White Paper

SanDisk Establishes the Big Data Flash Category with Its InfiniFlash Introduction

Sponsored by: SanDisk

Eric Burgener
March 2015

IDC OPINION

Over the next five years, more than 95% of all expenditure on information technology (IT) will go toward 3rd Platform computing infrastructure. These environments pose significant challenges to the legacy hard disk drive (HDD)-based storage solutions of the past, demanding significantly more performance, scalability, and agility for both primary and secondary storage applications. The market for flash-based arrays, which includes both all-flash arrays (AFAs) and hybrid flash arrays (HFAs), is on fire; the combined market was worth over $11.3 billion in size in 2014 and will exhibit strong double-digit growth rates over the next five years. These solutions offer storage performance that is easily 10x that of HDD-based systems, and IDC expects that these flash-based arrays will dominate primary storage environments within the next five to seven years.

The flash-based systems have targeted performance-intensive primary storage environments and are leveraging complementary storage efficiency technologies like thin provisioning, compression, deduplication, and space-efficient snapshots, clones, and replication to provide effective dollar-per-gigabyte costs that are only slightly higher than those of HDD-based systems and total cost of ownership (TCO) that is as much as 80% lower than that of HDD-based systems. Conventional flash, even with all of these cost-reducing technologies, has just not been inexpensive enough to consider for use in secondary storage environments.

While secondary storage environments do not generally require the sub-millisecond latencies that conventional flash delivers, it is clear that content repositories, media and other streaming services, big data and analytics, and Web infrastructure could benefit from solutions that provide better performance, consume less energy, and require less floor space than current HDD-based systems. The prospects for improving the performance, density, and energy consumption of HDDs are very limited, however.

A cursory mapping of the performance and cost characteristics of conventional flash and spinning disk reveals a large gap that presents a clear market opportunity for a new storage medium. SanDisk Corp., a major player in the flash storage space on both the consumer side and the enterprise side, has introduced a new product, called InfiniFlash, that fits into this identified market gap. IDC believes that this product establishes a new storage category, which we are calling "Big Data Flash." Big Data Flash costs roughly the same as spinning disk, delivers performance consistently better than that of HDDs, and allows the secondary economic benefits of flash deployment at scale to be brought to bear

in the secondary storage markets. This new category promises to transform conventional thinking about the most effective and efficient ways to build secondary storage platforms targeted for use with 3rd Platform computing.

IN THIS WHITE PAPER

This IDC White Paper assesses the technology implementation and market opportunity for InfiniFlash, a flash-based array platform from SanDisk that establishes a new category of external flash-based storage that IDC calls Big Data Flash. IDC describes "big data" technologies as a new generation of technologies and architectures designed to economically extract value from very large volumes of a wide variety of data types by enabling high-velocity data capture, discovery, and/or analysis.

SITUATION OVERVIEW

IDC expects that over the next five years, more than 95% of all IT spending will be for the 3rd Platform computing infrastructure. The 3rd Platform buildout is being driven by the requirements of an increasingly mobile workforce, social media, big data and analytics, and cloud computing and is based around technologies that for the most part weren't used in the 2nd Platform era (formerly the client/server computing era): virtualization, flash, and cloud. Workloads are also evolving and demanding massive scalability, extremely high levels of availability, and an agility in how IT resources are allocated and used that requires new architectures and new ways of thinking to meet increasingly stringent service levels in this new environment.

One of the biggest high-level differences between 3rd Platform computing and 2nd Platform computing is in managing data growth. In addition to the amount of data generated, collected, and stored from mobile devices and social media, the Internet of Things (IoT) has extended data collection to many types of devices that had never before been on networks. Online businesses such as Netflix, eBay, and other vendors maintain massive content repositories, generating revenue from their ability to deliver fast, easy access over high-speed networks to extensive catalogs of products and services. More and more businesses depend on real-time analytics of massive data sets to help them make operational decisions on a daily basis. In the 2nd Platform era, digital assets were primarily made up of structured data, and individual databases were rarely larger than tens of terabytes in size. In the 3rd Platform era, storage administrators must store structured, unstructured, and semistructured data types; provide rapid access to many of these data types across a variety of different endpoint device types and access methods; and deal with data stores that can potentially be hundreds of petabytes in size.

