The Future of NAND Flash – Integrators

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 three of a three-part series of short profiles on 20 vendors and solution providers that are delivering innovative Flash-related solutions to the enterprise marketplace.

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.

Software, Flash and Systems Integrators

Companies in this broad category range from investment-backed startups to some of the world's largest and most admired technology companies. What they all have in common is a passion for integrating their own proprietary software with largely commodity storage hardware components, whether they be HDD, NAND Flash or PCIe-based

solutions – or a combination of all the above. The "secret sauce" is in how these storage solution providers interweave their own software into an enterprise's new and existing storage fabric, whether providing additional performance for mission critical applications or enhancing backup and recovery capabilities. Software-defined, application and policy-driven storage are key messages for this group, placing the emphasis on available storage software services and capabilities such as compression, deduplication, replication, snapshots, policy-based data management and security rather than prioritizing the hardware.

Coraid is a leading provider of scale-out Ethernet storage solutions for enterprise and cloud customers. "Using Coraid's flexible building block approach to storage, customers can consolidate file, block and object storage for all their application needs without creating silos. Coraid storage leverages commodity hardware and massively parallel layer-2 Ethernet connectivity to deliver superior price-performance compared to fibre-channel and iSCSI alternatives." Coraid's scale-out architecture helps eliminate controller bottlenecks that limit flash performance. Coraid allows customers to integrate flash pervasively for caching as well as in hybrid pools. Enterprise customers can use Coraid's 'versatile' building blocks in all-Flash configurations, achieving over 700,000 IOPS in a 2U array, or with a mix of flash and HDD for both block-based and file-centric workloads. Coraid's scale-out architecture and policy-based automation is also suitable for communications service providers (CSPs).
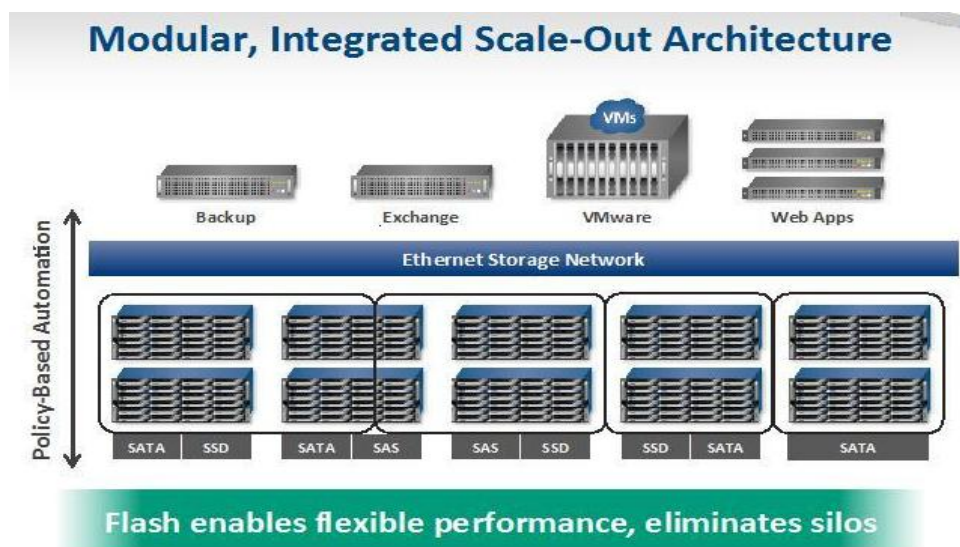
Dell has been an early adopter of Flash technologies (first to install SSD in a desktop, circa 2007) and has accelerated its storage portfolio through the relatively recent acquisitions of EqualLogic and Compellent. Compellent Storage Center solutions compete at the high-end of the enterprise storage market, with advanced software features that allow customers to manage multiple tiers of Flash (SLC, MLC, TLC) from a "single pane of glass with a couple of clicks" and can also manage all tiers of HDD (15k, 10k,
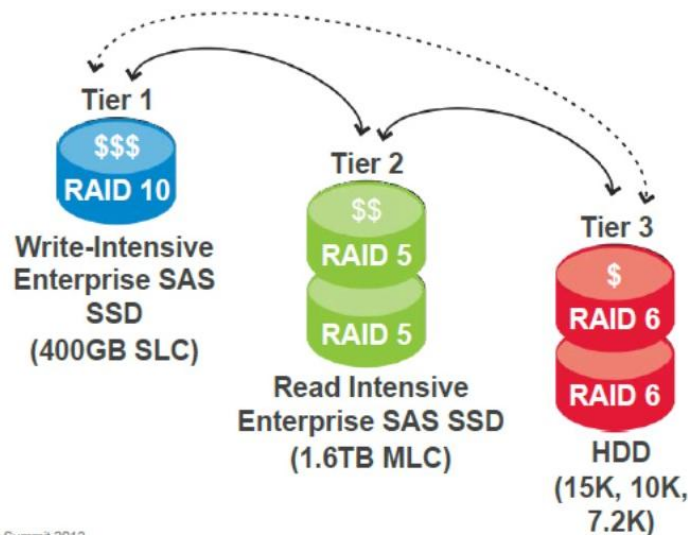
7.2k). Compellent's Storage Center 6.0 release includes several important enhancements such as 64-bit memory to help "detach" high-performance data from disk, tiering for larger amounts of hot/warm data and support for VMware vSphere™ Storage APIs for Array Integration (VAAI) with full copy offload and hardware-assisted locking.

