GIGAOM

MARKET RADAR

GigaOm Radar for Enterprise General-Purpose Storage Systems v1.0

Block Storage - External Enterprise Storage Systems

ENRICO SIGNORETTI

TOPIC: DATA STORAGE

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GigaOm Radar for Enterprise General-Purpose Storage Systems

Block Storage - External Enterprise Storage Systems

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1. Summary

External storage systems for the enterprise are adapting quickly to new needs and business requirements, with data now accessed from both on-premises and cloud applications. We are in a transition phase from storage systems designed to be deployed in data centers to hybrid and multi-cloud solutions, with similar functionalities provided on physical or virtual appliances as well as through managed services.

The concept of primary storage, data, and workloads radically changed over the past few years. Mission- and business-critical functions in enterprise organizations were concentrated on a few monolithic applications based on traditional relational databases. In this scenario, block storage was often synonymous with primary storage, and performance, availability, and resiliency were prioritized, usually at the expense of flexibility, ease of use, and cost. Now, after the virtualization wave and the exponential growth of microservices and container-based applications, the focus has shifted to flexibility, integration with the cloud, and dynamic resource allocation.

When it comes to modern storage, and block storage in particular, flash memory and high-speed Ethernet networks have commoditized performance and reduced costs, allowing for more liberty in system design. At the same time, enterprise organizations are working to align storage with broader infrastructure strategies, which address issues such as:

- Better infrastructure agility to speed up response to business needs
- Improved data mobility and integration with the cloud
- Support for a larger number of concurrent applications and workloads on a single system
- Simplified infrastructure
- Automation and orchestration to speed up and scale operations
- Drastic reduction of total cost of ownership (TCO) while significantly increasing the capacity per sysadmin under management.

These efforts have contributed to the growth in the number of solutions, as startups and established vendors alike move to address these needs. Traditional high-end and mid-range storage arrays have been joined by software-defined and specialized solutions all aimed at serving similar market segments, but differentiated by the focus they have about the points described above. A one-size-fits-all solution doesn't exist. In this report we will analyze several aspects and important features of modern storage systems to better understand how they impact the metrics for evaluating block storage systems, especially in relation to the needs of each IT organization.

2. About the GigaOm Radar Report

HOW TO READ THIS REPORT

This GigaOm report is one of a series of documents that helps IT organizations assess competing solutions in the context of well-defined features and criteria. For a fuller understanding consider reviewing the following reports:

Key Criteria report: A detailed market sector analysis that assesses the impact that key product features and criteria have on top-line solution characteristics–such as scalability, performance, and TCO–that drive purchase decisions.

GigaOm Radar report: A forward-looking analysis that plots the relative value and progression of vendor solutions along multiple axes based on strategy and execution. The Radar report includes a breakdown of each vendor's offering in the sector.

Vendor Profile: An in-depth vendor analysis that builds on the framework developed in the Key Criteria and Radar reports to assess a company's engagement within a technology sector. This analysis includes forward-looking guidance around both strategy and product.

3. Market Categories and Deployment Types

For a better understanding of the market and vendor positioning (**Table 1**), we assess how well enterprise block storage systems are positioned to serve specific market segments. We recognize three segments in this report: small-to-medium business, large enterprise, and specialized:

- **Small-to-medium enterprise:** In this category we assess solutions on their appeal to customers that value ease of use and deployment, with a focus on organizations ranging from very small startups to medium-sized infrastructures. Solutions optimized for this category can appeal also to large enterprises for departmental use cases, where rich feature sets and extensive data mobility and management capabilities are not priorities.
- **Large enterprise:** Here offerings are assessed on their ability to support larger and business critical projects. Optimal solutions in this category will have a strong focus on flexibility, performance, data services, and features to improve security and data protection. Scalability is another big differentiator, as is the ability of hybrid solutions to store data across on-premises and public cloud.
- **Specialized:** Optimal solutions will be designed for specific workloads and use cases, such as storage optimized for virtual infrastructures, big data, and high-performance computing (HPC).