The architectures and technologies of the past in the storage arena are not well suited to handle today's data management tasks cost effectively at this scale. HDDs are a case in point and present issues in terms of performance, reliability, and power and floor space consumption when trying to service 3rd Platform computing workloads that can easily be hundreds of terabytes in size or larger. 3rd Platform computing environments are by their very nature extremely performance intensive, routinely demanding hundreds of thousands of IOPS or more from their associated storage infrastructures. HDDs are much better suited for capacity-intensive environments that not only require a low dollar-per-gigabyte cost for capacity but also need relatively few IOPS per gigabyte. Even in 2nd Platform computing environments, storage overprovisioning was a major problem, driving most

companies to deploy 20–40% more capacity than they needed just to meet performance requirements. With the level of performance required in 3rd Platform environments, trying to build the storage infrastructure using just HDDs is not cost effective at all. Far too many devices are needed to do so, and all that overprovisioned storage capacity drives higher power, cooling, and floor space costs.

The data movement requirements in 3rd Platform computing are easily one to two magnitudes greater than they were in 2nd Platform computing. In virtual environments, storage for virtual machines (VMs) can be and often is moved around online to meet performance optimization and high-availability requirements. Large data sets need to be moved for backup, disaster recovery, upgrade, and datacenter migration requirements. For HDDs larger than 1TB, disk rebuilds with conventional RAID take too much time because of the amount of data that has to be moved, putting enterprises at risk for data loss in the event of a second failure during these periods. Devices of this size are in wide use because it is too expensive to create the very large data stores needed with smaller-capacity HDDs. Many of the newer storage platforms targeted at 3rd Platform computing environments have introduced newer, more efficient data protection algorithms, such as erasure coding or replication, to resolve these RAID issues.

HDDs are a mechanical device, and current enterprise drives exhibit annual failure rates (AFRs) of <1%. In 2nd Platform environments where tens of drives were in use, this often translated to a drive failure every couple of months and was not much of a concern. But in large-scale environments where a customer may have thousands of HDDs deployed, this easily translates to several drive failures a week. These types of failure rates are clearly a problem in very large-scale environments that have hundreds or thousands of high-capacity HDDs.

Is Conventional Flash a Viable Alternative in These Environments?

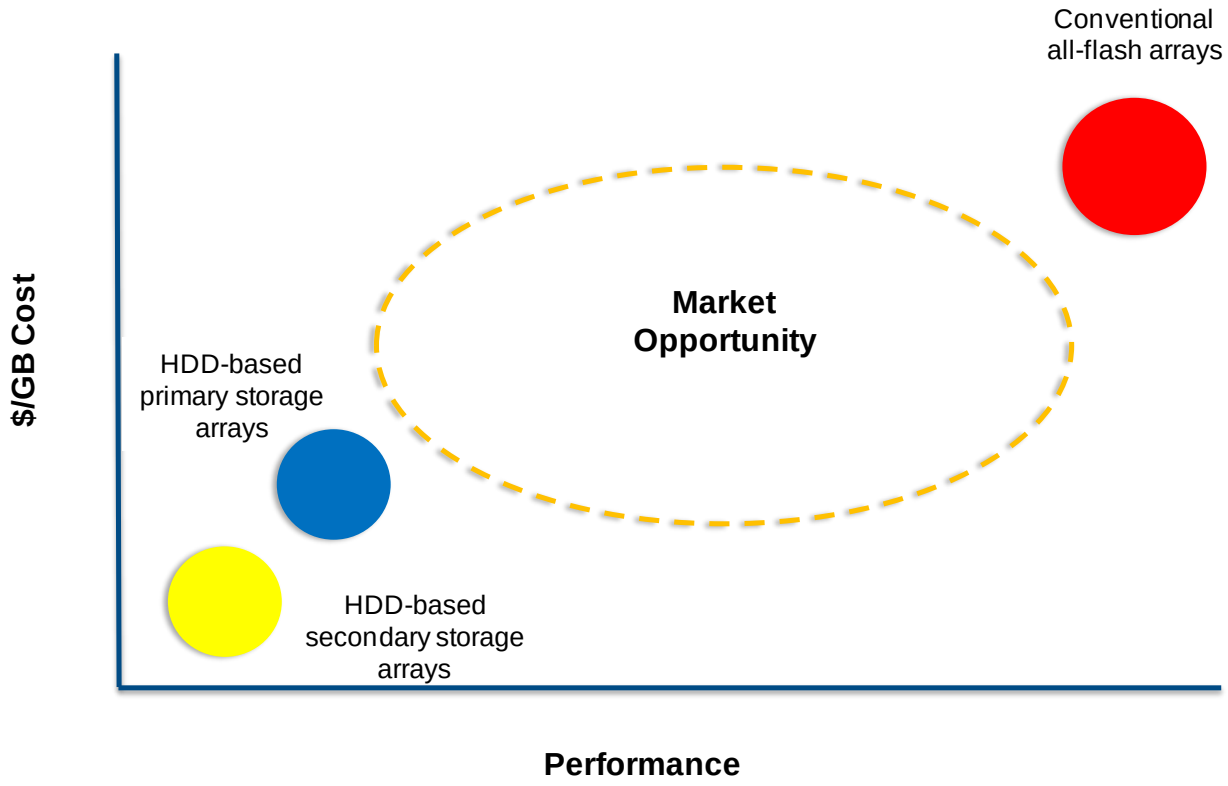
Flash storage has penetrated datacenters at an extremely rapid rate over the past five years. IDC survey data from 2013 indicated that more than 50% of enterprises had already deployed flash in some manner in production environments, and a high percentage of enterprises that had not yet deployed flash had it running in pilot. By fall 2013, the number of enterprises planning to purchase flash in the next 12 months crested 70%. In the enterprise, flash can be deployed either in servers or in network-based arrays.

