



Vendor Profile

Kaminario: Innovating Beyond Scale-Up and Scale-Out Flash Architectures to Make AFAs the Heart of a Modern Datacenter

Archana Venkatraman

Carla Arend

IDC OPINION

Flash storage, especially all-flash arrays (AFA), has been a hotly contested area of storage recently. It also remains the only bright spot in the declining European external storage market. According to IDC's European External Storage Tracker, all-flash systems grew 96% YoY in the first quarter of 2016. In contrast, the traditional hard disk array segment declined 23% in user value while hybrid flash arrays grew at a more modest 4%. Bucking the overall trend of a decline in capacity shipped, flash arrays recorded triple-digit growth in capacity this quarter, accounting for nearly 60% of total shipments.

In a bid to stand out in the lucrative flash storage market, different vendors took different approaches; some focused on power efficiency or scale-up architectures, while others differentiated on quality of service (QoS) or single-node performance or scale-out architectures. But as flash adoption matured and vendor-led innovation accelerated, many features became part of the standard flash architectures, making AFAs fit as general-purpose primary storage platforms hosting a variety of mixed workloads.

Kaminario was one of the first entrants into the AFA market to combine both scale-up and scale-out architectures into a single system to provide flexibility in terms of both capacity expansion and system reconfiguration. This flexibility offered European enterprises the panacea to overcome their storage capacity woes right at a time when cloud-native and mobile-native workloads started entering the datacenter with more complex and dynamic infrastructure requirements.

In addition to a differentiated architecture, Kaminario has been perceptive of the datacenter professionals' cost sensitivity and is one of the few early flash players that have shown commitment to continuously cut the cost of flash storage. It was one of the first flash vendors to offer triple level cell (TLC) technologies in flash-optimized arrays.

In IDC's opinion, Kaminario is well-positioned to grow its market shares in Europe as:

- The demands of 3rd Platform workloads are forcing customers to seek a better overall value proposition in general-purpose primary storage arrays, making the combination of scale-up and scale-out storage an attractive offering.
- Kaminario's commitment to offering low effective per-gigabyte cost for its systems appeals to cost-conscious European customers aiming to modernize their datacenters cost-effectively, as well as to SaaS players looking for a cost-efficient yet scalable flash platform.
- Kaminario is continuing to innovate on guarantee programs, performance and data management features to address a broad range of customers ranging from financial services to cloud service providers.

IDC believes that with continued innovation, deeper channel engagement and demonstrating the benefits of its ground-up architecture, Kaminario will be able to maintain its competitive edge as more scale-up vendors add scale-out features to broaden their appeal.

IN THIS VENDOR PROFILE

This IDC Vendor Profile analyzes Kaminario, an all-flash array vendor, and assesses its key success factors such as strategy, service offerings, business strategy, and market positioning. This vendor profile also analyzes the European flash storage market and end-user adoption trends.

SITUATION OVERVIEW

As digital transformation enters the mainstream in Europe, enterprise IT has become heterogeneous with older workloads such as relational databases, and custom business workloads leveraging on the infrastructure alongside a variety of newer workloads driven by mobile computing, social media/business, Big Data and analytics, and cloud services. These types of mixed virtual workloads place demands on storage performance, scalability, and agility that just cannot be met cost effectively by existing storage architectures. Following rapid innovation and maturity in flash storage technologies, flash quickly emerged as a viable alternative for the hosting of multiple workloads in 2014 in Europe.

The AFA market in Europe is maturing, with AFA systems becoming a viable option for mixed virtual workload consolidation. IDC estimates that the AFA segment in Europe will grow at a CAGR of 25% until 2020 to surpass \$2.3 billion in user value. Customers looking to replace their ageing storage infrastructures with AFAs are faced with a myriad of choices on the market. In conversations with IDC, end users cite performance and scalability, cost, enterprise-range data services and management features, data integrity, and availability as key criteria when selecting AFA solutions.