In addition, we recognize two deployment models for solutions in this report, on-premises and hybrid cloud:

- **On-premises solutions:** Available only for on-premises deployments. A traditional and simpler approach to block storage for those users who don't plan to move data seamlessly, and across different environments, through the storage infrastructure.
- **Hybrid and multi-cloud solutions:** These solutions are meant to be installed both on-premises and in the cloud, allowing customers to build hybrid or multi-cloud storage infrastructures. Solutions can be based on physical and virtual appliances or cloud-managed services. This approach is more flexible, and the user usually has greater control over data mobility and the entire infrastructure stack.

Table 1: Vendor Positioning

	MARKET SEGMENT			DEPLOYMENT MODEL	
	Small/Medium Enterprise	Large Enterprise	Specialized	On-Premises	Hybrid Cloud
DDN	+++	++	+++	+++	-
Dell EMC	+++	+++	+	+++	+
Hitachi Vantara	++	+++	-	+++	-
HPE	+++	+++	-	+++	++
IBM	++	+++	-	+++	-
Infinidat	++	+++	-	+++	+
NetApp	+++	+++	++	+++	+++
Pure Storage	+++	+++	-	+++	++
Zadara	+++	+++	++	++	+++

+++ Strong focus and perfect fit of the solution
++ The solution is good in this area, but there is still room for improvement
+ The solution has limitations and a narrow set of use cases
- Not applicable or absent.

Source: GigaOm 2020

4. Key Criteria Comparison

Following the general indications introduced with the GigaOm report "Key Criteria for Enterprise Block Storage," **Table 2** summarizes how each vendor included in this research performs in the areas that we consider differentiating and critical for hosted enterprise external block storage solutions. The objective is to give the reader a snapshot of the technical capabilities of different solutions and to define the perimeter of the market landscape.

Table 2: Key Criteria and Evaluation Metrics Comparison

	KEY CRITERIA						EVALUATION METRICS					
	AI-Based Analytics	New Media Types	NVMe-oF	Cloud Integration	API and Automation	Kubernetes Integration	System Lifespan	Flexibility	Ease of Use	$/IOPS	$/GB	TCO
DDN	++	++	+	+	++	+	++	++	+++	++	+++	++
Dell EMC	++	++	+	+	+	+	++	++	+++	++	++	++
Hitachi Vantara	+++	++	+++	+++	+++	+	+++	++	+++	++	++	+++
HPE	+++	+	+	++	+++	++	+++	++	+++	+++	+++	+++
IBM	+	++	++	+	++	+	++	+	++	++	++	+
Infinidat	++	++	-	+++	+++	++	+++	+++	+++	++	+++	+++
NetApp	++	++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++
Pure Storage	+++	+++	+++	++	+++	+++	+++	+++	+++	++	+++	+++
Zadara	+	+++	++	+++	+++	++	+++	+++	+++	++	++	+++

+++ Strong focus and perfect fit of the solution
++ The solution is good in this area, but there is still room for improvement
+ The solution has limitations and a narrow set of use cases
- Not applicable or absent.

