

Magic Quadrant for Primary Storage

Published 17 September 2019 - ID G00394522 - 42 min read

Next-generation primary storage arrays are being shaped by technologies such as NVMe, integration with public clouds and AIOps. I&O leaders must view future primary storage array investments as foundational to modernization and digital business transformation.

Market Definition/Description

The Magic Quadrant for Primary Storage covers vendors that offer dedicated products or product lines for solid-state arrays (SSAs), hybrid storage arrays or both. Hybrid storage arrays include both solid-state drive (SSD) and hard-disk drive (HDD) devices in their configurations. SSA products are 100% solid-state-technology-based systems that cannot be combined or expanded with any form of HDD. The Magic Quadrant for Primary Storage replaces two Magic Quadrants: the Magic Quadrant for Solid-State Arrays and the Magic Quadrant for General-Purpose Storage Arrays. Refer to “Gartner Revamps Storage Research With New Primary Storage Magic Quadrant and Critical Capabilities Research” for more information. This Magic Quadrant does not include companies participating in secondary/unstructured storage markets; for more details see “Magic Quadrant for Distributed File Systems and Object Storage” and “Magic Quadrant for Data Center Backup and Recovery Solutions.” This Magic Quadrant does not evaluate vendor financial performance and product families that were made generally available after 31 May 2019.

A primary storage array’s foremost purpose is to support response time and input/output per second (IOPS)-sensitive structured data workloads. Typical use cases include mission-critical workloads, mainstream database workloads and in-house-developed transactional applications. Other use cases include consolidation of virtualized applications, analytics, high-performance computing (HPC) and providing persistent storage for container environments. Primary storage platforms provide a broad library of data services that conserve capacity utilization, protect against data loss, and enhance recovery via local and remote replication. The architecture can be scale-up or scale-out. Host interface protocols can be block-based (Fibre Channel, iSCSI), file-based (Network File System, Server Message Block), or a combination of block and file protocols. For SSAs, the host interface may also be nonvolatile memory express over fabrics (NVMe-oF).

Magic Quadrant

Figure 1. Magic Quadrant for Primary Storage

Source: Gartner (September 2019)



Vendor Strengths and Cautions

DDN

DataDirect Networks (DDN) is a provider of external enterprise storage platforms designed to support workloads that require high-transactional performance and fast-bandwidth capabilities. The proven Storage Fusion Architecture (SFA) family, the core of DDN's storage portfolio, consists of solid-state array and hybrid array offerings, enabling it to cost-effectively address a range of use cases. Its acquisition of Tintri in September 2018 further extends its portfolio and provides DDN with a competitive enterprise storage platform designed specifically to support virtualized workloads. Since DDN acquired Tintri, it has made investments in R&D and client support to reassure the user base that Tintri will remain a credible platform for its IT infrastructure. DDN updated and further expanded its SFA portfolio in 2018 and early 2019. It introduced the SFA18K and SFA7990 hybrid systems, positioned as replacements of SFA14KX and SFA7700 respectively. It also announced two new solid-state arrays – SFA200NV and SFA400NV, both of which support internal NVMe drives. DDN also released A³I, an integrated system solution in partnership with NVIDIA and Hewlett Packard Enterprise (HPE), positioned for artificial intelligence/machine learning (AI/ML) workloads. DDN continues to rely on specialist independent software vendors (ISVs) that position its products for specific vertical industries such as retail, healthcare, automotive, life sciences and energy. It continues to strengthen its partnership with various server, networking and backup vendors in order to provide end-to-end solutions to its customers. Gartner's clients expressed a high level of satisfaction with performance and reliability of the SFA series, particularly for HPC workloads.

Strengths

- DDN is a preferred storage vendor for customers deploying performance-intensive, petabyte-scale AI/ML, HPC and big data analytics projects.
- DDN's SFA series is extremely dense and offers one of the highest throughputs for a two rack unit (2U) storage appliance.
- Ease of use and a rich set of data services make DDN's Tintri systems a suitable choice for midrange enterprise storage requirements.

Cautions

- DDN Tintri's capacity limitations may require multiple platforms to be deployed to support large virtualized environments, thus complicating infrastructure management.
- DDN Tintri solid-state arrays do not support NVMe SSDs and NVMe-oF and, thus, are not suited for highly performant workloads.
- The SFA series does not support file protocols natively and therefore cannot be deployed as a unified primary storage solution.

