The Future of NAND Flash – All-Flash Providers

RFG POV: In the relatively short and fast-paced history of data storage, the buzz around NAND Flash has never been louder, the product innovation from manufacturers and solution providers never more electric. Thanks to mega-computing trends, including analytics, big data, cloud and mobile computing, along with software-defined storage and the consumerization of IT, the demand for faster, cheaper, more reliable, manageable, higher capacity and more compact Flash has never been greater. This is part one of a three-part series of short profiles on 20 vendors and solution providers that are delivering innovative all-Flash-related solutions to the enterprise marketplace.

RFG attended the Flash Memory Summit (FMS), held over three-plus days in August at the Santa Clara Convention Center. FMS brought together nearly 200 exhibitors and speakers who regaled roughly 4,000 attendees with visions of Flash – present and future. It has grown significantly over the past eight years, very recently attracting more than its traditional engineering and computer geek crowd. The Summit now embraces CIOs and other business executives cleaving to the Flash bandwagon, including Wall Street types looking to super-charge trading algorithms, web-based application owners seeking lower latencies for online transactions and a growing number of government and healthcare related entities who need to sift through mountains of data more quickly.

The short profiles of 20 vendors and solution providers that are delivering innovative Flash-related solutions is not an exhaustive list – there are more than 30 vendors delivering all-Flash storage arrays alone. However, the profiled companies represent a cross-section of Flash solution providers, from SSD drive and controller manufacturers to system integrators and software companies.

Some companies, such as **IBM** and **Intel**, defy classification as they are a manufacturer or fabricator, system integrator, storage software provider, nanotechnology developer and more. While the following categories are broad, they are indicative of the breadth and strength of the enterprise Flash solutions provider landscape as it stands today,

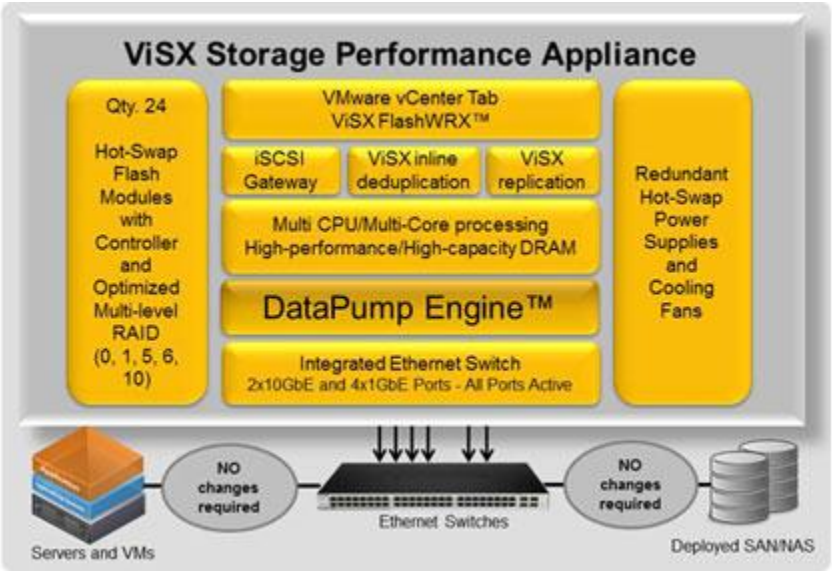
represented by established, global technology firms as well as by startups looking to disrupt the enterprise data storage market.