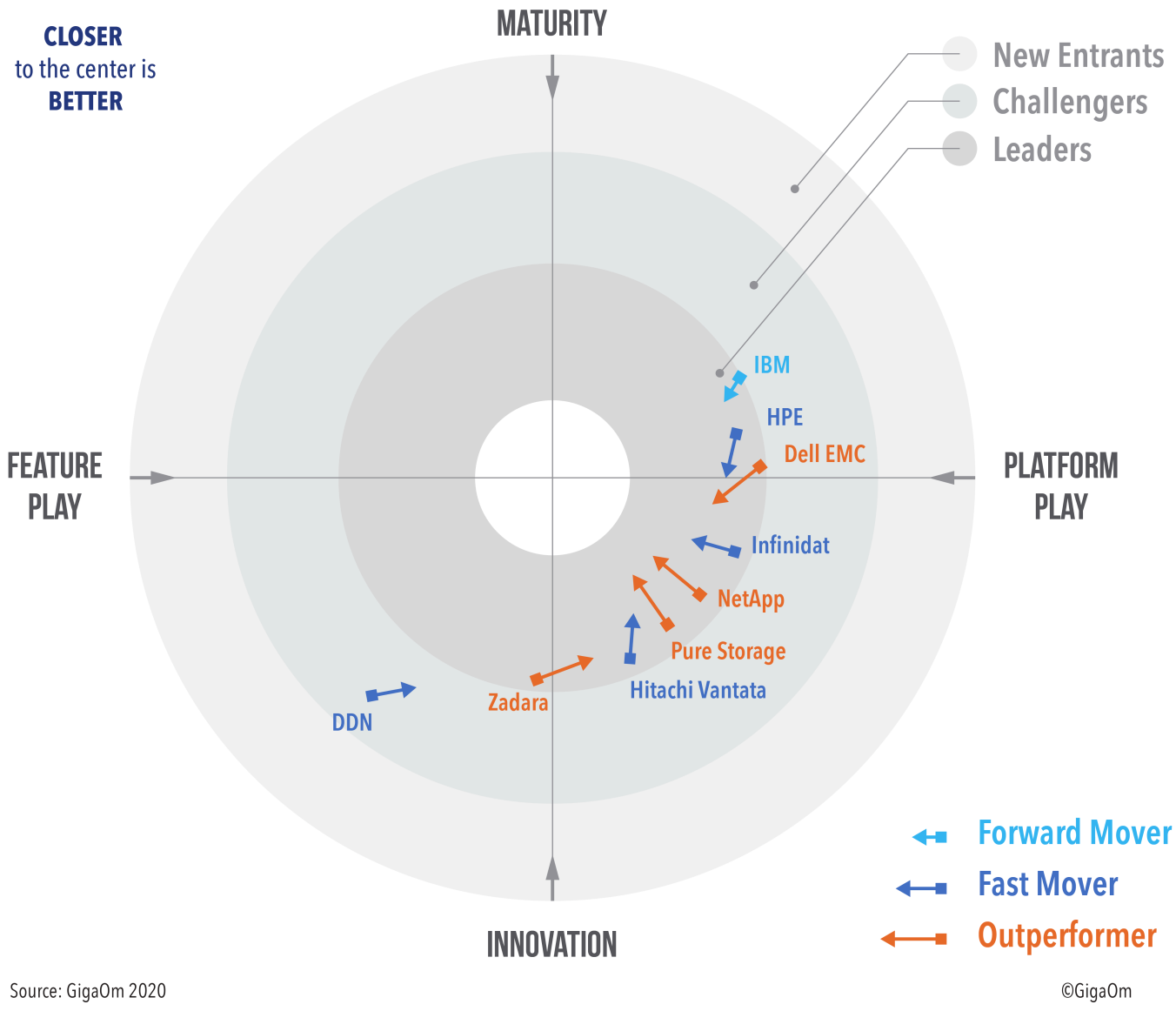
Source: GigaOm 2020

By combining the information provided in **Table 1** and **Table 2**, the reader should be able to get a clear idea of both the market and the available technical solutions.

5. GigaOm Radar

This report synthesizes the analysis of key criteria and their impact on critical metrics to inform the GigaOm Radar graphic in **Figure 1**. The resulting chart is a forward-looking perspective on all the vendors in this report, based on their products' technical capabilities and feature sets.

Figure 1: GigaOm Radar for Block Storage - External Enterprise Storage Systems



The GigaOm Radar plots vendor solutions across a series of concentric rings, with those set closer to the center judged to be of higher overall value. The chart characterizes each vendor on two axes—Maturity versus Innovation, and Feature Play versus Platform Play—while providing an arrow that projects each solution's evolution over the coming 12 to 18 months.

Block storage, in terms of external storage systems, is a very mature market, which is why there are several contenders in the leadership position on the radar chart. NetApp and Pure Storage are the current pace setters, but Hitachi Vantara and Infinidat are on a similar path to build a compelling solution ecosystem. Also worth note is Zadara, which still lacks some of the features of its competitors but has a very strong cloud proposition.

HPE and Dell EMC have a more conservative approach but are nonetheless accelerating their efforts to regain a role in the leadership area, with Dell EMC offering innovative new products that consolidate and simplify its product line.