Dell EMC

Dell EMC offers a broad array of storage products catering to entry-level, midmarket and enterprise market segments. Its enterprise storage product portfolio consists of the PowerMax All-Flash, Unity All-Flash and hybrid arrays, SC Series All-Flash and hybrid arrays, and XtremIO All-Flash. Dell EMC leads with PowerMax for high-performance mission-critical workload requirements. PowerMax storage arrays are based on an active-active controller architecture, scale up to 16 controllers and use industry-standard NVMe SSDs. The arrays support in-line compression and deduplication, thus reducing overall storage consumption and overall SSD investment. In the past 12 months, Dell EMC made progressive enhancements to the PowerMax product line by releasing a new PowerMax OS that provides integration with cloud-based predictive analytics engine CloudIQ. Dell EMC also updated its Unity product portfolio by releasing the Unity XT series, an NVMe-ready array. However, Unity XT was made generally available too late to be included in this Magic Quadrant evaluation. The Unity All-Flash and hybrid arrays are unified storage systems positioned for database and application and/or file use cases. Dell EMC also continues to invest in the SC Series and XtremIO for specific use cases and their large installed bases; with recent software released for both platforms.

Strengths

- Dell EMC has an extensive portfolio of entry-level, midrange and high-end primary storage arrays that can address a diverse variety of workloads.
- Dell EMC is able to demonstrate its focus on sales and postsales customer experience by offering a variety of guarantee programs via its Future-Proof Loyalty Program.
- Dell EMC has a strong and reliable partner network in both emerging and mature markets that continues to support its customers.

Cautions

- The alignment of Dell EMC's product support processes, procedures and personnel is ongoing, resulting in sporadic, inconsistent client support quality.
- While the PowerMax arrays support internal NVMe SSD media, they do not provide end-to-end NVMe capabilities.
- The lack of interoperability among Dell EMC storage systems adds management complexity and operational inefficiencies when deployed in large IT infrastructures.

Fujitsu

Fujitsu is a Japanese technology conglomerate that offers enterprise and client hardware and software as well as IT services. Fujitsu's storage arrays are an integral part of its broader portfolio of products that includes servers and networking solutions, and that enables the company to support end-to-end infrastructure solution requirements. Its primary storage product line consists of the ETERNUS DX hybrid storage arrays and ETERNUS AF solid-state array product lines. ETERNUS DX and ETERNUS AF share the same microcode; therefore, data can be replicated or migrated between the product lines transparently. ETERNUS AF flash systems – AF250 S2 and AF650 S2 support 32GB FC host interfaces and also large-capacity SSDs of up to 30.72TB that enable deployment of high-density storage systems with a lower physical footprint. Fujitsu continues to make enhancements to its storage product portfolio, improving software capabilities and releasing new hardware platforms. In October 2018, it introduced the DX8900 S4, a hybrid storage array that can scale to 24 controller nodes and more than 100PB. The product is positioned for workload consolidation use cases. The use of an NVMe cache to accelerate reads and a field-programmable gate array (FGPA) to offload data compression processes increases overall system performance of the DX8900. Fujitsu continues to collaborate with new partner OEMs that can enable compelling end-to-end solutions for the customer. The company also has dedicated programs and financial models for its service provider customers and continues to drive significant revenue from this vertical.

Strengths

- Fujitsu's customers express a high level of satisfaction with product quality and overall reliability.
- ETERNUS DX and AF provide a comprehensive set of data services that improves manageability and increases overall efficiency.
- ETERNUS DX and AF series offer proprietary encryption technology as an alternative to AES 256, which helps reduce overall encryption-related performance degradation.

Cautions

- Fujitsu has limited direct sales and channel presence outside Japan and Europe.
- ETERNUS AF arrays do not support end-to-end NVMe capabilities and only use NVMe SSDs as a cache.
- ETERNUS systems require a separate gateway appliance to enable integration with public clouds, thus complicating the overall deployment.

Hitachi Vantara

Hitachi Vantara, a subsidiary of Hitachi Ltd., was formed in 2017 by consolidating Hitachi Data Systems (storage and servers), Hitachi Insight Group (Internet of Things [IoT]), and Pentaho (a data integration and analytics company acquired by Hitachi in 2015). The company's storage portfolio is characterized by its strong performance, highly reliable storage products, and common operating system and management platform. This established reputation and worldwide sales and support presence are attractive to global companies. The Hitachi Virtual Storage Platform (VSP) is consistent across its entire portfolio of hybrid arrays (G series) and SSAs (F series). The company's engineering expertise is demonstrated by its internally developed flash module drives (FMDs), which enable consistent performance even with data reduction employed. Hitachi VSP has competitive artificial intelligence for operations (AIOps) capabilities and further potential to bolster this by leveraging Pentaho to provide deeper infrastructure insight based on its AI/ML capabilities. The company is now offering more competitive business programs and guarantees in addition to its flexible consumption-based purchasing models for customers. In the past 15 months, Hitachi Vantara released a series of new flash systems – VSP F350, F370, F700, F900 – as well as hybrid arrays – VSP G350, G370, G700 and G900 – which improved overall performance and capacity. It also released connectors for VMware vRealize, VMware Site Recovery Manager (SRM) and OpenStack environments.

Strengths

- Hitachi Vantara offers robust data protection and resiliency features supported by a 100% availability guarantee across its entire portfolio.
- The company's custom FMDs offer hardware-level compression with negligible impact to performance, which were fortified with up to a 7-to-1 capacity efficiency guarantee when diagnostic tools are used.
- The common operating system and data management provide ease of use and greater operational efficiency for users.