All-Flash Providers

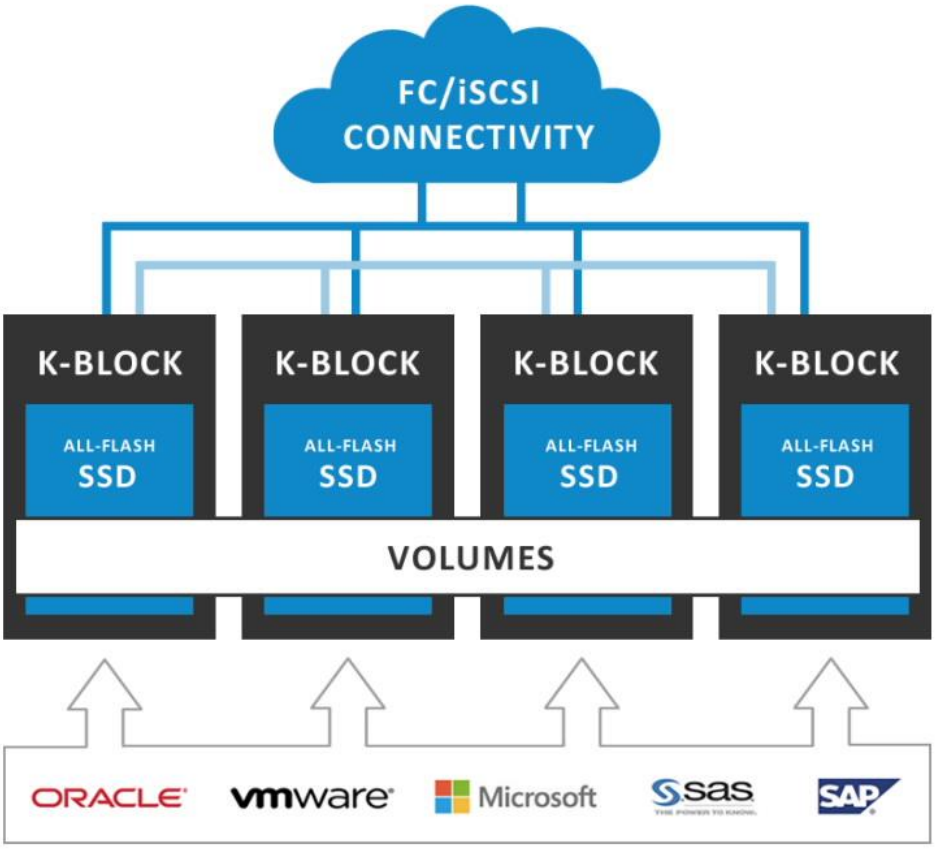
This group consists of smaller, mostly private equity or investor-backed companies that are primarily in the business of supplying all-Flash storage appliances to enterprises of all sizes. The success of these all-Flash providers hinges on their ability to exploit the advantages of inexpensive MLC NAND Flash, whether through proprietary hardware improvements or the development and delivery of a rich software feature set that improves Flash longevity, manageability and, of course, speed. Some version of MLC NAND Flash manufactured by a handful of providers, including Intel, **Micron**, **Samsung**, **SanDisk**, **SK Hynix** and **Toshiba**, is included in all of these flash-based storage solutions.

In smaller enterprises, Flash arrays have become affordable and functional enough to replace an organization's entire HDD storage stack. In larger companies, all-Flash solutions co-exist with the legacy SAN fabric (and increasingly NAS as well) or sit closer to the application on a PCIe card within the server, providing the performance needed for mission-critical Tier 1 applications. Now that all-Flash vendors have succeeded in scaling their solutions up and/or out economically, it has become feasible for organizations to consider migrating entirely away from multi-tiered HDD storage strategies in favor of a single, performance-centric Flash storage tier.

Astute Networks has been in business for more than 13 years, making the switch a few years ago to what it refers to as Networked Flash™ rather than direct attached storage (DAS). Leveraging its TCP or "Tranquil" Offload Engine (TOE) Ethernet-like chip technology, Astute's ViSX storage appliance uses Samsung-supplied MLC NAND Flash and in-house developed iSCSI storage protocol "accelerators" to solve the network latency problem. ViSX, powered by its patented DataPump Engine™ processor, "speeds up application performance and delivers up to five times the performance and price/performance advantage over the competitive iSCSI-based storage arrays for I/O intensive database and VDI applications." Astute focuses primarily on mid-market enterprises in the healthcare, higher education and manufacturing industries.



