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## **All-Flash Storage Vs. Hybrid Storage: Weighing Workload Against Cost** <sup>[1]</sup>

by [Joseph F. Kovar](#) <sup>[2]</sup> on March 10, 2015, 2:35 pm EDT

Solution providers and their clients looking for ways to improve the performance of their storage infrastructures <sup>[3]</sup> are increasingly turning to flash storage.

The market for flash storage is booming, with every major storage vendor, most second-tier vendors, and a host of startups vying for mind share and market share in the performance storage market.

### ***[Related Video: Partners Weigh Flash Array vs. Hybrid Array]***

The rush to market by storage vendors combined with demand from storage customers has led to an explosion in the sales of flash arrays. Research firm IDC in January estimated the worldwide flash-based array market reached \$11.3 billion in 2014. This includes all-flash storage array sales of \$1.3 billion for the year, along with \$10.0 billion in hybrid flash storage array sales.

All-flash arrays, as the term states, are storage arrays that exclusively use flash-memory or SSDs for primary storage.

Hybrid arrays, also known as hybrid flash arrays, use a mix of flash storage and spinning disk for primary storage, with the "hottest" or most-likely-to-be-accessed data stored on flash media and data less likely to be needed immediately on spinning disk. With hybrid arrays, vendors typically include software that automatically migrates data between the flash and the spinning disk tiers based on anticipated or recent access.

Hybrid arrays are not the same as more traditional disk-based arrays with flash-based cache. In hybrid arrays, the total capacity is considered primary storage, whereas on disk arrays with flash-based cache the flash is used for temporary fast reads or writes with the actual storage of the data done on the hard drives.

The all-flash array and hybrid array business, like many disruptive IT technologies, initially was driven by startups including Kaminario, Pure Storage, SolidFire, Violin Memory, NexGen, Tegile, Tintri, Panasas and StorTrends.

Legacy storage vendors such as Cisco Systems, Dell, Dot Hill, EMC, Hewlett-Packard, Hitachi Data Systems, IBM and NetApp were slower to enter the market. Some, such as Cisco, EMC, NetApp and IBM, entered the market via acquisitions. Others modified existing storage solutions by replacing part or all of the disk capacity with flash storage.

The startup all-flash array and hybrid array vendors, very few if any of which are profitable or even cash-flow positive, are staking their business on a couple of claims, including that their arrays were designed from the beginning to be optimized for flash storage. They also have received a bonus in the form of first-to-market compared to their legacy storage rivals.

Legacy storage vendors, while later to market, have a couple of advantages over their startup rivals, including profitable operations, large established client and partner bases to target, and proven software.

Proven software stacks could actually be the legacy vendors' key advantage. Those vendors already have experience with storage management software and with such key storage services as replication, mirroring, snapshot and others. However, several startups have started adding those services in a move to catch up with their legacy rivals.

Storage-focused solution providers have become rapid adopters of all-flash and hybrid storage arrays, and say that the choice of which technology to use depends primarily on a customer's workload.

All-flash arrays are really targeted at high-performance applications including databases, high-performance computing, and financials, said Aaron Cardenas, CEO and founder of P1 Technologies, a Hermosa Beach, Calif.-based solution provider that partners with such flash storage vendors as Tintri, Nimble Storage and EMC's XtremIO.

"All-flash arrays are still very few and far between," Cardenas told CRN. "Hybrid flash arrays are applicable to the entire market, while maybe 5 percent of typical applications require all-flash array performance."

Cardenas said that split between the two flash storage technologies mirrors the split between SAN and NAS for spinning disk arrays.

"Look at the SAN holdouts," he said. "A lot of storage is swinging towards NAS, which can meet 95 percent of all workload requirements."

Talk about all-flash storage arrays ultimately comes down to input/output operations per second, or IOPS, said Michael Tanenhaus, principal at Mavenspire, an Annapolis, Md.-based solution provider.

"At the high end, the focus is on the highest IOPS," Tanenhaus told CRN. "It's a simple

metric. When you go with a hybrid flash array, you have to talk about moving data to the disk."