Cautions

- Gartner clients are starting to consider alternatives to Hitachi storage arrays as they are trailing the competitors on innovation.
- For users seeking solid-state arrays with the latest drive and host protocols, appealing for highly performant workloads, Hitachi Vantara has yet to incorporate NVMe SSDs or NVMe-oF in its current offerings.
- Ongoing churn in sales and support personnel is impacting regional customer experience and beginning to impede overall client satisfaction.

HPE

HPE offers a complete enterprise storage portfolio from entry-level to high-end arrays that include Nimble Storage, 3PAR StoreServ, XP7 and the recently announced HPE Primera storage system. HPE's AIOps platform, InfoSight, offers proactive infrastructurewide diagnostics and AI-based recommendations. HPE has expanded HPE InfoSight across its storage products and server products, and also it integrates with VMware. This allows proactive troubleshooting and automation of Level 1 and Level 2 support on Nimble and 3PAR platforms. The 3PAR StoreServ is a highly performant, scalable array designed for high-end use cases, but it was also positioned for the midrange until the acquisition of Nimble in 2017. Given the product overlap, the 3PAR StoreServ product has been refocused to more demanding workloads, while Nimble is an efficient, simple-to-use midrange offering. Both the Nimble and 3PAR StorServ platforms can leverage cost-effective SSD technology with competitive business programs and investment protection to enable nondisruptive migration to next-generation NVMe and storage-class memory (SCM) technology. Both 3PAR StoreServ and Nimble Storage support HPE Cloud Bank Storage, software that works in conjunction with HPE StoreOnce Systems to help integrate 3PAR and Nimble Storage arrays with public clouds for backup use cases. Nimble Storage customers can leverage HPE Cloud Volumes, a cloud block storage service delivered by HPE, to replicate data for use cases such as test/dev and disaster recovery (DR). The newly announced HPE Primera storage system is not included in this Magic Quadrant evaluation.

Strengths

- InfoSight remains a differentiator in predictive and proactive support and AI-based insights with infrastructurewide visibility, which helps automate support, simplifies management and improves customer satisfaction.
- Nimble and 3PAR storage systems integrate with a broad range of hypervisors, containers, backup vendors and public clouds.
- Flexible purchasing models with investment protection for capital expenditure (capex) purchases with its Timeless Storage program and a consumption-based offering via HPE GreenLake are viewed as compelling value additions by its customers.

Cautions

- 3PAR StoreServ and Nimble have competing value propositions for midrange storage requirements, which can be confusing for customers deciding on which platform and feature set best fits their requirements.
- For users seeking solid-state arrays with the latest drive and host protocols appealing for highly performant workloads, HPE has yet to incorporate flash-based NVMe SSDs or NVMe-oF in its current offerings of 3PAR and Nimble Storage.
- 3PAR StoreServ and Nimble products are based on different platforms with their own GUIs and cloud integration abilities, which adds administrative complexity.

Huawei

Huawei is a China-based technology conglomerate that offers a broad range of enterprise and consumer products. With 48.5% of its storage revenue now coming from countries outside of mainland China, Huawei has progressively become one of the leading providers of primary storage on the global stage. Its external enterprise storage portfolio for primary storage workloads – OceanStor – spans all market segments, from entry level to midrange to high end. Featuring multiprotocol host support and a scale-out active-active architecture, the portfolio is composed of hybrid array and solid-state array models that support storage area network (SAN) and network-attached storage (NAS) IT infrastructures. OceanStor platforms provide a comprehensive set of features and functions supporting performance acceleration, capacity utilization, data protection and system security. eService, a cloud-based storage management platform, uses artificial intelligence and machine learning to proactively monitor and report on platform status including risk predictions and automatic ticket creation. Between 2018 and early 2019, Huawei announced new versions of OceanStor Dorado6000 V3 and Dorado18000 V3 that support internal NVMe SSD media. It also released a new SmartIO card, host connectivity module that supports 32Gb FC and 40GbE/100GbE connections. Huawei's go-to-market initiatives focus on a flash-first strategy directed at the telecom industry, where it has a commanding position; and on working with reseller and system integrator partners in 20 countries in the Asia/Pacific, EMEA and Latin America regions.

Strengths

- Operating compatibility between Huawei's hybrid array and solid-state array models provides users with cost-effective solutions with unified management when the IT infrastructure requires both optimized performance and lower-cost persistent storage.
- Available on all OceanStor models, the Huawei HyperMetro mirroring feature provides gateway-free, active-active capabilities between two locations supporting high-availability DR.
- Huawei's SmartVirtualization plus SmartMigration software enables users to nondisruptively migrate data from competitive external enterprise storage systems to OceanStor, or to migrate from an older OceanStor platform to a new OceanStor platform.