Larger vendors enjoy an edge in that they are able to offer end-to-end solutions, which can be a major differentiator in certain circumstances. One company to watch over the next 12 to 18 months is DDN, as it builds out its intriguing Tintri product line.

INSIDE THE GIGAOM RADAR

The GigaOm Radar weighs each vendor's execution, roadmap, and ability to innovate to plot solutions along two axes, each set as opposing pairs. On the Y axis, **Maturity** recognizes solution stability, strength of ecosystem, and a conservative stance, while **Innovation** highlights technical innovation and a more aggressive approach. On the X axis, **Feature Play** connotes a narrow focus on niche or cutting-edge functionality, while **Platform Play** displays a broader platform focus and commitment to a comprehensive feature set.

The closer to center a solution sits, the better its execution and value, with top performers occupying the inner Leaders circle. The centermost circle is almost always empty, reserved for highly mature and consolidated markets that lack space for further innovation.

The GigaOm Radar offers a forward-looking assessment, plotting the current and projected position of each solution over a 12- to 18-month window. Arrows indicate travel based on strategy and pace of innovation, with vendors designated as Forward Movers, Fast Movers, or Outperformers based on their rate of progression.

Note that the Radar excludes vendor market share as a metric. The focus is on forward-looking analysis that emphasizes the value of innovation and differentiation over incumbent market position.

6. Vendor Insights

DDN

DDN was already well known for its high-performance computing, AI, and big data analytics storage and entered the enterprise storage market through three acquisitions: Tintri, Nexenta, and Tegile. Now combined under the Tintri brand, the products from these acquisitions complement each other, with VMstore specialized for virtualized workloads and a NAS interface, while IntelliFlash addresses general-purpose storage for a broad set of use cases. IntelliFlash systems can be deployed in hybrid and all-flash storage configurations with an NVMe back end. The IntelliFlash solution shows good performance figures thanks to its internal, multi-level caching architecture, even if it doesn't support NVMe-oF yet, and $/GB is good as well, thanks to a combination of deduplication and compression techniques.

The management interfaces are easy to use, and integration with leading OS and virtualization platforms is well done. However, the IntelliFlash solution presents limited cloud and Kubernetes integration. The analytics system for this platform is well designed with advanced predictive analytics features and insights about the status of the system in terms of health, performance, capacity, and potential issues. Information can be automatically shared with DDN to enable proactive maintenance actions.

Strengths: The new Tintri products now address new use cases and extend DDN's reach to small and medium organizations.

Challenges: Tools to manage the systems in the product line are different and the integration is still at the beginning. No NVMe-oF support; limited cloud integration.

Dell EMC

Dell EMC recently restructured its mid-range product line, introducing a new all-flash, NVMe-based product called PowerStore, while keeping its Unity XT system for hybrid deployments. The new PowerStore model is designed with the latest technology in mind and includes an innovative, container-based OS for the back end, while keeping a familiar operating model for the system on the front end. The two-prong strategy has helped propel Dell EMC back into a leadership position from a technology standpoint.

PowerStore offers a scale-up architecture and can be federated with other systems to centralize management with advanced automated provisioning and load-balancing capabilities, providing a scale-out user experience. Integration with the cloud and Kubernetes is not on par with competitors yet, but the roadmap is promising.

The PowerStore architecture allows virtual machines to run directly in the system (AppsON) without the need for external servers. This feature enables users with data intensive edge use cases to simplify the

infrastructure and lower costs, bringing compute and storage closer to each other. The CloudIQ SaaS-based Analytics suite provides a complete view of the system in real-time while helping to improve day-to-day support operations and capacity planning. Dell EMC offers all possible combinations of purchasing and subscription models for its hardware and software.

Strengths: Dell EMC has a complete product line-up and can address all use cases for enterprises of all sizes. The new PowerStore is based on a modern design and has great potential.

Challenges: PowerStore is not available as a VM that can be deployed in the cloud or as a cloud managed service yet, but the roadmap is promising. Kubernetes CSI plug-ins are available for all storage systems, but there isn't a solution designed to address complex Kubernetes environments yet.