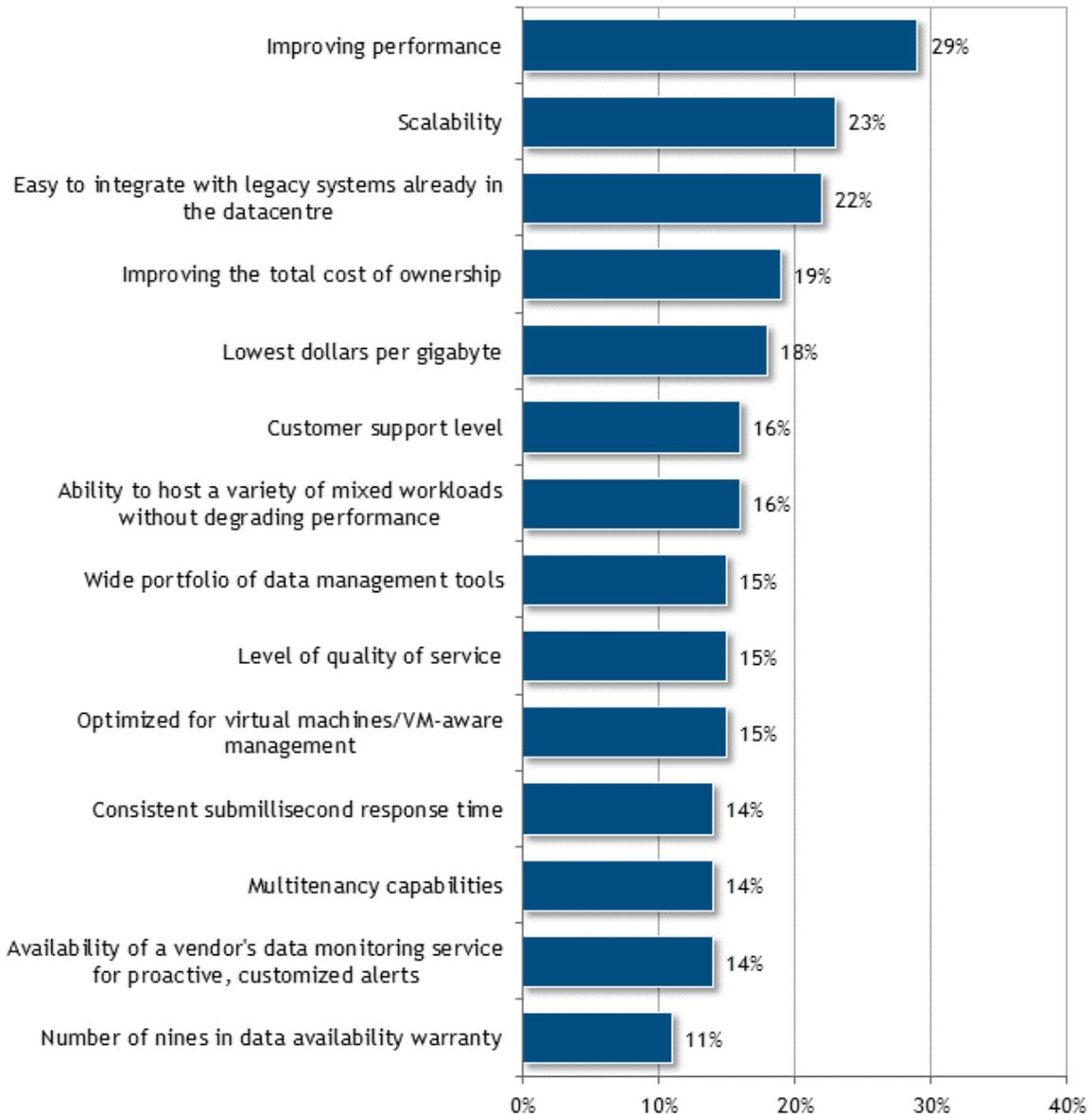
IDC's April 2016 Datacenter End-User survey in Europe showed that 79% of respondents are planning to deploy more flash storage technologies in the next 12 months, with key industries such as banking and financial services, IT service providers, retail, media and telecom, healthcare, manufacturing, and transport and travel favoring AFAs over HFAs in their flash deployment plans.

The study further found that performance, scalability, cost, and compatibility with existing datacenter systems are the top 5 considerations for end users when investing in flash storage (See Figure 1). This was closely followed by customer support and the ability to host multiple workloads. In IDC's opinion, these considerations reflect the maturity in the European marketplace around flash usage, with many enterprises seeking enterprise-grade features such as scalability, integration with legacy systems, multi-workload consolidation, and so forth, while investing in flash arrays.

FIGURE 1

Flash Array Purchase Considerations

Q. *What are your top consideration factors when purchasing flash storage systems for your organization?*



Source: IDC, 2016

When AFAs first came to market, they were generally relatively small systems that were targeted for a single application that demanded extremely high performance. This was because of flash's new technology status and high acquisition costs. Over time, enterprises started to reap the benefits of flash and wished to leverage that level of performance across more production applications. Vendors, aware of their customers' interest in mixed workload consolidation, began to increase the scalability of their systems and add more enterprise-class data management features such as snapshots, clones, encryption, and replication.

