writes per day, which extends their longevity and enables the overall array to deliver high levels of endurance and performance. Dell has used "phone home" data from system and drive monitoring to ensure drives are utilized below drive write specifications.

TLC drives can benefit both new arrays and those already deployed, as customers may start with a single tier of SSDs in any format, then add a second format to boost performance or reduce costs as their needs change. In addition, enterprises can add a tier of low-cost HDDs (7.2K) to their all-flash configurations to further reduce costs, by leveraging the automated data movement features of AST. Dell offers support options up to seven years on all drives including SSD. In IDC's opinion, taking cost-effective TLC flash drives and combining them with enterprise storage IP to deliver equal levels of performance will be instrumental to truly driving down the cost of flash. IDC also believes that using tiering technologies to direct writes to high-performance flash and then move "cold" data to lower-cost read-intensive TLC flash (which Dell refers to as "Mainstream Read-

Intensive" SSDs) will enable organizations to optimize their flash investments in the long term. Dell began shipping TLC drives in August 2015, and its industry-first support for TLC is likely to significantly influence the adoption of flash because:

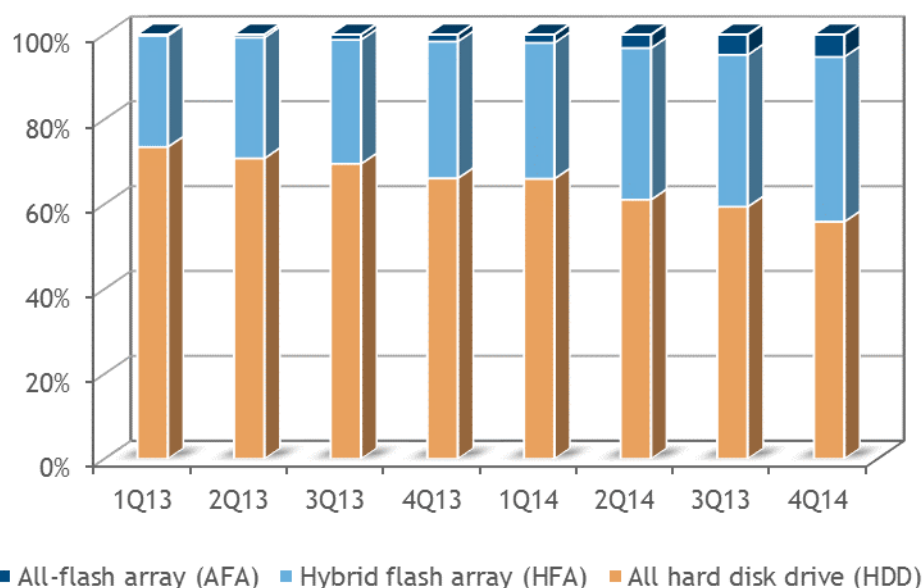
- The new flash drives, built on TLC 3D NAND technology, bring down the \$/GB cost of the all-flash array to roughly the same cost as 15K RPM HDDs, but offer flash-grade performance to address the single biggest stumbling block to flash adoption – cost.
- Dell is providing a full warranty on the TLC-based SSDs for the length of the service contract – not just on failures but also on durability, demonstrating the enterprise-readiness of TLC flash drives.

FLASH MARKET OVERVIEW – HFA VERSUS AFA IN THE LONG TERM

There is no question about flash's role in the datacenter, as it provides a total cost of ownership (TCO) based on \$/IOPS that is 50%-80% lower than a comparably configured pure HDD-based array over a three- to five-year period for a given set of workloads. For many enterprises, the real question is which type of array to invest in. Figure 1 shows that HFAs are currently a much bigger market than AFAs, and IDC's current forecast data reveals that HFAs will continue to outsell AFAs in terms of overall revenue until 2019. We believe, however, that the entry of new flash technologies such as TLC will fuel faster growth in both HFA and AFA segments.

FIGURE 1

Storage Array Type Sizing



Source: IDC EMEA, 2015

HFAs Will Remain One of the Top Storage Investment Priorities

We believe that HFAs or even HDDs – especially the 7.2K HDDs that have a significant \$/GB advantage – will remain a viable enterprise storage option in the foreseeable future. This is because, according to our estimates, over two-thirds of enterprise data is for less-performance-

sensitive applications. When workload consolidation includes less-performance-sensitive applications, IDC expects enterprises to continue to opt for hybrid platforms, particularly when the level of flash optimization of these platforms can effectively guarantee flash performance for both reads and writes for selected applications.

HFAs have a very rich set of mature data services that meet the requirements for mixed workload consolidation, giving them an advantage over AFAs. IDC believes that when designed properly, HFAs can deliver sub-millisecond latencies comparable to AFAs. HFAs also offer the flexibility for enterprises to move their cold data to less expensive drives and optimize their storage investment. IDC believes this flexibility will become a critical requirement for enterprises because over time they will have a substantial amount of cold data in their new storage technologies, including flash, that they will try to move to cheaper arrays without going through the pain of data migration.