Flash provides performance that is, at a minimum, 10x that of spinning disk, but flash also offers other significant benefits with 3rd Platform computing workloads. Flash devices on average consume about half the power of a spinning disk device. Performance-intensive applications need far fewer flash devices to meet IOPS requirements, cutting down on energy and floor space costs by, generally, at least 40% and sometimes as much as 80%, depending on application environments. AFA vendors regularly report that performance-rich flash allows their customers to deploy up to 30% fewer servers to drive storage performance, saving on not only server costs but also, more importantly, expensive software licensing costs for applications like Oracle, SQL, and Microsoft Exchange. The significantly higher performance of flash allows storage efficiency technologies like inline data reduction, space-efficient snapshots, zero copy clones, and thin provisioning to be used to decrease effective dollar-per-gigabyte cost even in high-performance application environments, driving even more savings. And flash is a more reliable medium than spinning disk, providing 3x–4x better reliability than even the best HDDs.

The previously mentioned features all make flash potentially very attractive for hyperscale data stores that need high performance to handle not only application I/O but also the timely movement of large data sets. Lower failure rates simplify ongoing management issues, while the high performance minimizes rebuild and other data movement concerns. The problem with conventional flash is simple though: cost. Although flash prices are coming down, IDC expects that by 2018, the cost of conventional flash will be about 20x the cost of capacity-optimized HDDs ($0.692 versus $0.034). The large gap in performance and cost between HDD and conventional flash points up a large market opportunity (see Figure 1) for a storage medium that would offer flash-like performance with spinning disk-like cost.

FIGURE 1

The Market Opportunity for a New Storage Medium



Source: IDC, 2015

Pure HDD-based systems typically deliver storage latencies in the 5-20ms range, whereas the best arrays that leverage conventional flash can consistently deliver sub-millisecond or better latencies. There are certainly environments, like very large-scale financial services and retail or big data and analytics applications, that can fully benefit from this performance, but the performance bar is not that high for many tier 2 and 3 applications. For content repositories, media and other streaming services, many big data and analytics applications, Web serving, and many other secondary storage

environments, the ability to consistently deliver sub-5ms latencies would result in very noticeable improvements in application performance. A storage medium that in general offered flash-like characteristics, but gave a little on performance to lower the dollar-per-gigabyte acquisition costs, could be very attractive for these types of workloads. It may not be appropriate for many performance-intensive tier 1 application environments that can cost-justify AFAs, but it would be a much better fit for hyperscale environments that demand massive capacities, a high ingest rate, a low change rate, and a high read rate that is intermixed with some measure of random write I/O as well.

Moving Toward a New Storage Category

Figure 1 indicates the market opportunity for a storage medium that would slot in between high-performance, high-cost conventional flash and lower-performance, lower-cost spinning disk options. IDC has spoken at length about the opportunity for conventional flash to eventually dominate spinning disk in performance-intensive primary storage environments, but the dollar-per-gigabyte cost of this type of flash will clearly limit its ability to penetrate secondary storage markets. Those applications can't justify flash costs because they can't take advantage of conventional flash performance to fully leverage its secondary economic benefits (much lower device count, lower energy consumption and reduced floor space requirements, and lower server and server licensing costs).

To understand the price point at which flash would become interesting to these markets, one must understand how the secondary economic benefits would apply in secondary storage environments. Applications like content repositories, media and other streaming services, big data and analytics, and Web serving in general would benefit much less from deduplication, making compression a more important data reduction technology. In primary storage environments, compression can often achieve data reduction ratios of 2:1 to 4:1, depending on the application environment. For a "back of the envelope" analysis, it is probably safe to assume a conservative average secondary storage compression ratio of 2:1 in these environments.