Kaminario, an all-flash vendor, launched its first AFA product after three years in incubation with a long-term vision of becoming a digital transformation facilitator rather than simply providing a high-performing storage solution to overcome specific performance bottlenecks.

Company Overview

Kaminario, headquartered in Needham, Massachusetts was founded in 2008, and the vendor shipped its first AFA array – the K2 platform – in 2011, making it one of the earlier entrants into the AFA market. Kaminario's differentiator was that its flash architecture, combining both scale-up and scale-out technologies, was built to support unprecedented configuration flexibility.

Between 2011 and 2015, Kaminario received \$143 million in total venture capital funding, making it a well-financed storage startup to take on the big storage incumbents. Kaminario currently has six investors on board, including Mitsui Global Investment, Globespan, and Sequoia. The company's leadership team is made up of professionals with storage expertise from EMC, IBM, 3PAR, Oracle, HPE, and even Pure Storage.

Company Strategy

While much of the focus in the early years was to accelerate product innovation and address the technological demands of its customers, build PoCs, and demonstrate successful use cases, Kaminario has honed its focus on global expansion in the last couple of years, especially to tap potential in the EMEA market.

In 2015, the company dramatically grew its channel business and committed to a 100% channel route in EMEA. In IDC's opinion, such a commitment to the reseller community gives the channel an additional incentive and encouragement to boost the vendor's profile and technologies in a crowded storage marketplace – something that is critical for a startup like Kaminario to penetrate the deep installed base of the incumbent vendors. In EMEA, the vendor has offices in London, Paris, and Israel and local support centers.

Kaminario's partner program – ACCELERATE – aims to offer channel members a combination of discounts, rebates, and incentives to earn high overall margins industry-wide in a stagnant storage hardware industry. Partners also have access to other benefits, including technical and market training, marketing resources and discounts on demo systems. The program also includes consulting to help technology resellers craft business strategies around the all-flash datacenter. It has over 150 channel partners globally.

Kaminario K2 All-flash Storage Arrays

The fully integrated hardware and software platform, K2, allows up to eight dual-controller nodes (each of which supports internal capacity expansion) to be clustered together under a true single-system image, complete with fully, evenly distributed data and metadata to deliver extremely consistent performance, despite varying workloads. A system can start with a single node (called a K-Block) that has dual active-active controllers and 24 SSDs, but can be expanded up to 96 SSDs per K-Block and up to 8 K-Blocks, all connected across a redundant, dedicated low latency InfiniBand network. The K2 is essentially a software-defined system running on top of industry-standard hardware and is sold across enterprises and small and medium businesses in Europe across multiple verticals including financial services, healthcare, utilities, technology, and software-as-a-service markets.

In IDC's opinion, early AFA vendor Kaminario's commitment to combine scale-up and scale-out architectures in a single system demonstrates the team's deep expertise in the storage market. This is because, back in 2011, many of the flash deployments were restricted to niche use cases and to boost the performance of single-purpose workloads which a scale-up AFA solution could

satisfy. But, as a new generation of more dynamic workloads started to enter the datacenter as a result of digital transformation initiatives, storage performance and capacity issues became even more amplified, forcing users to seek cost-effective, flexible, and performant storage infrastructure that can accommodate multiple workloads. As this happened, more organizations started to understand the value that scale-out architectures could provide and began evaluating AFA platforms that go beyond traditional scale-up architectures. In the past two years, K2 has been increasingly purchased as a general-purpose (rather than dedicated) primary storage array by Kaminario customers in Europe. IDC believes this is testimony that its technology strategy is yielding results.

In our opinion, Kaminario's belief in the all-flash datacenter future and its strong ambition to be a technology enabler for enterprise digital transformation is at the core of it engineering a "ground-up" combination architecture that will stand the test of time as traditional scale-up vendors add scale-out features to make their AFA arrays fit for mixed workloads. In IDC's opinion, the flash provider's scale-out architecture and its patented I/O optimization algorithms can deliver consistent high performance in complex workload environments – ideal for ISV and SaaS environments. Recent successes with SaaS and ISV providers in Europe are further testament that Kaminario's technology is fit for large-scale cost-efficient deployments and scale-out workloads.

But another business strategy that shows the team's deep understanding of storage challenges and its dream of facilitating an all-flash datacenter fit for the digital era is Kaminario's commitment to bringing the cost of flash down.