Cautions

- The geopolitical attitude of leaders in some countries, in particular the United States, may preclude organizations located in those countries from considering Huawei as a viable supplier of primary storage arrays.
- Public cloud affinity is limited to Huawei Cloud, Huawei's empowered public cloud partners, and backup/recovery to/from Amazon Web Services (AWS).
- The Huawei OceanStor management software experience does not measure up to best-of-class products in ease of use.

IBM

IBM continued to broaden and enhance its portfolio of high-end and midrange solid-state arrays and hybrid arrays, which includes the DS8880 series, the FlashSystem series and the Storwize family of products. Introduced between July 2018 and April 2019, FlashSystem 9100, and Storwize V7000 and V5100/F are NVMe-SSD-based SSAs based on the Spectrum Virtualize storage operating system. These systems support 32 Gbps FC and NVMe-oF, and enable customers to combine both IBM's proprietary NVMe-based FlashCore Modules as well as commodity NVMe SSDs in the same system. Other differentiating features include backup and DR to AWS and IBM Cloud, and hardware-assisted compression, as well as deduplication that together provide a 2-to-1 data reduction guarantee and a 5-to-1 guarantee postworkload analysis. All software functions are included in the base license, although there is a charge for encryption. Introduced in April 2019, Storwize V5010E and V5030E are entry-level SAS-based hybrid flash systems based on the same software. For mission-critical mainframe environments, IBM enhanced its DS8880 enterprise storage family by providing next-level performance, data protection, resiliency and availability across hybrid multicloud deployments. Postsales experience for all IBM storage is enhanced by IBM Storage Insights, a cloud-based analytics tool that can help perform centralized storage monitoring and capacity management, provide "best practice" recommendations, and streamline the support experience.

Strengths

- IBM offers a broad range of solid-state arrays and hybrid storage arrays addressing customer requirements across different use cases.
- IBM has a strong presence in emerging geographic markets; customers continue to leverage its strong partner network and support capabilities in these regions.
- The FlashSystem 9100, and Storwize V7000 Gen3 and V5100F support NVMe flash drives, are storage-class memory-ready and support for NVMe-oF, thus allowing enterprises to deploy workloads with high-performance requirements on these platforms.

Cautions

- IBM FlashSystem 9100 does not support file protocols natively and hence cannot be deployed as a unified storage solution.
- The DS8880 flash system can be offered at a higher price compared to similar systems from its competition.
- The DS8880 storage family does not support compression and deduplication, which can make it more expensive for users with workloads that can benefit from data reduction.

Infinidat

Infinidat continues to make innovative improvements to its hybrid array product portfolio with the goal of cost-effectively addressing enterprise storage performance requirements without transitioning customers to solid-state arrays. The economics of Infinidat's platform position it as a viable consolidation target for large data centers. Although InfiniBox, its flagship storage system, supports internal NVMe SSDs and is NVMe-oF- and SCM-compatible, a majority of its I/O activity is addressed by its relatively large DRAM footprint along with SSDs used as a cache. Hence, investing in these technologies is made optional. In May 2019, Infinidat announced its Elastic Data Fabric vision that aims to ensure seamless data mobility between the edge, the core and the cloud. Customers can also leverage InfiniVerse, a SaaS-based platform that supports predictive analytics and can centrally monitor and manage these systems. Infinidat also offers flexible consumption and as-a-service models via its Capacity on Demand (COD) and InfiniBox FLX programs. In addition to Infinidat's storage appliances, enterprises can use its Neutrix Cloud managed storage service for primary storage and DR, located in close proximity to leading public cloud providers, such as AWS, Microsoft Azure and Google Cloud Platform (GCP).

Strengths

- Infinidat scores high for customer satisfaction due to its high level of resiliency, stable microcode, ease of management, overall performance and all-inclusive pricing model.
- InfiniBox integrates with a broad range of hypervisors, containers, public cloud and backup vendors.
- InfiniBox facilitates a zero recovery point objective (RPO) disaster recovery solution that does not require three-site topologies, instead leveraging the InfiniSync appliance on the primary site, a rugged system that can replicate data to the secondary site via a cellular network.

Cautions

- Infinidat's nontraditional architecture may cause some I&O leaders to devote resources and time to validate performance claims with a comprehensive proof of concept (POC).
- InfiniBox does not support deduplication, thus potentially increasing storage consumption for certain applications, such as virtual desktop environments.
- Infinidat does not offer an SSA solution, which may limit its consideration for customers demanding an SSA-only solution.

Infotrend

Founded in 1993 and based in Taiwan, Infotrend is a small but established provider of external enterprise storage platforms with a global presence enabling localized sales, service and support. Conforming to the well-known dual-controller symmetric active-active scale-up architecture, Infotrend's EonStor portfolio includes hybrid and solid-state array models. The EonStor DS and GS hybrid models and the GSa solid-state array models span the entry to midrange segments of the primary storage market. The EonStor DS family supports only block host protocols, while the GS and GSa models support block and file host protocols. Data services software is available to cover the basic functions concerning capacity utilization efficiency, data protection, and security; however, deduplication is a postprocess implementation. The cloud affinity of the GS hybrid and GSa solid-state array offerings is enhanced by the optionally licensed integrated cloud storage gateway function that allows tiering to Amazon Simple Storage Service (Amazon S3), Microsoft Azure, OpenStack Swift, Alibaba Aliyun and Baidu Wangpan cloud platforms.