As a more reliable medium, flash requires less redundancy than spinning disk. This, combined with needing fewer flash devices to meet data movement requirements, will likely contribute to needing fewer devices overall, although the savings here will not be as high as it is in performance-intensive primary storage environments. However, this will vary based on whether the alternative spinning disk-based solution is built from performance-optimized HDDs or from capacity-optimized HDDs. Capacity-optimized HDDs tend to deliver roughly one-fourth of the IOPS that performance-optimized HDDs deliver, so more capacity-optimized HDDs would be needed to meet the same IOPS requirements. Flash devices on average also consume roughly half the power of spinning disks, so TCO savings accrue from much lower power consumption.

Given these considerations, we can assume a very conservative data reduction ratio of 2:1 for secondary storage workloads and a conservative 20% lower device count. We will also assume that the medium consistently delivers sub-5ms latencies even as configurations scale. If a flash-based medium was available at roughly $0.40 per gigabyte for raw capacity by 2018, a flash-based configuration would cost roughly the same as a storage solution built out of performance-optimized HDDs priced at $0.183 per gigabyte and would have a 40–80% lower TCO. To compare a flash-based configuration with a storage solution built entirely out of capacity-optimized HDDs, we would have to assume that we'd need 4x the number of devices to meet the IOPS requirements, a number that significantly raises not only the acquisition cost but also the TCO of that solution.

Based on this quick analysis, we can start to formulate what a viable storage product that could meet the previously defined market opportunity might look like. The storage product would have the secondary economic benefits of flash and cost $0.40 per gigabyte by 2018. It would have to deliver performance (latencies, IOPS, and throughput) that is consistently better than the best case that performance-optimized HDDs can offer today. And since this would be targeted at secondary storage environments, it should be built for scalability into the tens or hundreds of petabytes for application workloads that require high ingest rates, exhibit low change rates, and need high read rates with some level of intermixed random writes. It should be delivered in a package that meets enterprise requirements for availability, reliability, and manageability; should be able to support multiple data types (block, file, and object as well as structured, unstructured, and semistructured); and should mesh well with preexisting datacenter workflows for operations like access, monitoring, and break/fix. Targeted as it would be at massively scalable environments, an appropriate name for this new category would be "Big Data Flash."

Assessing the First "Big Data Flash" Entry: SanDisk InfiniFlash

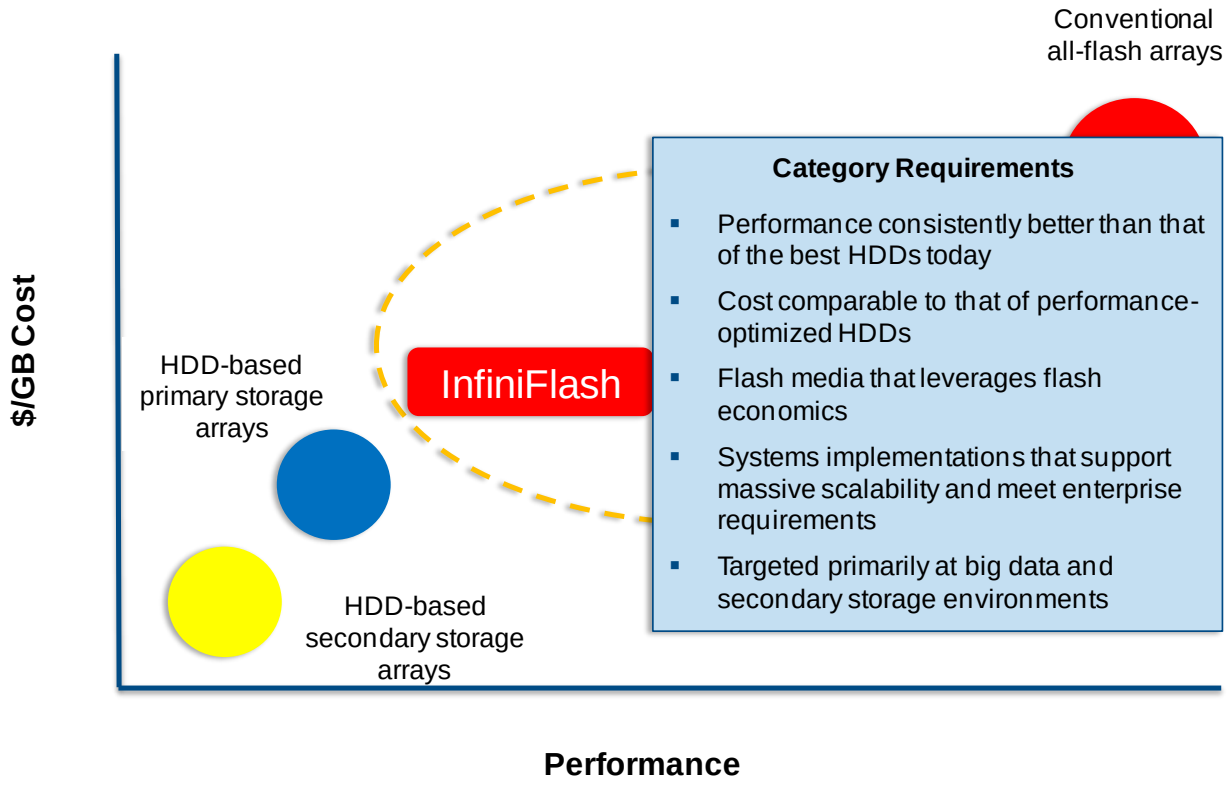
SanDisk is a $7 billion global company based in Milpitas, California, that delivers storage solutions for both the consumer market and the enterprise market in many areas, including datacenter, computing, mobile, and consumer electronics. Founded in 1988, SanDisk has grown into a global brand with over 8,500 employees worldwide, a market cap of over $20 billion, and one of the strongest storage technology portfolios in the industry with over 5,000 patents. In March 2015, SanDisk introduced InfiniFlash, establishing a new product category that IDC refers to as Big Data Flash, which offers compelling performance and cost metrics for the enterprise market. This is a major event in the storage industry that will enable the use of flash technology for a whole range of application environments that until now have not been able to cost justify flash use, effectively delivering not only better performance but also the secondary economic benefits of flash to hyperscale environments.