Kaminario top executives are veterans of the storage industry, having previously worked at **EMC**, IBM and other storage firms. Founded in 2008 and funded by several VC firms, including Sequoia Capital, Kaminario provides "enterprise-class resiliency" to customers. Its scale-out technology is key to providing what Kaminario refers to as "3D consistent performance": low latency, high IOPS and high throughput. Kaminario K2 is built to support mixed workloads to meet actual customer needs by "marrying a variable block size algorithm, optimized for any I/O size, with a true scale-out architecture. K2 system bandwidth can scale from a few GB/sec to more than 20GB/sec while running real mixed customer loads." K2 snapshots also match the I/O size from the application. Application consolidation is also made easier. The Financial Services sector is a key vertical.



Pure Storage has a simple five-point recipe for Flash disrupting enterprise storage: disruptive performance, cost parity to disk or better, resiliency, usability and supportability. Pure believes data reduction software is essential for affordable Flash with 5x to 10x data reduction achievable. According to Pure, the "musts" of data reduction are: "inline and always on (to avoid writes), global (across entire array), no performance penalty, deduplication *and* compression (DB & VM/VDI), small chunk size (effectiveness + alignment) and no trusting hashes (collision = corruption)." Pure states deduplication is a concern for HDD, which is very I/O intensive and its ZeroSnap™ feature allows users to "instantly snapshot any volume with no performance overhead." Pure Storage is installed throughout many industries, vastly improving I/O-intensive workloads such as VDI and DB queries.

