



The Hard Disk Autopsy



by George Crump, Lead Analyst

[The Violin Memory Systems "Disk is Dead" campaign](#) says what needed to be said; disk, at least for the production use case, is dead or it least it should be. An autopsy done on the technology will find that it died because it could not keep up with the performance demands of the modern data center and it could not use capacity effectively.

The Performance Wall

The performance of a hard disk is largely dependent on its rotational speed as well as the intelligence of the file system in how it orders data being written to that hard drive. In large part the only way to increase performance is to add additional hard disk drives. Even if there is no capacity justification to add those drives the performance imperative dictates that the spindles be added. The result is wasted HDD capacity and data center resources like power, cooling and floor space.

Flash storage fills the performance need left by the death of hard disk. Flash delivers performance in terms of raw IOPS and low latency, and a well-designed flash array can deliver that performance on far fewer and denser devices.

The Capacity Wall

With the arrival of 8TB and 10TB HDD technology, it may seem odd to even suggest an HDD capacity wall. However, in production storage there certainly is. The capacity wall that HDDs face in production storage is that data efficiency like deduplication and compression techniques typically can't be used without adding flash to the HDD array. The lack of effectiveness means that 8TBs of data requires 8TBs of space.

Flash storage, however, can use its excess performance resources to leverage technologies like deduplication and compression to store more data in the same space. A 5:1 reduction ratio is considered a reasonable expectation for a data center using an all-flash array. Especially if that array is supporting a mixture of virtualized servers and desktops, unstructured data and database workloads. That means that same 8TBs of capacity may be able to store as much as 40TBs of data.

SSD - The Hard Disk Resurrection?

As the role of hard disks changes to storing backup and archive data, solid state disks (SSD) appear to be the gateway drug to performance. They are in essence hard drives in a resurrected state. SSDs have the same form factor as hard disk drives, making it easy for

vendors to deliver an all-flash solution. Other than improved performance, SSDs carry many of the same challenges as HDDs.

SSDs, because of their need to fit into a hard disk bay, are typically physically larger than their flash module counterparts, a flash storage device that looks more like DRAM. The wasted space, caused by retrofitting flash into a hard disk slot, leads to wasted data center floor space. Also, since SSD often go into the same chassis as an HDD, the chassis is designed to power HDD, not memory. As a result, there is often little power savings.

The future of flash is an approach that looks nothing like a hard disk drive. Instead it will leverage a more modern form-factor and interface that allows densely packing these flash into purpose-built storage systems. A purpose built design eliminates the other SSD challenge; achieving optimal performance while increasing density and decreasing power consumption.

High performance is an end-to-end problem. Every component from the interface that connects the flash array to the storage network to the internals of the flash array to the flash NAND itself has to be tuned to work together. Often, storage systems are HDD arrays retrofitted with SSDs and see very few other changes. Certainly performance improves compared to an all HDD system but it is not an optimal use of flash.

Conclusion

It is reasonable to expect in a few years that we will be declaring "The SSD is Dead". It has served as a viable gateway to flash storage specific future. Despite all the hype around software-defined "everything", a silicon-driven world will likely be powered by hardware that is purpose-built to take advantage of the low latency and high performance of flash.

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Violin's All-Flash optimized solutions accelerate breakthrough CAPEX and OPEX savings for building the next generation data center. Violin's Flash Fabric Architecture (FFA) speeds data delivery with chip-to-chassis performance optimization that achieves lower consistent latency and cost per transaction for Cloud, Enterprise and Virtualized mission-critical applications. Violin's All-Flash Arrays and Appliances, and enterprise data management software solutions enhance agility and mobility while revolutionizing data center economics. Founded in 2005, Violin Memory is headquartered in Santa Clara, California.