SanDisk's close relationships with hyperscale, 3rd Platform computing customers have contributed significantly to the InfiniFlash project. Requirements from end users were clear: Hyperscale computing needed performance on demand, delivered consistently where needed regardless of the requirements of other workloads; high capacity and density in a scale-out architecture; low acquisition and operating costs at scale; simplicity of deployment and administration; and enterprise-class availability, reliability, and manageability. All parties involved, including both end users and SanDisk engineers, knew that a product that met this definition would be unique in the storage industry.

Figure 2 shows InfiniFlash's placement and key differentiators with respect to the identified market opportunity.

FIGURE 2

InfiniFlash Market Opportunity



Source: IDC, 2015

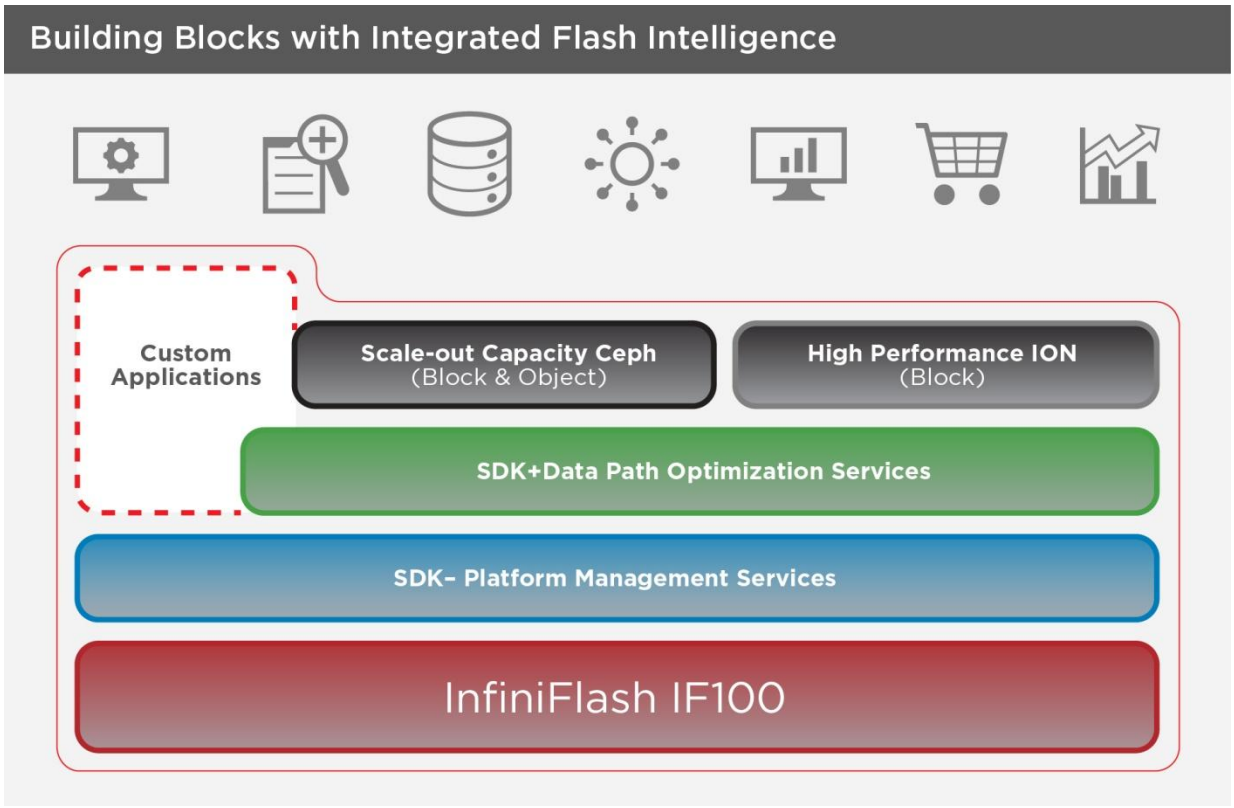
At InfiniFlash's core is an operating system, the InfiniFlash OS, that is optimized for scale-out, flash-based media; inherently supports block-, file- (future), and object-based access; and offers enterprise-class data services including self-healing automatic failover, snapshots, clones, encryption, and replication. Data protection options include erasure coding and replication. Stripe sizes are granularly customizable at the container level to optimize access performance for the type of data being stored. Storage efficiency technologies include thin provisioning, compression, space-efficient implementations of snapshots and clones, and snapshot replication based on delta differentials.