Strengths

- The EonStor hybrid and solid-state arrays continue to offer a strong value proposition from a price/performance perspective.
- Infotrend's longevity as a provider of external enterprise storage solutions is a testimony to the value of its offerings over an extended period.
- Infotrend regularly provides industry-verifiable benchmarks that deliver performance transparency to the extent practical without actually requiring clients to run benchmarks.

Cautions

- The EonStor platforms do not support quality of service (QoS) or multitenancy functions, which may hamper performance in a shared workload environment.
- The EonStor GSa solid-state array models do not support NVMe SSDs and are not positioned as NVMe-oF- or SCM-ready.
- Infotrend does not provide a cloud-based AIOps client support offering to enhance EonStor postsales support.

Inspur

Inspur is a China-based IT infrastructure provider that is following the China “Belt and Road Initiative” to expand its limited market penetration outside its home country. Its mainstream storage portfolio for primary workloads includes the AS series and the HF series of products. The AS series is available both as a hybrid array and as solid-state-array-based systems, while the HF series of products is available as solid-state array models. All hybrid and solid-state array platforms are based on a scale-out active-active architecture with controller modules that are separate from the drive enclosures scaling from two to eight. Model differentiation is based on CPU performance, the number of cores, cache size, number of front-end ports, drive type and the number of drives supported. All models simultaneously support popular block, file and object host protocols. Featuring broad hypervisor and operating system certification, the Inspur platforms include a complete library of data service software. Inspur released new high-end and midrange hybrid and solid-state array models in March 2019 and April 2019, further strengthening its storage portfolio for primary storage workloads.

Strengths

- The performance of the AS series scales linearly as the number of controller modules are increased.
- Inspur storage products are competitively priced to win in markets dominated by established global enterprise storage vendors.
- Inspur provides users with both external enterprise storage and server solutions with unified service and support.

Cautions

- Limited penetration outside of China inhibits Inspur’s client support infrastructure responsiveness.
- For users seeking solid-state arrays with the latest drive and host protocols, Inspur has yet to incorporate NVMe SSDs or NVMe-oF in its current offerings.
- Inspur’s ability to assist large non-China-based enterprise clients to implement complex storage infrastructures is constrained by the company’s small field sales and support staff outside of China.

Kaminario

Kaminario has been competing in the solid-state array market since it was founded in 2008. Kaminario has two products: its K2, based on SAS-connected SSDs; and the K2.N architecture, introduced in June 2018, which is based on an end-to-end NVMe architecture. These products can scale up as well as scale out. Kaminario K2 supports both FC and iSCSI host protocols; and K2.N supports NVMe-oF via RDMA over Converged Ethernet (RoCE) v2. Both storage systems run on its VisionOS, with inclusive software for orchestration and automation (Flex) along with analytics and machine learning via Kaminario Clarity. Kaminario focuses mainly on SaaS and service providers, and has pivoted the company to a software-composable infrastructure approach. The company has embraced its flexible consumption-based storage-as-a-service model that offers both operating expenditure (opex) and capex pricing models. Kaminario has partnered with global distributor Tech Data along with Western Digital, which will use the Kaminario software on its OpenFlex composable infrastructure product and provide an SSD supply. The Tech Data partnership particularly will serve as an efficient means to widen Kaminario's sales and channel bandwidth, but it still owns all levels of customer support.

Strengths

- Kaminario has a robust and flexible product offering that consistently demonstrates strong scalability of performance and capacity at attractive costs because of its use of standard industry hardware and its data reduction abilities.
- Kaminario offers investment protection through nondisruptive migration to K2.N, as well as the ability to employ the latest SSD and controller technology.
- The company offers flexible opex and capex consumption models, which include an enterprisewide licensing model that is based on a single, consumption-based license.

Cautions

- Kaminario has significant customer concentration within the SaaS and cloud-based application provider segments and is not directly targeting traditional enterprise customers.
- Kaminario does not offer a cost-effective hybrid storage array solution, which may limit its competitiveness in certain data centers.
- As a private company, Kaminario lacks financial transparency for users to assess its investment strategy and long-term viability.