Hitachi Vantara

Hitachi Vantara has closed the gap between its high-end enterprise storage line and the low-end products in its portfolio with the new VSP E990. All Hitachi Vantara storage systems use the same OS and expose the same feature set, enabling users to design their infrastructures with a consistent set of characteristics both at the core and at the edge. Alongside storage systems, Hitachi Vantara now offers a complete management platform, Hitachi Ops Center, which is powered by ML algorithms, and aimed at simplifying and improving operations for the entire storage stack.

The Hitachi portfolio supports both hybrid and all-flash, NVMe-based solutions, alongside advanced data services and efficient data footprint optimization, giving organizations of all sizes several options to find the right match between $/GB and $/IOPS. Cold data can be offloaded to object stores like Hitachi Content Platform (HCP) or to the cloud, but a virtual version of the product running on public clouds is not available yet. Kubernetes CSI plug-ins are aligned with current specifications, hence with limited support for advanced data services. Traditional purchasing models are now joined by modern, subscription-based pricing that allows customers to align on-premises infrastructure to cloud-like expenditure models.

Strengths: Hitachi Vantara has long provided rock-solid products and top-notch support services. The E990 demonstrates that Hitachi Vantara can adapt its high-end enterprise storage systems to the general enterprise market.

Challenges: Hitachi Vantara is known as a conservative storage company and its user interfaces have lagged behind competitors. Hitachi Ops Center is an important step forward in this regard and the roadmap is promising with regard to AIOps functionality.

HPE

HPE has a comprehensive storage portfolio that includes the Nimble Storage, 3PAR, and Primera product lines addressing mid-range and high-end enterprise needs. Unfortunately the OS is not shared across all systems, which limits interoperability.

HPE InfoSight, HPE's AI-based analytics suite, still retains its leadership in analytics and storage management when compared to similar products in the market, and is now adopted by a large number of HPE products to help improve the overall user experience and drive down infrastructure TCO. HPE is also extending its reach to the cloud with HPE Cloud Volumes (based on Nimble storage) and has a good roadmap regarding Kubernetes integration.

The latest addition to the product line, Primera, has a modern design with a modular OS and an NVMe back end. It inherits the best characteristics of 3PAR while adding new features such as an embedded AI system to automate performance and resource optimization, and advanced data services to meet high-end storage requirements.

The HPE GreenLake program appeals to customers with subscription options that range from traditional purchasing models to models that simplify the transition from capital expenditure (CapEx) spending to operating expenditure (OpEx) spending for HPE customers. And HPE boasts one of the largest partner and channel networks in the world, providing a strong foundation for companies seeking to integrate HPE systems into their end-to-end infrastructures.

Strengths: Primera is immature in some aspects but shows strong potential. InfoSight is still the best AI-driven analytics tool for storage.

Challenges: Nimble and Primera use two different operating systems, and cloud integration is limited to Nimble-based Cloud Volumes at the moment.

IBM

The IBM storage portfolio is broad and includes all-flash and hybrid solutions. The mid-range and all-flash products now run on the same OS stack—Spectrum Virtualize—with different functionality exposed depending on the resources available in the system. High-end systems, such as the 9200 Family, already support NVMe-oF, storage class memory, and dedicated flash memory modules with embedded hardware-accelerated compression capabilities for high-performance and ultra-low latency needs. On the other hand, mid-range and low-end systems can be configured with NVMe or SAS back ends. Storage-class memory is supported for high-performance workload requirements while automated tiering and other resource optimization techniques are available to improve capacity consumption and $/GB.

The IBM Storage Insights predictive analytics suite can monitor both IBM and several third-party systems, helping establish a complete view of the storage infrastructure from a single interface. Support for Kubernetes is still limited, with basic Container Storage Interface (CSI) plug-ins available for each platform. Integration with the cloud is achieved through cloud tiering features embedded in the systems and virtual instances of Spectrum Virtualized deployed in the public cloud to provide a consistent user experience and set of features across different environments.

Strengths: IBM boasts an end-to-end storage portfolio, with some IBM FlashSystem products providing compelling performance and features, while others can be configured for capacity-driven applications.

Challenges: Spectrum Virtualize can run in a cloud VM, but the number of services specifically designed for the cloud is still limited.