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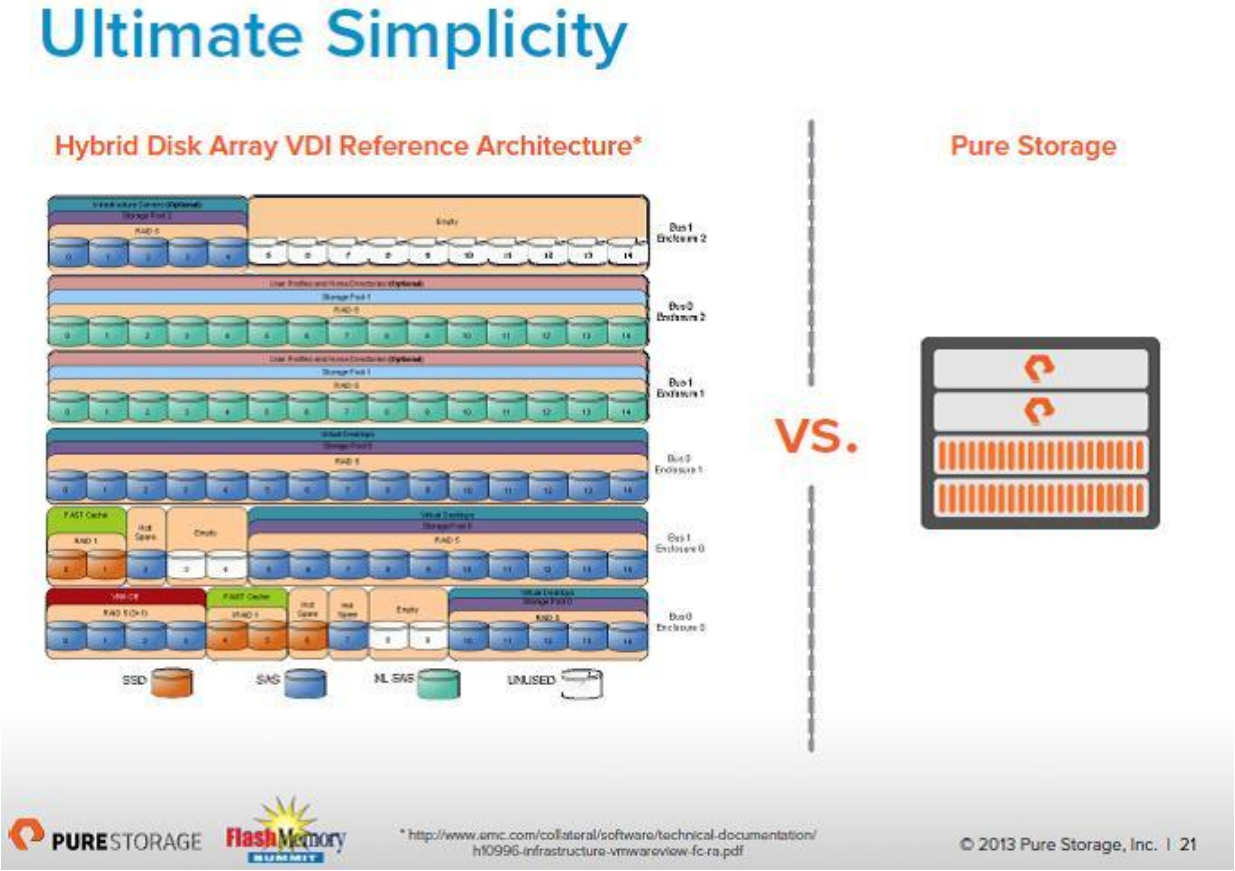