Lenovo

The Lenovo Data Center Group (DCG) continues to evolve its external enterprise storage portfolio for primary workloads as it further assimilates the partnership with NetApp, while inexorably disengaging from older partnerships with IBM and Seagate. Strategically, Lenovo DCG's go-to-market motion centers on the ThinkSystem DM and DE Series – technology licensed from NetApp under an original equipment manufacturer (OEM) arrangement but manufactured by Lenovo DCG and sold under the Lenovo DCG ThinkSystem brand. Made up of hybrid and solid-state array models that share common operating and management software, the ThinkSystem DM Series consists of robust offerings that address the requirements associated with demanding structured-data-storage workloads. Targeted at entry-level opportunities, the ThinkSystem DE Series is also composed of hybrid array and solid-state array models that feature leading price/performance attributes. Lenovo DCG has enhanced its XClarity management software to support the DM and DE Series platforms, enabling users to integrate and manage all Lenovo ThinkSystem servers, storage and networking offerings with a common management tool. The relationship with NetApp includes a separate joint venture (JV) to develop products specifically for the China market. The Lenovo DCG retains the ThinkSystem DS Series and Lenovo V Series offerings, technology sourced from Seagate and IBM respectively, to support the needs of the installed bases and to respond to tactical opportunities.

Strengths

- The addition of the ThinkSystem DM and DE Series, based on proven NetApp intellectual property (IP), helps to elevate Lenovo DCG's standing as a credible provider of IT solutions for the enterprise market.
- With the addition of ThinkSystem DM and DE Series to its IT portfolio for the enterprise market, Lenovo DCG provides channel partners and end users a compelling choice for competitive storage attached to Lenovo DCG servers.
- The Lenovo DCG-NetApp JV opens the door for both organizations to increase their penetration into the fast-growing China market.

Cautions

- Lenovo DCG is dependent on NetApp to make the necessary R&D investments essential to maintaining a competitive posture in the fast-changing primary storage market.
- Lenovo has signaled it plans to discontinue selling the ThinkSystem DS Series and Lenovo V Series by January 2021.
- Client presales support for the ThinkSystem DM and DE Series is inconsistent as Lenovo DCG builds out its global sales and support infrastructure organizations.

NEC

NEC is an established provider of IT infrastructure solutions with a long history of developing well-engineered external enterprise storage systems. NEC's strategy in the system platform business emphasizes reliability and stability, attracting relatively conservative customers from government and financial sectors. Designed to support primary storage workloads, NEC's M-Series portfolio includes entry-class to midrange-class hybrid storage arrays and SSAs, all supported by uniform operational and management software. Beyond sharing a common library of data service software, the NEC M-Series also features advanced power saving and autonomous device control technologies, enabling data center managers to reduce power and cooling expenses and meet emerging environmental regulations. To strengthen its viability as a worthy provider of external enterprise storage platforms, NEC has established strategic relationships with leading operational, backup/recovery and application ISVs, as well as the key independent hardware vendors (IHVs). Even though the M-Series products stand up well from a competitive perspective, NEC's market penetration outside its home country, Japan, is minimal.

Strengths

- NEC offers deep integration with VMware environments and supports Virtual Volumes (VVOLs), VMware Storage Replication Adapters and vCenter plug-ins.
- M-Series storage systems are competitively priced for customers that require a well-featured external enterprise storage array with key storage data services and a choice between hybrid and solid-state arrays.
- The M-Series integrates with NEC's disk-based backup and archive deduplication appliance, HYDRAsTOR, via DirectDataShadow software, thus streamlining the backup and archive process.

Cautions

- The M710F feature set does not include controller-based compression or data deduplication functions.
- The NEC M-Series does not offer a tiering function to public cloud platforms.
- NEC's client support infrastructure does not include AIOps support tools for the NEC M-Series.

NetApp

NetApp's product portfolio comprises AFF, FAS, SolidFire, E-Series and EF-Series systems that collectively address various enterprise storage requirements. NetApp continues to refine and enhance its primary storage portfolio in concert with its Data Fabric strategy to facilitate and simplify data management in distributed core, edge and cloud IT environments. In May 2018, NetApp was one of the first primary storage vendors to offer NVMe drives and NVMe-oF front-end host connectivity with its AFF A800. In May 2019, NetApp added 100GbE connectivity, a new midrange NVMe offering (the AFF A320), and a new AFF C190 entry-level all-flash array aimed at delivering flash for the price of disk. Among other new software offerings and updates aimed at simplifying deployment and management and incorporating Active IQ (the company's AIOps platform), NetApp delivered two new versions of ONTAP during the past year. ONTAP 9.5 features synchronous SnapMirror, FlexCache volumes, and high-availability failover for NVMe-oF. ONTAP 9.6 features REST APIs, NVMe-oF ecosystem expansion and in-flight encryption. Most major primary storage vendors have a cloud strategy, but, to date, NetApp ONTAP delivers the deepest integration with the largest cloud storage service providers (Amazon, Google and Microsoft). NetApp storage arrays in private data centers can replicate, back up or archive data to public cloud in addition to enabling hybrid-cloud-based application architectures.

Strengths

- NetApp's Data Fabric strategy has enabled the company to position itself as a storage solution for hybrid IT environments.
- By combining predictive analytics with actionable intelligence, NetApp's Active IQ has demonstrated an increased focus on customer satisfaction.
- NetApp solid-state arrays have led in adoption of next-generation end-to-end NVMe capabilities and host network connectivity, so that advanced customer infrastructures can fully leverage the performance of NVMe.