For one, the K2 systems allows a mixing of generational technologies, supporting the ability to rapidly integrate newer controller and media technologies into an existing system while preserving existing investments, giving organizations more value for their money and the ability to start small. As highlighted by IDC's end-user survey, this was one of the top 5 considerations for end users when investing in flash-based storage solutions.

Kaminario Envisions All-Flash Datacenters With TLC Technology

Despite the falling prices, the perception of a high acquisition cost for flash is still its biggest adoption barrier. IDC believes that each drop in the per-gigabyte price of flash opens it up for use with more applications. Storage efficiency technologies such as inline compression and deduplication in flash-based arrays are helping to reduce that cost more quickly, as is the more widespread use of less expensive multi-level cell (MLC) NAND technology (versus single-level cell [SLC]). IDC believes that flash technologies such as triple-level cell (TLC) and 3D NAND can help lower these costs even more and accelerate flash storage adoption in Europe, especially at a time when business data continues to grow at an unprecedented rate.

TLC flash is a type of solid state flash memory that can store three bits of data per cell of flash – more data than MLC, which is currently widely used in flash arrays. Although a TLC flash die contains the same capacity as an MCL flash die, the die is smaller in TLC, providing cost savings.

The ability to store more data in the same space makes TLC flash less expensive and, therefore, popular in consumer devices. However, the role of TLC in enterprise storage has been questioned over doubts about its durability and lower endurance levels, due to the fact that the more bits the flash cell has, the fewer write cycles it will have.

Kaminario is the first AFA vendor to make TLC enterprise-ready in its K2 v5.5. It addresses the reliability and endurance challenges of 3D TLC NAND by reducing the number of writes on the TLC drives in its K2 systems. It is using RAM-based deduplication and byte-aligned compression to reduce the number of writes on TLC flash. It also uses sophisticated algorithms to conserve writes on a DRAM level, load-balancing the writes across all SSDs to prevent write hot spots. It

also employs its Log Structure Array (LSA) data layout, which writes large blocks in a way that is optimized for the flash media. Kaminario is offering a seven-year flash endurance guarantee under any workload.

Kaminario drives a low effective per-gigabyte cost for its systems relative to most other competitors today, delivering in the range of \$1/GB (assuming 4:1 data reduction ratios) and leveraging technologies such as its adaptive block-size algorithm, byte-aligned compression, and 3D NAND to help the company deliver on this objective. Kaminario also supports up to 3.2GB/sec of system bandwidth (25.6GB/sec for an eight-node system) and allows the simultaneous mixing of FC and iSCSI host connections.

FUTURE OUTLOOK

Kaminario's key strategies to strengthen its market positioning are to launch QoS functionalities and a cloud-based datacenter-aware storage analytics platform in 2016 and beyond.

Until now, K2 has lacked in-built QoS features. The lack of QoS controls has not yet been an operational concern for most Kaminario customers. A K-Block can deliver over 250,000 IOPS, but it is the ability to scale performance linearly across up to eight nodes that allows it to deliver more IOPS than most applications need today.

Currently, for smaller and medium-sized enterprises in Europe, QoS still is a tick in the box but a very highly desirable feature. Besides, as flash arrays continue to become general-purpose storage platforms hosting mixed workloads, the lack of QoS controls could become an issue – perhaps not so much from an inability to field sufficient IOPS but from an inability to use available IOPS more efficiently and cost effectively. In addition, service providers and SaaS customers that operate on a large scale prefer flash arrays with robust QoS capabilities to overcome the "noisy neighbor" issue. In IDC's opinion, as Kaminario's SaaS and ISV customer base grows and as more traditional enterprises begin using QoS features more actively, it will become one of the key decisive factors for customers, and Kaminario must prioritize it.

In May this year, Kaminario announced collaboration with software vendor Zerto to improve IT efficiency and make data highly available for enterprise customers. IDC believes that in complex virtual environments, high availability, including replication between primary and DR sites becomes a challenge. But at the same time, the pressure to become an "always-on" enterprise is higher than ever before in the digital era. Together, Kaminario and Zerto will have the ability to help overcome this highly problematic IT data storage and DR challenge by automating processes so that applications and data are immediately available to end users. Kaminario also has a similar relationship with FalconStor to leverage its replication capabilities in Kaminario configurations.

There is no doubt that Kaminario is setting its ambitions high to expand its AFA market shares to the enterprise and SaaS customer areas. In addition to upgrading their enterprise-grade and SaaS-grade capabilities such as QoS and replication and high availability, Kaminario is expanding guarantee programs to cover performance (Five 9s), availability, and capacity, and launching cloud-based analytics services. It has already added native replication capabilities in the latest K2 version (5.5) and has launched its "Perpetual Array" functionality. In IDC's opinion, the perpetual array feature offers guarantees around scalability. This will allow customers to mix and match older and newer controllers to have a scale-out architecture without worrying about forklift upgrade or data migration expenses.