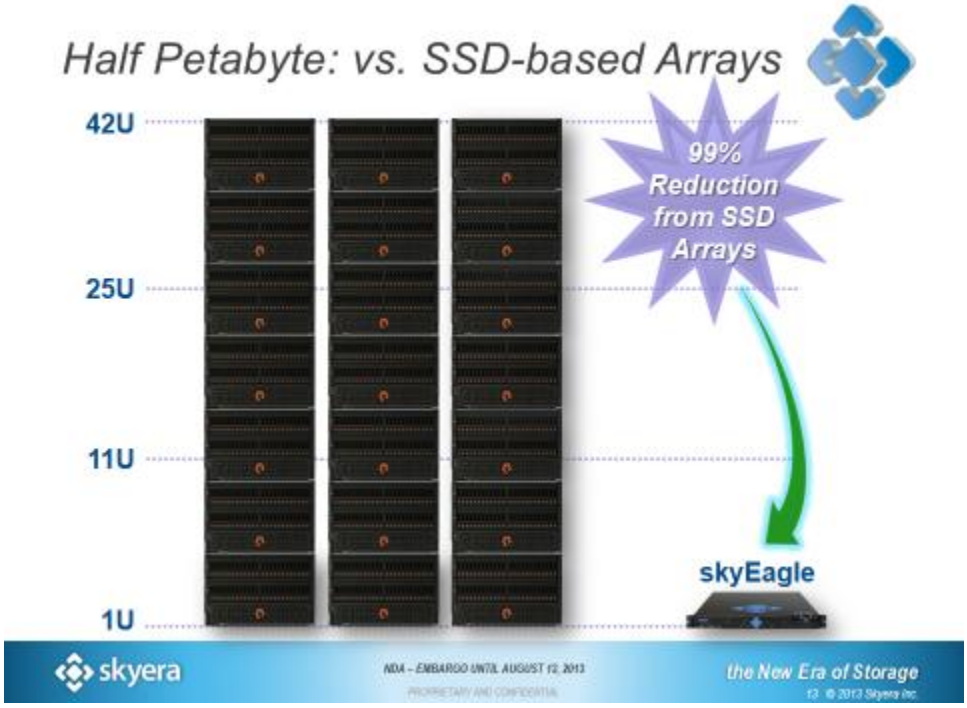
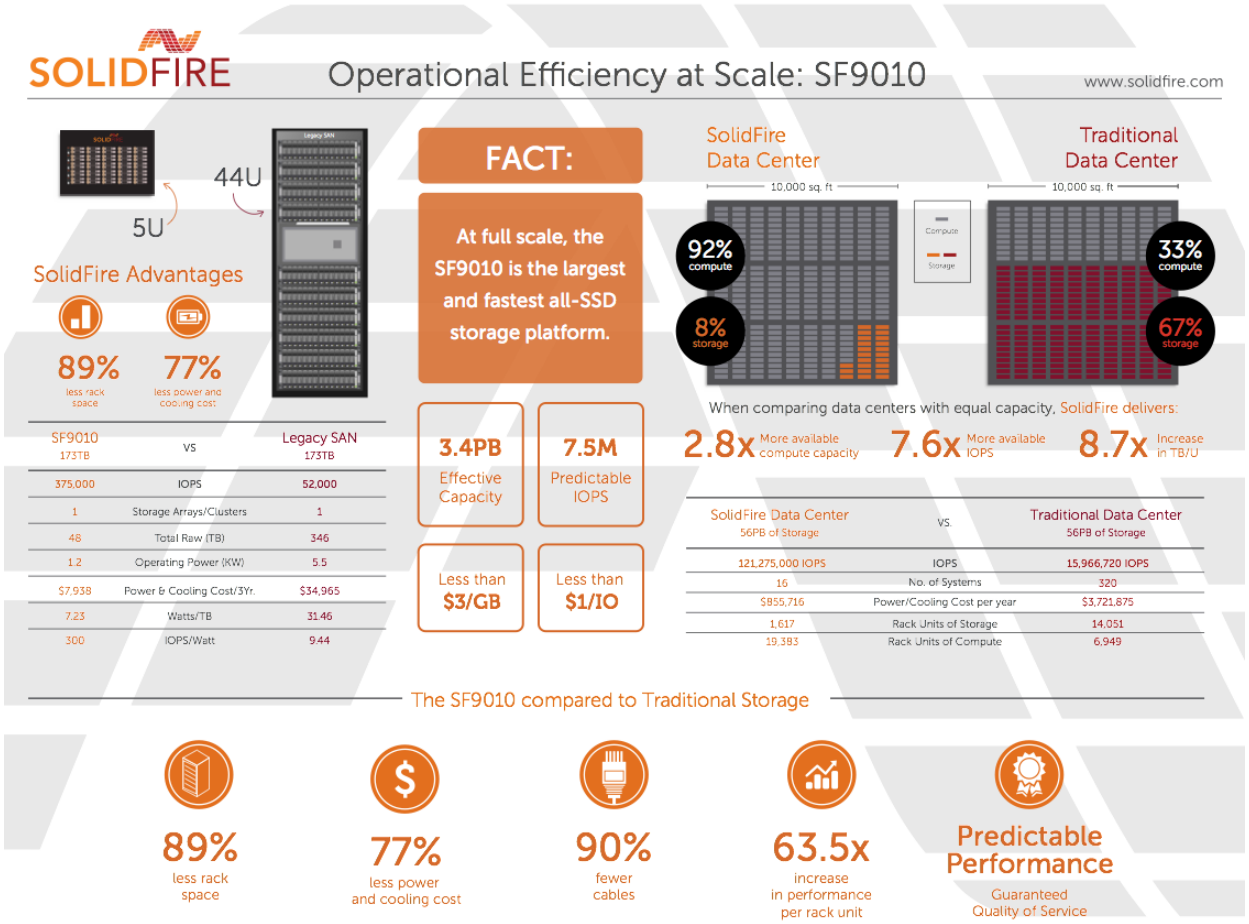