Cautions

- Gartner clients report that postsales support effectiveness has been inconsistent and has impeded overall customer satisfaction.
- NetApp's prospects and customers in emerging markets must choose reliable channel partners, as the company's ability to execute directly in these countries remains largely a work in progress.
- The EF-Series is a performance-only-oriented array and lacks a comprehensive suite of data management services.

Oracle

Oracle enterprise storage products focus on addressing storage and data protection requirements for the Oracle Database. The Oracle ZFS Storage Appliance ZS7-2, launched in December 2018, is available as a hybrid array and in all-flash configurations. Engineered to provide integration with Oracle Database and Oracle Cloud, the Oracle ZFS Storage Appliance family provides enhancements to Oracle Databases in diverse environments. It offers a set of data services including in-line compression, in-line block-level deduplication, encryption, cascading replication, QoS, system analytics, management, cloud migration and security functions. All data services except for replication, cloning and encryption are bundled into a single base software license. Gartner customers stress competitive levels on the reliability and performance of ZFS. Support and maintenance for the ZFS Storage Appliance are offered in three different tiers – Premier Support, business-critical support and Platinum Support – and are charged at a fixed percentage of sale price. Oracle also offers a preassembled configuration, the ZFS Storage Appliance Racked System. Oracle engages support staff in all major geographies to address local escalations and expand client care. Although the ZFS Storage Appliances has all the essential attributes of a primary storage array, Oracle customers mainly use the Oracle ZFS Storage Appliance for secondary use cases such as backup and test/development. The appliances are often deployed alongside Oracle engineered systems such as Oracle Exadata and Oracle Private Cloud Appliances.

Strengths

- Oracle ZFS Storage Appliances support block, file and object protocols using the same storage OS.
- Oracle ZFS Storage Appliances are available under flexible acquisition models, including the traditional capex method, a “right to use” program and a flexible capacity program.
- The DTrace analytics feature of Oracle ZFS Storage Appliance systems provides real-time analysis and monitoring functionality, enabling fine-grained visibility into disk, flash, controller, CPU, networking, cache, virtual machine and other elements.

Cautions

- Oracle ZFS Storage Appliance offerings are seamlessly integrated with Oracle Cloud but are not currently integrated with AWS, Microsoft Azure, GCP or IBM Cloud.
- Oracle does not provide capacity or performance guarantees for its Oracle ZFS Storage Appliance deployments.
- Multitenancy and synchronous replication remain missing features in the ZFS Storage Appliance platform.

Pure Storage

Pure Storage competes in the primary storage market with its purpose-built solid-state array family of FlashArray//X and legacy FlashArray//M products that serve block interface protocols. The FlashArray//X features NVMe in its //X50, //X70 and //X90 models, and does so with no premium compared to its standard SAS-connected SSDs. Pure Storage's hardware innovation complements its foundational Purity Operating Environment and Pure1 management and support software. Pure1 has been enhanced with a Meta AI engine that powers features such as virtual machine analytics and workload planning. This gives its customers full-stack visibility for virtual machine troubleshooting, as well as proactive tools to manage capacity, mobility and performance growth in on-premises private and public clouds. Pure Storage introduced its CloudSnap product in early 2019, which allows snapshot portability to leading public clouds. Pure Storage's product strategy has been designed around simplicity, and that is also evident in its business programs. The company has instituted many business programs and recently enhanced its Evergreen Storage program. This program now has a gold tier, offering trade-in credits to modernize existing legacy controller and capacity. The company has also brought the cloud consumption model to complement its Evergreen business model via Evergreen Storage Service (ES2).

Strengths

- Simplicity is a foundational attribute of Pure Storage's product and support strategy, reducing complexity, administration and maintenance, and underpinned by creative business programs.
- From product to support, the company exudes a customer-focused culture that leads to exceptional customer satisfaction and retention.
- The company's organically developed DirectFlash software and hardware modules have eliminated the premium of NVMe technology and allows access to next-generation technologies nondisruptively.

Cautions

- Gartner clients have expressed concerns that the company does not have sufficient local support in emerging geographies.
- Pure Storage has struggled to attain sustained profitability, causing some clients to be concerned about the company's long-term viability.
- Pure Storage does not offer a cost-effective hybrid array solution, which may limit its competitiveness in certain data centers.

Synology

Synology is Taiwan-based storage vendor that develops midrange unified storage systems, with a specific focus on NAS. Its enterprise product portfolio mainly comprises the FS Series and XS+/XS series. The FS Series comprises all-flash-based systems, whereas the XS+/XS series are hybrid systems and are available in maximum capacity configurations of 553TB and 560TB respectively. All Synology product lines use the DiskStation Manager (DSM) operating system, a web-based operating system that provides storage management functionalities. The DSM operating system also allows Synology systems to be configured for specific application use cases, such as email server, file sync and share server, as a backup target, video surveillance, and file storage. The ability to support block protocols such as iSCSI provides midsize enterprises with a low-cost SAN solution. Applications can be downloaded from the application package center included in the DSM operating system. Synology has a strong presence in all major geographies and is supported by a strong network of channel partners and distributors. Support staff are stationed across all major regions to provide 24/7 support to its customers.