IDC also believes that many large enterprises have a lot of cold data where an all-flash configuration may be seen as an unnecessary investment. As these enterprises become more strategic in their storage investment – particularly around flash – they will increasingly prefer vendors that offer tiering at a granular level. Enterprises will want to tier within a volume that enables them to use hybrid flash because eventually, within their SSDs, they will create a lot of data which becomes inactive over time. Larger customers with lots of inactive data will prefer products that allow them to tier to HDD and add "cheap and deep" disks within SSDs while keeping hot data and all writes to flash. HFAs also require less of a leap of faith than purchasing an AFA platform because of the cheaper acquisition costs and maturity of the technology, as well as the fact that many enterprises want to leverage their existing HDD investments.

While Dell's industry-first move to introduce TLC benefits small all-flash environments, enterprises will continue to invest in HFAs over the next few years as their evolving datacenters and workloads become dynamic, mixed, and heterogeneous. The addition of TLC in hybrid arrays enriches cost and performance metrics by providing enterprises with more bang for their buck.

THE EVOLUTION OF THE FLASH STORAGE LANDSCAPE

The storage market is brutally competitive and history tells us that storage hardware companies that fail to break into the major league must retreat into a niche or contemplate an exit from the market.

Today, the mainstream storage vendors all have competitive flash solutions. But IDC believes the major storage suppliers that can effectively adopt technologies such as TLC combined with tiering architecture will be able to significantly cut the technology lead created by AFA-only startups. With Dell unveiling its TLC flash roadmap, other flash vendors will quickly follow suit. IDC believes enterprise customers will favor vendors that can prove that their TLC-based arrays are durable and come with a meaningful warranty. In our opinion, Dell's AST firmware, which reduces the number of rewrites to extend the life of flash, gives it a strong competitive edge.

Tiers of flash storage, analogous to the HDD tiers enterprises are familiar with, strongly favor vendors with automatic data-movement software that offers multi-tier all-flash systems capable of handling mixed workloads at sustained high levels of performance and efficiency.

FUTURE OUTLOOK AND VENDOR CHALLENGES

The enterprise flash market is red hot but it is becoming increasingly crowded. We believe the speed of innovation around performance, durability, and cost-efficiency will determine vendors' competitive advantage.

Dell is the first vendor to hit the market with its TLC 3D NAND SSDs. IDC believes Dell's large installed base and its demonstrable commitment to driving down the cost of flash will help it capture a significant share of the flash market, where it has shown significant growth in recent years, according to IDC's hybrid array market share reports.

IDC's own research into enterprise flash adoption revealed that over half of the users preferred SSDs from their existing storage suppliers rather than from a different (startup) vendor, highlighting the importance of convergence, systems compatibility, and sales and support relationships as criteria for flash adoption.

But Dell also faces some challenges. While it may have a lead over other flash vendors with its TLC arrays, its competitors are likely to introduce similar low-cost offerings later this year.

Dell will also have to overcome the challenges around the perception of limited endurance of TLC flash technology by emphasizing that it is providing a full warranty on the SSDs (TLC-based) for the length of the service contract, not just on failures but also on durability to put users at ease. It will also need to emphasize that its engineering efforts have been focused on optimizing TLC drives for data reads and minimizing the number of writes per day on the drives to make the flash arrays durable, high-performing, and cost-effective. It must also create market awareness, educate channel partners, and build more blueprints and PoCs. In addition, it must highlight its compelling cost proposition as it calculates its cost for capacity (\$/GB) before applying data reduction technologies (compression and dedupe), contrary to the standard practice of calculating \$/GB after applying data reduction technologies.

Dell's efforts to bring TLC to enterprise flash are already a significant milestone in the evolution of flash. How it empowers its channel partners, builds user confidence in TLC, and demonstrates cost and performance benefits will determine its success in the industry. But it has already set itself ahead of the crowded flash market with its latest TLC drive support and approach.

ESSENTIAL GUIDANCE AND RECOMMENDATIONS FOR FLASH BUYERS

IDC recommends that enterprises – especially those with large volumes of consumer-type data, such as telcos' billing systems, retailers, etc. – consider using flash storage. Those enterprises that are considering investing should:

- Conduct due diligence on flash adoption and start with non-critical workloads and applications, and strategically add flash for maximum efficiency and effective long-term TCO.
- Consider both performance and price/performance ratios when making a purchase decision. Flash storage can offer significant benefits for certain workloads, but it is not cost effective for workloads that do not require high performance or high write cycles.
- Ask providers about flash storage roadmaps and build relations with suppliers that demonstrate commitment to delivering cost-effective and performance-oriented flash solutions.
- Upgrade to newer flash technologies such as TLC but ensure that workloads or applications will not suffer performance issues by evaluating both the vendors' engineering capabilities around TLC and their warranty terms.

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