At initial release, SanDisk is introducing three InfiniFlash platforms: the IF100, the IF500, and the IF700. The IF100 is the hardware platform itself and provides the maximum opportunity for customers to incorporate their own custom value-add software stack. The IF500 is SanDisk's flash-optimized Ceph distribution, which includes the IF100 hardware platform along with a flash-optimized software stack. The software stack for this platform includes a software development kit (SDK) for platform management and

enclosure tuning services as well as an SDK for data path optimization services. With the IF500, data is automatically rebalanced when resources are added, removed, or reconfigured. The IF700 includes the SanDisk ION Accelerator to provide a high-performance block shared storage platform (128TB scalable to 512TB) for use cases such as NoSQL databases, HPC workloads, and custom enterprise block applications. Figure 3 shows the InfiniFlash offerings include the base platform (the IF100) as well as additional flash-optimized software included in two other platforms (the IF500 and the IF700).

FIGURE 3

The InfiniFlash Base Platform and Software Stack



Source: SanDisk, 2015

Designed for use with Web-scale applications, InfiniFlash also includes development libraries for direct application integration, enabling advanced functions like triggers, message passing, and in situ data transformations. Although InfiniFlash can be used off-the-shelf at first release with block- or object-based applications, an included SDK enables customers to optimize their applications for use with InfiniFlash to obtain even better performance, efficiency, and TCO benefits if so desired. S3/Swift access is supported for object storage and iSCSI for block storage at first release, with CIFS/NFS support scheduled for a follow-on release. InfiniFlash also includes a command line interface and a RESTful API for monitoring and managing InfiniFlash enclosures, giving customers a path to easily integrate it with existing datacenter monitoring, management, and automation solutions.

InfiniFlash is targeted at a distinct set of tier 2 and 3 workloads running on virtual infrastructure, including content repositories, media and other streaming services, big data analytics, and Web serving. These environments all require massive capacities and exhibit low change rate of data, where consistently low-latency, high-bandwidth read access during high ingest rate with intermixed random writes is required. There are two types of customer targets here as well. End users can buy InfiniFlash and use it as they would use any other enterprise storage solution, reaping the performance, efficiency, and TCO benefits of this new class of cost-effective, massively scalable flash. Developers, including not only vendors but also in-house developers at customer sites, can take advantage of APIs that SanDisk is providing to directly control access to and manage the low-level flash itself to obtain additional benefits. IDC has long maintained that, with the advent of flash, application developers will eventually start to enhance their applications to work better with flash just as they did with disk (e.g., developing transaction logs for databases running on HDDs), and SanDisk is the first enterprise storage vendor to directly enable this with APIs.

The performance and cost economics of Big Data Flash have the real potential to relegate HDD-based solutions that today dominate secondary storage environments to a niche role within the next five years. If successful, this revolutionary product is very likely to encourage other introductions of this type from SanDisk competitors such as HGST, a wholly owned but independently operated subsidiary of Western Digital, and Seagate.