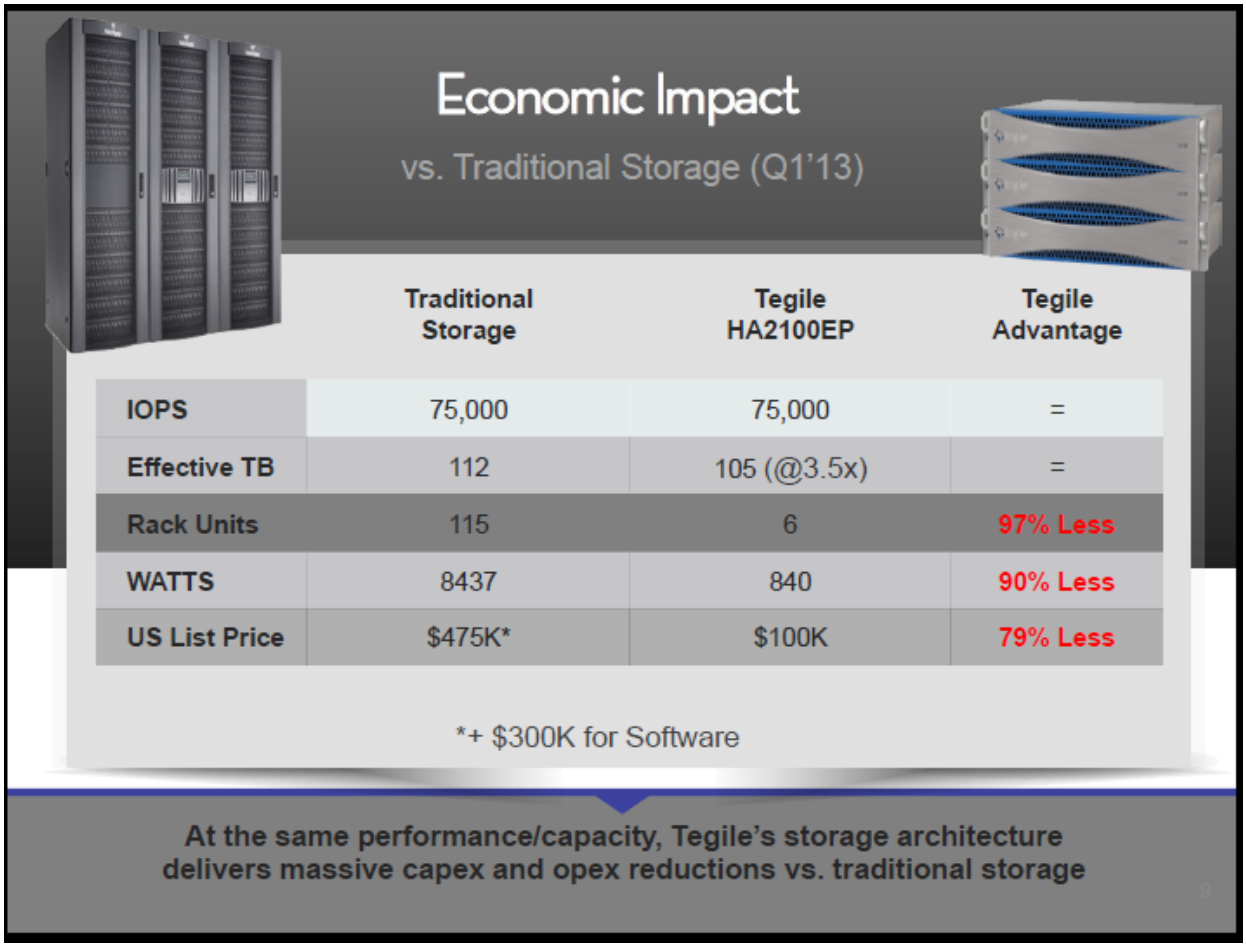
Skyera created some buzz at FMS with the announcement of their half-petabyte Flash array that establishes price parity with traditional HDD arrays. Its "SeOS™ is composed of three layers that provide a complete suite of functionality, including easy administration, data protection, security and optimization, and real-time monitoring of Skyera arrays." The skyEagle array will deliver 5 million read-optimized IOPS and fits into a single long 1U enclosure. Skyera states their pricing for Flash storage, after applying data reduction technologies, will reach 45¢ per GB compared with $19 per GB for some high-end Flash solutions. Utilizing 16-nm MLC MAN (Most Advanced NAND) Flash supplied by SK Hynix and Toshiba changes the parameters for Flash longevity. Customers using Skyera's existing Flash arrays include telecom, service providers, finance and government.