FlashMemory SUMMIT SSD Tiering

DELL The power to do more

Tier 1
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Write-Intensive Enterprise SAS SSD (400GB SLC)

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RAID 5
RAID 5
Read Intensive Enterprise SAS SSD (1.6TB MLC)

Tier 3
$
RAID 6
RAID 6
HDD (15K, 10K, 7.2K)

Flash Memory Summit 2013
Santa Clara, CA

4

IBM back in April, announced its Flash Ahead Initiative, signaling to the market it was "all in" with its commitment to Flash technology. Key sections of the announcement included a commitment of more than $1 billion in Flash research and development, the opening of 12 Flash Centers of Competency around the world and the introduction of the IBM FlashSystem™, which leverages eMLC and SLC flash controller and storage flash array technology acquired by IBM through its acquisition of Texas Memory Systems (TMS)), and is "designed with an all-hardware data path engineered to deliver the lowest possible latency." IBM has Flash-optimized its entire storage portfolio, offering clients opportunities to create a Flash tier within their existing HDD environments as well as enhancing its San Volume Controller (SVC) software to deliver advanced Flash-handling capabilities.

Future architecture possibilities
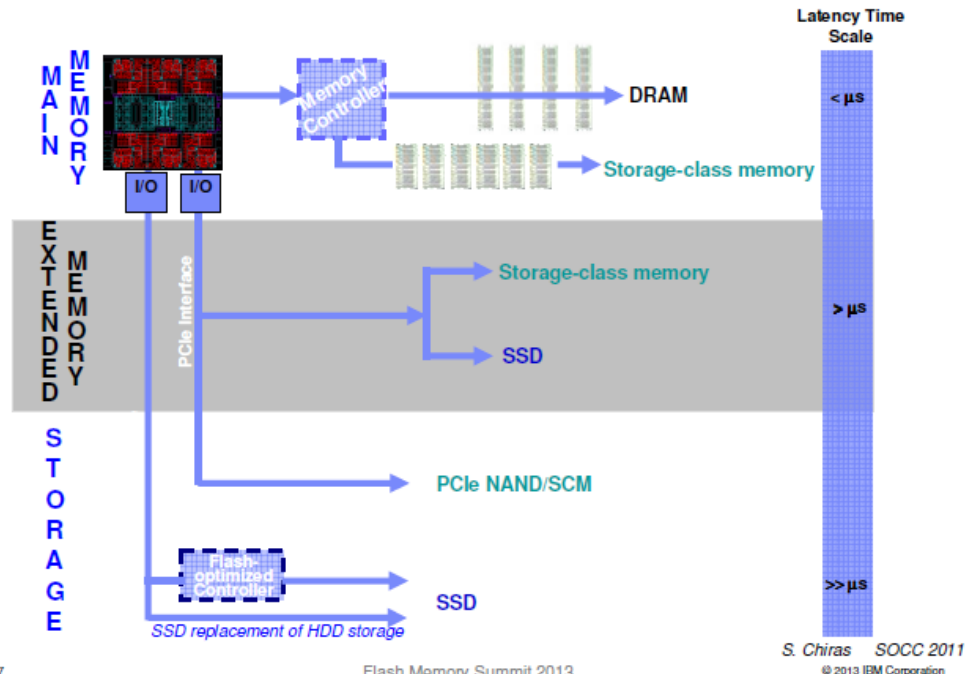
NetApp has taken HDD market share away from competitors and continues to OEM its NAS devices with success through IBM and others. Meanwhile, NetApp is shipping its EF 540 all-Flash array featuring low latency, configuration flexibility, custom performance tuning with complete control over data placement along with sub-millisecond response times requiring just 2U of rack space. To super-charge its clients' existing HDD assets, NetApp introduced its Flash Accel intelligent caching software solution that adjusts dynamically according to workload. "Flash Accel paired with Flash Cache potentially reduces storage costs by 30 percent by offloading 80 percent of IOPS to the server. Intelligent data coherency provides block level invalidation rather than flushing the entire cache, providing persistent cache across VM and server reboots."