The SanDisk Value-Add

Although customers are not required to use Ceph with InfiniFlash, if they choose to do so, they will find that SanDisk has added some interesting enhancements. On its face, Ceph is media agnostic, but SanDisk has made specific changes to this technology to further optimize it for use specifically with the InfiniFlash implementation. Changes include performance optimizations for all-flash environments (which have been contributed back to the open source community), improvements to enhance parallelism, back-end optimizations to XFS, and messenger performance enhancements. Taken together, these enhancements improve block read performance by 10x and object read performance by 5x, as well as improving the endurance and reliability of the storage solution as a whole.

As a flash manufacturer, SanDisk is able to produce this massively scalable flash-based solution at a price point below $1.00 per gigabyte at scale *at introduction*. On a dollar-per-gigabyte basis, that is roughly 2x the cost of 15,000rpm HDDs on an acquisition cost basis today, but when the other efficiencies of InfiniFlash are taken into account — smaller device counts, lower energy consumption and reduced floor space requirements, and compression — it is no exaggeration to say that it is lower in cost with 5x–10x better performance. From a TCO point of view, when the secondary economic benefits of flash are taken into account across a multiyear enterprise life cycle, there is no comparison: InfiniFlash is the hands-down winner by a wide margin.

Business and Technical Benefits of InfiniFlash

From a technical point of view, InfiniFlash is clearly a better solution for the hyperscale tier 2 and 3 workloads than HDDs. It offers 50x the IOPS, 5x–10x the throughput, consistently lower latencies than even the best HDD response times even as configurations scale, 5x better power efficiency, 5x better density, and 4x better reliability — all at roughly the same acquisition cost on a solution basis (assumes 2:1 average data reduction ratio) and a significantly lower TCO (as much as 80% lower).

From a business point of view, InfiniFlash performance will provide faster access to large content repositories and a better user experience for media and other streaming services, speed time to insight for big data and analytics applications, enable higher-density datacenters that make much more efficient use of available power and floor space, and, in general, provide competitive advantage against competitors still relying on HDD-based storage solutions for their tier 2 and 3 applications. InfiniFlash's ability to move data at up to 7GBps (for a maximally configured system) or 400MBps per flash card addresses the concerns hyperscale environments have today around operations that require massive data movement, providing additional degrees of freedom for administrators in the areas of data protection and migration. With its better reliability, InfiniFlash will require less operator intervention to address issues like failed module replacement, thereby helping increase the span of control a single administrator can handle. Its scale-out architecture allows much more granular and better balanced expansion, and with its ability to support tens to hundreds of petabytes, it will provide a longer useful life even in today's high-growth data environments. And InfiniFlash will do all this without requiring a storage budget any larger than the storage budget enterprises are using today for HDD-based solutions. In fact, with the TCO advantages that InfiniFlash brings to the table, those storage budgets can decrease time.

A massively scalable storage solution with Big Data Flash characteristics is certain to enable new types of secondary storage applications. This new media type encourages the use of flash in ways never before possible.

FUTURE OUTLOOK

There has been no argument that flash is a better storage technology in many ways than HDDs for performance-intensive 3rd Platform computing environments. IDC encourages customers whose HDD-based arrays are approaching a refresh cycle to absolutely look at flash-based arrays and compare not just dollar-per-gigabyte acquisition cost but also the better performance and secondary economic benefits of flash that result in smaller storage infrastructures and a significantly better TCO even when raw flash capacity is 5x-6x the cost of HDD capacity. But until SanDisk's InfiniFlash announcement, these same arguments could not be made for secondary storage environments because the cost of raw flash capacity was still too expensive for capacity-intensive applications. Now, that is no longer true.

3rd Platform computing workloads like content repositories, media and other streaming services, big data and analytics, and Web serving are the future, and cost has been the single most important reason why HDD rather than flash was still being used for companies' storage solutions. Outside of cost, there is no argument about whether or not these applications would benefit from the better performance and reliability of flash. There have been questions about HDD scalability and density, but scale-out architectures have helped kick those considerations down the proverbial road for now. Custom flash modules today already provide the best density for primary storage applications (e.g., the HGST-Skyera AFA's ability to house 136TB of flash capacity in 1U), and the opportunity to create ever larger HDDs is limited by access and rebuild time considerations. InfiniFlash is coming to market with a density that at the outset is already better than Skyera's industry-leading density.

IDC has already forecast that flash-based arrays – with their better performance, reliability, and TCO – will dominate primary storage environments over the next five to seven years, effectively replacing pure HDD-based arrays. The cost of raw flash capacity, however, has limited the use of this technology in secondary storage environments. If InfiniFlash can prove out the claims it is making with

respect to performance, scalability, density, reliability, and cost, it will clearly put HDD-based solutions in these areas under pressure as well. This new category of storage could easily become the storage foundation of choice for these types of hyperscale secondary storage environments.