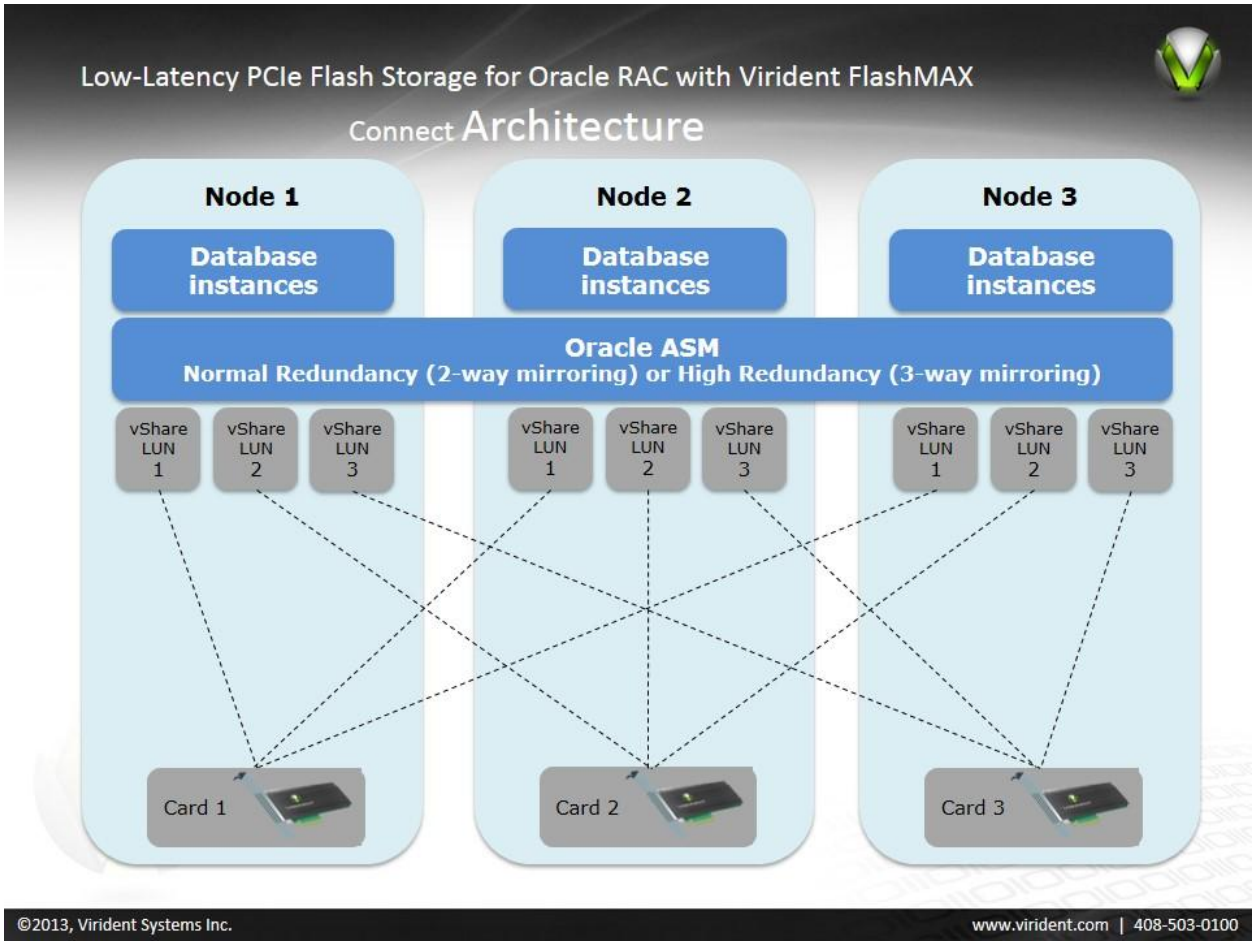
SolidFire's SF9010 is an All-Flash scale-out array for large public and private cloud infrastructures scaling from five to 100 nodes engineered to deliver guaranteed performance to thousands of applications within a shared infrastructure. Billed as the "World's fastest, largest all-SSD storage platform", the SF9010 incorporates the QoS (quality of service) features of SolidFire's existing product line that has made it appealing for deploying large scale cloud infrastructures. One customer states, "Traditional HDD arrays are not capable of delivering QoS consistency. Running many bursty, unpredictable and IO-intensive workloads within the same shared storage infrastructure makes delivering predictable application performance almost impossible." With SolidFire's QoS functionality, companies can now allocate, manage and guarantee storage performance, making services like PaaS (Platform as a Service), SaaS (Software as a Service) and IaaS (Infrastructure as a Service) more predictable.