Infinidat

Infinidat boasts a modern, hybrid architecture that delivers a no-compromise feature set with compelling $/GB and $/IOPS figures at petabyte (PB) scale. To achieve this goal Infinibox takes advantage of a data path designed around a combination of DRAM, Flash memory, and hard disk drives tiers associated with sophisticated caching technology to optimize data placement. These characteristics enable Infinidat customers to consolidate several workloads and more data per storage system to reduce the overall TCO of the infrastructure. Infinidat has also developed an easy-to-use ML-driven management system to support and simplify day-to-day operations and provide proactive support. Infinibox now supports NVMe/TCP with plans to support NVMe/FC in future product versions.

Infinidat offers a hybrid pricing model that can appeal to organizations, whether they prefer to work with CapEx budgeting or OpEx—including the option for subscription-based billing. Support for cloud-native applications is good thanks to a clever implementation of the CSI plug-in for Kubernetes, which allows you to copy and migrate data to remote systems or the public cloud for backup, disaster recovery, or development activities. Infinidat has a complete offering of integrations for major OS and virtualization platforms, as well as options for replicating and accessing data from within major cloud providers.

Strengths: High-end enterprise characteristics and a balanced architecture that enables users to consolidate a wide range of workloads in a single system and deliver a consistent performance experience.

Challenges: Infinidat now supports NVMe/TCP, but does not yet support NVMe/FC, although it has committed to support both NVMe/FC and NVMe/RoCE at a future date. The entry level configuration is not suited for small enterprise needs.

NetApp

NetApp has been building a comprehensive product portfolio that goes beyond traditional storage, while adding several new services and integrations with the cloud. The storage line-up is solid, with some products dedicated to specific workloads and use cases (Solidfire and E-series), as well as general-purpose arrays based on NetApp's ONTAP OS. The engineering team is very active and new ONTAP OS versions are released twice a year with new functionality.

All mid-range and high-end systems, including NVMe-based and hybrid models, can count on a series of integrations at the high level common to all storage systems (such as with SnapMirror for data replication), as well as a unified platform for monitoring and analytics (ActiveIQ). NetApp was the first in the market to offer end-to-end NVMe, and it now offers NVMe/FC on AFF systems and NVMe/RoCe and NVMe/Infiniband on EF series, yielding impressive performance figures. At the same time, other

components such as FlexCache contribute to improve performance by bringing data closer to where it is actually needed.

NetApp has displayed a strong commitment to supporting cloud and cloud-native workloads, with products dedicated to serve customers that operate in hybrid environments. In this context, support for Kubernetes is pretty strong, thanks to CSI plug-ins for all the platforms and Trident, a container storage orchestrator aimed at abstracting and optimizing data volume placement and management across a NetApp-based infrastructure. A virtual appliance for cloud deployments, as well as various integrations with object stores to offload cold data to the cloud (for example with FabricPool automated tiering) combine to improve the $/GB ratio of all-Flash solutions and the overall flexibility of the platform.

Strengths: Broad vision around data that goes well beyond traditional storage systems and reaches areas such as hybrid cloud, data, and applications management.

Challenges: Even though NetApp is creating a compelling ecosystem, some solutions need work to be fully integrated with the rest of the products.

Pure Storage

Pure Storage has quickly emerged to become one of the leading vendors in the external block storage market space. The company's products are well architected and easy to manage, and designed to be balanced and efficient in real-world enterprise scenarios. Recently Pure Storage began offering a growing number of integrations with the cloud, even though data management solutions are still limited.

One of the first primary storage vendors able to provide an end-to-end NVMe architecture, with storage-class memory and an array optimized for QLC NAND options, the company has steadily expanded the range of use cases for its all-flash storage systems. The FlashArray family has NVMe/RoCE support and is ready to support NVMe/FC, with FlashArray//X optimized for performance-driven workloads and FlashArray//C as a compelling solution optimized for capacity-driven workloads. User interfaces and integrations with other components of the stack are well implemented and the company also boasts top-notch Kubernetes integration with a dedicated orchestrator for improved data placement and management. All the systems can offload cold data to private and public object stores to improve capacity utilization, while Cloud Block Store (a cloud block storage solution based on the same Purity Operating Environmet used in the physical systems) offers a consistent user experience for hybrid cloud deployments.