Kaminario's latest "Flash Assured" business guarantee programs are aimed at taking the guessing game out of flash purchase decisions. In IDC's opinion, taking the guessing game out from

scalability, performance, capacity, and cost allays enterprises' fears around over-provisioning or under-investing and accelerates flash adoption more effectively.

Challenges

As scale-out benefits become better recognized, many flash vendors are adding the feature to their offerings to better target primary storage environments. IDC believes that even more vendors will integrate these kinds of capabilities into their platforms going forward. The combined scale-out and scale-up architecture has been a strong differentiator for Kaminario. IDC believes that Kaminario should leverage its early-mover advantage and demonstrate the benefits of its ground-up scale-out architecture over retro-fitted features. We also believe that competing vendors' scale-out architecture strategy further acknowledges Kaminario's vision and deep understanding of the storage market and re-emphasizes its role in enabling digital transformation.

As a start-up vendor, Kaminario is also up against big storage vendors with strong installed bases in Europe. By ramping up its marketing and awareness programs, deepening channel relations and adding regional workforce, the vendor will be able to overcome these competitive challenges. IDC also believes Kaminario's market strategy of attracting more SaaS customers will yield benefits as these customers typically have shorter IT purchase life cycles and are more willing to purchase from newer, niche AFA vendors.

Lastly, amid dwindling external storage revenues, flash is the only bright spot in the storage industry and IDC expects even more fierce competition going forward as AFA becomes a mature market with only a few dominant vendors. We believe that vendors with broad portfolio offerings, rich feature sets, cost-efficiency, continued innovation and effective go-to-market strategies will be the ones that survive.

ESSENTIAL GUIDANCE

Since launching K2 in 2011, Kaminario has displayed the vision and ability to execute its strategies to maintain its growth trajectory. It has not just continued its innovation to provide truly scale-out architectures and cost-effective all-flash solutions, but has also gone on to add more enterprise-grade features. The company told IDC that its revenues for 1Q16 grew over 120% YoY and that it added twice as many new customers in the last 12 months than the previous year. Kaminario's future business strategy is well-articulated too – it is adding features around analytics and QoS and extending channel commitment. It is also looking to innovate around application-aware functionality and assessing how new technologies such as Xpoint (CrossPoint) can fit into its roadmap.

Advice for Kaminario

In order to maintain its growth and market position in the fast-moving AFA space, Kaminario should:

- **Amplify its strengths:** Kaminario should demonstrate through PoCs and use cases how scale-out and scale-up foundation is right at the heart of its solutions and how it is core to its engineering innovation. This will help it to continue differentiating its offerings from other scale-out AFA products. It should also emphasize how its latest K-Assured guarantee programs can help customers rely on it without worries as they follow on their digital transformation journeys.
- **Accelerate QoS additions:** The use of AFA solutions in primary storage for consolidating mixed workloads is becoming a common practice. The vendor should focus on adding QoS capabilities quickly to ensure it meets all the features on enterprise and SaaS providers' wish lists.

- **Continue addressing core AFA adoption hurdles:** Kaminario is one of the few AFA vendors that has addressed the high cost of flash hurdle by adopting technologies such as TLC early on. It is also addressing other concerns such as data migration issues, replication, availability, and forklift upgrades. It should continue to focus its engineering efforts and investments to address users' AFA-related concerns to further gain confidence from enterprise customers.
- **Expand in the European market:** Building a strong position in the second largest market for AFA products requires continuous investment in marketing, building brand awareness and expanding a strong reseller network across the various European geographies.

Kaminario has consistently shown its commitment to digital transformation, 3rd Platform workloads, cost-efficiency and now the integration of new features and new technologies. There is no doubt that Kaminario's solutions, strategy, customer portfolio, and finances all look healthy. It is also well-positioned to cater to the needs of traditional enterprises and SaaS and ISV customers, giving it a wider total addressable market. How well and how quickly it executes on its future ambitious roadmap to maintain a competitive edge as scale-out architectures become common offerings will determine its long-term success in the fiercely contested yet lucrative AFA landscape.

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IDC U.K.

IDC UK
5th Floor, Ealing Cross,
85 Uxbridge Road
London
W5 5TH, United Kingdom
44.208.987.7100
Twitter: @IDC
idc-community.com
www.idc.com

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