Tegile offers an all-Flash array with a twist, combining the power of Flash with HDD capacity. Its Zebi array combines a unified SAN and NAS platform, along with a proprietary Metadata Accelerated Storage System (MASS) to deliver high performance, high capacity and high reliability at low cost. Zebi utilizes a large pool of DRAM and Flash as cache to mask the latency of spinning disks and extracts metadata to dramatically improve performance from a pool of inexpensive 7.2k RPM HDD drives. Tegile users can experience up to 3.5x data reduction with 200k IOPS in a 10U package, in effect providing a half-PB of useable storage when starting with 144TBs of original HDD capacity. Redundant VMDK (virtual machine disk format) data is reduced to a single instance, while caching algorithms promote active data real time. Primary market is SMB, with 10 percent using all-Flash.



Virident effectively delivers networked all-Flash storage to the server – as close to the application as possible. Also referred to as server-based SAN, Virident's FlashMAX II is a "Storage Class Memory (SCM) solution that offers enterprises unconditional performance combined with the industry's highest storage capacity in the smallest footprint. FlashMAX PCIe SSDs range in capacity from 550GB to 2.2 TB, in both MLC and SLC types of flash media." In addition to offering memory-class performance of more than 1.5 million IOPS and HDD-like capacity up to 2.2 TBs in a single compact form factor, Virident is directing a software-led transformation to provide storage administrators, CIOs and application owners what they expect from enterprise-class storage solutions, including high availability and data mirroring. Virident sells direct or through OEMs, including EMC and Seagate. HGST (formerly known as Hitachi Global Storage Technologies), a wholly owned subsidiary of **Western Digital**, entered into a definitive agreement to acquire Virident two weeks ago and plans on Virident's solutions becoming part of its high-value storage offerings.



Whiptail all-Flash arrays help customers "get applications moving at the speed of Flash." The ACCELA and INVICTA arrays are capable of moving customers up the performance stack as they handle writes as quickly – or more quickly – than reads, according to independent lab tests. WHIPTAIL's RACERUNNER operating system allows for consolidation of write-dependent applications including VDI, OLTP and databases that rely on lock, group and join functions. RACERUNNER minimizes write amplification which can shorten the useful life of Flash as well as consume bandwidth while reducing critical write performance. WHIPTAIL also works with its customers to help them understand how to optimize applications to better utilize their Flash arrays, including strategies for consolidation, cache management and meeting tighter recovery time and point objectives (RTO and RPO). Just this month **Cisco Systems** announced it was entering the data storage market by acquiring WHIPTAIL.

Conclusion

The Flash storage market is expected to grow exponentially over the next few years as enterprises look for faster, less expensive, more reliable, manageable, higher capacity and more compact storage solutions. All-Flash offerings meet these requirements for high-performance, low-latency applications.

RFG POV: The new all-Flash offerings now provide enterprises with multiple options to consider and break the lock multi-tiered HDD storage solutions have had. IT executives can now implement strategies with a single, performance-centric Flash storage tier or with a hybrid Flash-HDD tiered solution. IT executives and staff should analyze current and future storage capacity and performance requirements for each application type before selecting a target storage architecture and implementation.

Additional relevant research is available. Interested readers should contact Client Services to arrange further discussion or interview with Mr. Gary MacFadden, Principal Research Analyst.

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