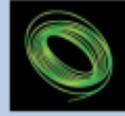## Flash or Cache? Deep Dive on SSD versus HDD (*plus cache*) for Arrays

INFINIDAT

In storage systems (and in particular storage arrays), the conventional wisdom has been that flash storage in the form of solid-state drives (SSDs) are necessary for high performance, and NVMe® SSDs provide the highest performance of all storage media. However, a recent interview in Blocks and Files by Infinidat (started by a number of ex-EMC alumni) would like to be the start of a rewrite to this narrative. According to Kent Steinhardt (Field CTO at Infinidat), focusing on the media is looking in the wrong place. Steinhard says the comparison of hard disk drive (HDD) vs SSD performance is like trying to "compare two different cars to determine which one will win a race based upon the horsepower of the engines. The greatest determining factor will be the skill and intelligence of the driver behind the wheel, and not the car itself."

That Inifidat would take this position is not surprising given that they are a laggard in the move to all-flash arrays (AFAas), and continue to focus on HDDs as their primary storage **capacity** technology which they claim they do because of the low price of HDDs vs SSDs. However, the architecture of Inifinidat's arrays makes this argument somewhat hollow. The Infinidata F6300, their flagship hardware product which has a usable capacity of up to 4PB and is capable of 1.3M (Read?) IOPS and 25GB/s throughput, contains over 3.0TB of memory and up to 368TB of "flash cache". In this sense, Infinidat's products have the classical storage array architecture of the 2000s – a hierarchical storage approach where the movement of data across storage tiers is managed by software. Also interesting is the use of RDMA-based NVMe over Fabric (NVMe-oF™) for networking on both Ethernet and FC. Given that there are zero NVMe-based HDDs, that means a hefty NVMe to SCSI translation layer must sit between the network interface and the drives, which will increase latency for non-cached data.

And, as anyone who has been in the array business knows, storage performance claims should be taking with a grain of salt, especially with benchmarks as simple as IOPS and bandwidth. For instance, while Infinidat claims 25GB/s of storage throughput, the "pipes" going into their array are 25Gb/s Ethernet and/or 32Gb/s Fibre Channel (FC) connections, meaning that a compute host cannot get more than (roughly) 3GB/s of throughput unless link teaming is utilized. And,

while 1.3M IOPS (again, probably "Read" IOPS) is a big number, a cluster of Pure Storage FlashBlades has been [clocked at](#) 24M NFS IOPs. Finally, most vendors focusing on HDDs rely on the story that HDDs are significantly cheaper than SSDs on a $/TB basis, which would be great if the storage media was the bulk of the cost of a storage array (it isn't). Fixing "slow" (as in HDD performance) is never cheap, and Infinidat's arguments are eerily reminiscent of those made by IBM about flash storage several years ago. That is, until IBM switched to flash, now [touting](#) NVMe-based AFAs as the right direction for enterprises to go…

> *"'Our Infinibox is so performant that there's no need to use costly memory products like Optane', said product head Yair Cohen.*
>
> *That was without citing any competitors in particular but he probably meant Pure Storage and Dell EMC, who have both recently begun to offer Intel Optane in their arrays, and with whom the leadership at Infinidat seem obsessed.*
>
> *Pure is a supplier that seems firmly ensconced in some enterprise sectors, such as banking, when it was so recently a startup too. Meanwhile, Dell EMC has built its reputation on its Symmetrix/VMAX arrays, which were invented by Infinidat founder Yanai."*
>
> Yann Serra, Computer Weekly

Mike Heumann, Managing Partner

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