Coherent Cache Behavior
And Flash Accel Intelligent Invalidation

- Reads and writes are inserted into cache
- Snapshots are created for backup
- Cache invalidation by Flash Accel corrects cache, while keeping the cache persistent
- Data coherency is maintained for further reads and writes by the application
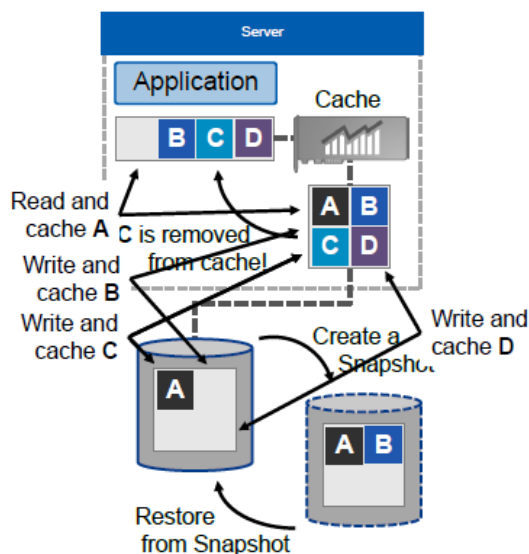
Permabit developed its Albireo software suite to meet the deduplication and compression demands of enterprises straining to keep storage costs under control and deliver expected performance levels. Delivered as an OEM product for hardware, software, or cloud service providers, Albireo deduplication technology can be run at the controller level due to its small footprint and efficient resource utilization and integrates at the firmware, device driver, file system, appliance or application level to deliver: "Multiple GB/sec IO throughput, 5 – 35x reduction rates, minimal memory and CPU footprint, petabyte scalability within a single device, guaranteed data integrity and a flexible, simple integration." Albireo also offers inline, block level compression and can reduce the amount of memory set aside for overprovisioning by reducing random write latency by 4x or more and increasing random write throughput by 4x or more.

SSD Deduplication
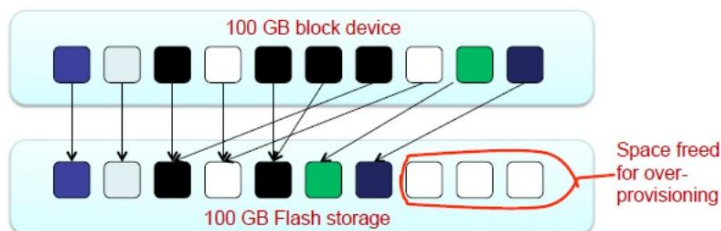
- Deduplication identifies duplicate blocks
- Space is saved by storing only one copy of the blocks to SSD
- Freed space can be used for over-provisioning

Conclusion

The 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. The software, Flash, and systems integrators will play a key role in honing down the options and delivering comprehensive solutions for enterprises to consider and architect their solutions around.

RFG POV: The latest wave of storage technology is immature and a myriad of options exist to confound IT executives and slow down decision-making. IT executives and staff should understand the storage trends and directions and then analyze current and future storage capacity and performance requirements for each application type. Then IT executives should be demanding storage integrators provide solutions that automate, consolidate, simplify and standardize storage operations so that they can contain their operational personnel costs and transformation their data center operations.

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