Pure Storage offers a SaaS-based management platform, Pure1, that employs AI-based analytics for advanced real-time status monitoring, capacity planning, simplified management, and proactive support features. The platform has produced very positive reports about user experience among Pure's customers. These systems are the core of a strong solution ecosystem that includes cloud-like, OpEx-friendly plans to simplify hardware and software acquisitions for its customers, as well as a strong technology and channel partner network to back it up.

Strengths: Balanced approach to system and software design optimized to address new technology trends, resulting in compelling products and services that integrate well with customer infrastructures.

Challenges: While Pure Storage is accelerating its pace of development, the company's cloud and data management solutions are still limited compared to those offered by its competitors.

Zadara

Zadara is unique in that it offers a seamless, on-premises to cloud experience that extends from traditional, data center-resident systems to storage systems that can be accessed directly within major cloud providers as a managed service, while keeping an identical user experience. Notably, Zadara presents consistent functionality, features, and subscription models across these deployment targets and provides an easy-to-configure SaaS management environment. The service is available in multiple clouds and for on-premises deployments, simplifying data mobility across clouds while keeping complete control over infrastructure and security.

The result is a compelling blend of cloud convenience (including OpEx model pricing) and on-premises performance and control that Zadara customers laud. High security standards and flexibility are two other key aspects of this solution that have impressed enterprises. Zadara offers several configuration solutions starting from high-end, storage-class memory devices down to high-capacity hard disk drives that can be combined in virtual arrays that present several protocol and data services, alongside options to improve resource consumption and data footprint optimization. Integration with Kubernetes is still limited, but Zadara is working on it with planned updates for the second half of 2020.

Strengths: Very flexible product and extensive feature set, with a compelling cloud-friendly purchasing model.

Challenges: Although the UI is easy to use and consistent, analytics-based features are limited when compared to some of the competitors.

7. Analyst's Take

The market for external enterprise storage systems is not growing. Organizations are foregoing on-premises investments to move workloads and data to the cloud, or to leverage cost-effective alternatives such as software-defined storage solutions or hyperconverged systems. In this scenario, enterprise storage vendors relentlessly work to improve their offering and make it more flexible and cloud friendly.

Another important reason for market stagnation is that $/GB is in steady decline, driven by technology usually adopted by scale-out systems for files and objects. In fact, budgets for data storage are growing, but because of the better $/GB and $/IOPS, the diversification of data and workloads, and the limited growth of structured data versus unstructured data, revenues for block storage are shrinking while capacity delivered is actually growing.

If we look at the market from the user perspective, the most successful vendors are working on hybrid cloud and data management solutions, even if their approaches are different. On the other hand, a few providers are keeping a cloud-only stance, or plan to actively support hybrid cloud directly in the future.

8. About Enrico Signoretti

Enrico has 25+ years of industry experience in technical product strategy and management roles. He has advised mid-market and large enterprises across numerous industries and software companies ranging from small ISVs to large providers.

Enrico is an internationally renowned visionary author, blogger, and speaker on the topic of data storage. He has tracked the changes in the storage industry as a Gigaom Research Analyst, Independent Analyst and contributor to the Register.

9. About GigaOm

GigaOm provides technical, operational, and business advice for IT's strategic digital enterprise and business initiatives. Enterprise business leaders, CIOs, and technology organizations partner with GigaOm for practical, actionable, strategic, and visionary advice for modernizing and transforming their business. GigaOm's advice empowers enterprises to successfully compete in an increasingly complicated business atmosphere that requires a solid understanding of constantly changing customer demands.

GigaOm works directly with enterprises both inside and outside of the IT organization to apply proven research and methodologies designed to avoid pitfalls and roadblocks while balancing risk and innovation. Research methodologies include but are not limited to adoption and benchmarking surveys, use cases, interviews, ROI/TCO, market landscapes, strategic trends, and technical benchmarks. Our analysts possess 20+ years of experience advising a spectrum of clients from early adopters to mainstream enterprises.

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