With conventional flash sure to dominate primary storage in the foreseeable future, and this new category of Big Data Flash competing in the secondary storage markets, it is now realistic to think about an "all-flash datacenter."

ESSENTIAL GUIDANCE

The creation of the new category of Big Data Flash will be a welcome development in an industry that is struggling with legacy HDD technologies for secondary storage applications in the 3rd Platform computing era. As a flash memory storage manufacturer and supplier, along with its supplier relationships (both upstream and downstream), storage technology patent portfolio, and general expertise in the flash arena, SanDisk is in an excellent position to introduce this new category and make it successful. SanDisk management should be thinking not only about its first product entry in this new market but also about the most effective way to promote the development of the market.

For such a compelling technology, there should be a significant marketing budget to generate widespread awareness. The first focus should be on generating several extremely high-profile, extremely compelling success story references that underline the criticality of this new storage medium. Developer and channel partner programs should be put in place to develop a rich ecosystem of InfiniFlash-based solutions as quickly as possible, with an emphasis on the ease of working with SanDisk as a partner. Significant strategic consideration should be given to determining which InfiniFlash elements are made available to the open source community to help develop the right standards and which should be retained as sustainable differentiators against inevitable future market entrants.

On the product side, SanDisk needs to ensure a bulletproof enterprise-class product offering that is easy to integrate into relevant preexisting datacenter workflows. The addition of NFS/CIFS support in the near term will be important, and as the market develops, SanDisk may consider other software-based technologies, like data deduplication, that may allow it to expand to other secondary storage markets like backup, disaster recovery, and archive. In that case, other data protection APIs will need to be supported as well. And of course, continuing to work to lower the effective cost dollar-per-gigabyte cost of InfiniFlash will be important. At $1.00 per gigabyte, InfiniFlash is already a compelling alternative to HDDs for the targeted secondary storage application environments, but lower effective dollar-per-gigabyte cost will only make this offering that much more compelling.

The performance and cost characteristics of Big Data Flash will enable not only new types of secondary storage applications but possibly also new types of primary storage applications that meet its performance profile. The availability of the application development API is sure to engender some custom development in the 2015–2016 time frame, but if the technology takes off, other vendors selling more general-purpose applications related to content repositories, media and other streaming services, big data and analytics, and Web serving will be sure to take advantage of it as well. SanDisk would do well to take steps to make this API a standard as this new category develops.

CONCLUSION

Given evolving I/O requirements in 3rd Platform computing environments, there is a significant opportunity for products in the "Big Data Flash" category. We have seen secondary storage environments evolve over the past 15 years, from tape to scale-out secondary storage architectures based around disk. IDC views flash as a technology that will transform storage in the datacenter, and if Big Data Flash is able to deliver on the category definition we've outlined in this white paper, there is a good chance that we'll see a future evolution of secondary storage architectures from disk to flash. Big Data Flash addresses key 3rd Platform computing requirements for access and data movement performance while promising to lower TCO and improve secondary storage platform reliability.

SanDisk's flash technology expertise gives the company advantages in introducing this technology, and the enterprise expertise it has developed over the past 12–18 months is augmenting that advantage. In introducing the first product entry in this category, SanDisk has demonstrated its capability for innovation, but there are other functional and go-to-market considerations to firmly establish its product with customers that must be addressed in the near term as this market develops. Still, at this point, SanDisk is clearly a big step ahead of the competition with this introduction with a compelling technology that end users need.

End users are encouraged to evaluate InfiniFlash against its target application environments: content repositories, media and other streaming services, big data and analytics, and Web infrastructure. Its performance, feature set, and cost profile represent a better way to address the needs of these environments than scale-out architectures based on HDDs.

About IDC

International Data Corporation (IDC) is the premier global provider of market intelligence, advisory services, and events for the information technology, telecommunications and consumer technology markets. IDC helps IT professionals, business executives, and the investment community make fact-based decisions on technology purchases and business strategy. More than 1,100 IDC analysts provide global, regional, and local expertise on technology and industry opportunities and trends in over 110 countries worldwide. For 50 years, IDC has provided strategic insights to help our clients achieve their key business objectives. IDC is a subsidiary of IDG, the world's leading technology media, research, and events company.

Global Headquarters

5 Speen Street
Framingham, MA 01701
USA
508.872.8200
Twitter: @IDC
idc-insights-community.com
www.idc.com