The actual performance of flash storage can vary with the vendors' technology and strategies, Tanenhaus said.

SolidFire [4], for instance, provides up to 1 million IOPS, but lets customers and partners assign quality of service and the actual number of IOPS depending on what is paid for, letting partners make money on how many IOPS are provided, he said.

General-purpose flash, on the other hand, is suitable for many enterprise tasks where typical workloads in virtualized environments generate an average of 10,000 IOPS, or burst to 20,000 IOPS. VDI, or virtual desktop infrastructure, adds 10,000 IOPS to 30,000 IOPS, he said.

"IBM [5], meanwhile, focuses 100 percent on low latency, so the price point will be higher than general-purpose flash storage," he said.

Choice of technology depends completely on use case, said Lief Morin, president of Key Information Systems, a Woodland Hills, Calif.-based solution provider.

Commercial clients may have an online transaction processing environment that needs sub-2-millisecond or sub-millisecond performance, or 50,000 IOPS, Morin told CRN.

"That's a good flash statement," he said. "But it's all about the technology requirements, and the economics. You can go all-flash, you can go hybrid, you can go all spinning disk. These are all real options in the market now."

The big advantage of hybrid flash arrays over all-flash arrays is flexibility in expanding capacity, said Corey Preville, CEO, business development manager and owner of CorData, a Herndon, Va.-based solution provider.

While having 100 percent SSD storage is a great idea, the fact that capacity of many solutions is fixed means that customers can get painted into a corner as capacity requirements grow, Preville told CRN.

"With hybrid flash arrays, customers can buy more disks to increase capacity because they're cheap," he said. "Nobody knows how much capacity they'll need. With hybrid arrays, if you need more performance or capacity, pop in another 'brick.' If that doesn't help, OK, the requirements for the excess performance or capacity will catch up later."

Preville also said all-flash arrays may have issues with workload leveling, which could cause applications to overuse the capacity on certain parts of the arrays.

"Anyway, with SSD, what you buy today will be better soon," he said.

One thing holding back a wider adoption of flash storage technology is the cost per GB of storage compared to spinning disk arrays, solution providers said. And while the cost of flash-based arrays is falling, there is still a lot of hype about it, they said.

A lot of flash array vendors talk about bringing prices to below \$3 per GB, and they do, Cardenas said. "But disk is falling to under 60 cents per gigabyte," he said. "Vendors are

moving flash cost to close to yesterday's disk arrays. I don't think anyone is willing to pay \$3 per gigabyte for disk anymore."

While flash storage offers much higher performance than disk storage, it is important to remember that there are limitations, solution providers said.

Most people don't realize that SSDs and flash technology are consumables that wear out, Tanenhaus said. "After a certain time, it needs to be replaced," he said. "Maybe people feel flash has the same warranty as disk, and it's true, for break-fix issues. But flash wears out after time. Disk doesn't."

Tanenhaus said one way to look at the issue is to remember how customers of the first Prius hybrid cars were surprised they needed to replace their batteries. "They got hit by a wave of replacements," he said. "Flash storage in a couple of years will also be hit by a wave of wearing out."

Despite its higher price and relative immaturity when compared to disk, flash is the future of storage, solution providers said.

All-disk arrays now more likely to be used for archiving, Morin said. "Spinning disks are terrible," he said. "Customers spend a lot more for power and cooling than for flash. The disks need a lot of space."

Furthermore, a lot of spinning drives are required to match the performance of flash, Morin said. "A spinning disk maybe provides 300 IOPS per drive, which isn't much," he said. "If you have an application that needs 100,000 IOPS, and there are applications that do, you need thousands of drives. But do you need all that capacity? And the cost to invest in the required infrastructure is large. We can do flash in a 2U enclosure for about \$2 per gigabyte. It may be expensive compared to disk. But not in terms of infrastructure."

Disk storage will always be a part of the industry, but mainly for archive purposes, Tanenhaus said. "I believe we have only a few years before the majority of storage migrates to flash technology," he said.

*PUBLISHED MARCH 10, 2015*

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