Strengths

- The Synology DiskStation Manager provides an intuitive, web-based user interface that is simple to use and manage.
- The Synology DiskStation Manager offers a broad range of application services that users can download from the marketplace as required.
- Synology has a strong focus on the video surveillance storage market, with specific products that address this use case.

Cautions

- Synology has a limited number of channel partners that cater to the enterprise storage market.
- Synology storage arrays lack scale-out capabilities and therefore are less attractive to customers considering data center consolidation.
- Synology systems lack reduction technologies such as deduplication, thus increasing overall storage consumption.

Western Digital

Western Digital is a California-based flash memory, SSD, HDD and enterprise storage system manufacturer that caters to various data center, mobility and edge computing use cases. It is able to address a broad range of use cases as a result of strategic acquisitions such as HGST, SanDisk and, more recently, Tegile Systems. Its enterprise storage product portfolio mainly consists of IntelliFlash N-Series NVMe-based solid-state arrays, HD-Series and T4000 Series hybrid systems (from Tegile Systems). Each of these products offers a comprehensive set of data services, such as in-line compression, in-line deduplication, backup of snapshots to S3-compatible object storage, cloning and replication. Storage health and configuration management is supported via IntelliCare, a cloud-based analytics platform. Western Digital continues to actively engage with OS vendors, and hypervisor, backup and cloud vendors to ensure that its product portfolio integrates with the broader ecosystem. Customer escalations are handled by technical support staff located in all major geographies to ensure 24/7 support.

Strengths

- Western Digital is able to price IntelliFlash SSAs below industry average by leveraging its vertical integration capabilities into its own component supply base.
- IntelliFlash N-Series NVMe-based systems are interoperable with hybrid disk shelves, thus offering Western Digital's customers greater flexibility at lower costs.
- IntelliFlash supports in-line compression and in-line deduplication, both of which can be managed at an individual LUN level or a file level.

Cautions

- Western Digital's IntelliFlash has limited presence outside North America, which could limit global support capabilities.
- Enterprises moving toward a hybrid cloud architecture are limited by IntelliFlash's inability to deeply integrate with public clouds such as AWS and Azure for storage tiering and DR use cases.
- IntelliFlash currently does not support synchronous replication, limiting its scope in environments with low RPO and recovery time objective (RTO) requirements.

Vendors Added and Dropped

We review and adjust our inclusion criteria for Magic Quadrants as markets change. As a result of these adjustments, the mix of vendors in any Magic Quadrant may change over time. A vendor's appearance in a Magic Quadrant one year and not the next does not necessarily indicate that we have changed our opinion of that vendor. It may be a reflection of a change in the market and, therefore, changed evaluation criteria, or of a change of focus by that vendor.

Inclusion and Exclusion Criteria

The inclusion criteria represent the specific attributes that analysts believe are necessary for inclusion in this research. To qualify for inclusion for primary storage, vendors offering solid-state arrays, hybrid storage arrays or both must meet the following criteria:

Vendor Criteria

- Storage arrays are sold through a combination of direct, indirect or OEM channels (but not exclusively), and must have a minimum average selling price for the entire family of \$24,999 per array.
- The product and a service capability must be available in at least two of the following three geographies – Asia/Pacific, EMEA and/or North America – by either direct or channel sales.
- The vendor must have generated greater than \$50 million in primary storage revenue over the last four quarters (as of March 2019) and/or have an installed base of at least 500 current customers within the upper-midsize and large-enterprise markets. Gartner defines the upper-end midmarket as being 500 to 999 employees, and the large-enterprise market as being 1,000 employees or more.
- The vendor must sell its product stand-alone, without the requirement to bundle it with other vendors' storage products in order for the product to be implemented in production.
- The vendor must provide an enterprise-class support and maintenance service, offering 24/7 customer support (including phone support). This can be provided via third-party service organizations or channel partners.

Product Criteria

- The vendor must produce and release primary storage products for general availability as of 31 May 2019. All components must be publicly available, shipping and included on the vendors' published price lists as of this date. Products shipping after this date will have an influence on only the Completeness of Vision axis.
- The primary storage array must be available as a single configuration of the required hardware and software needed to reliably store and retrieve data using industry-standard block host connection protocols.
- The primary storage array should have no single points of hardware failure.
- In the case of SSAs, the system must be a self-contained, solid-state-only system that has a dedicated model name and model number. It must be initially sold with 100% solid-state technology and cannot be reconfigured, expanded or upgraded at any future point in time. This includes with any form of HDD within expansion trays via any vendor special upgrade or specific customer customization or vendor product exclusion process into a hybrid or general-purpose SSD and HDD storage array.
- In the case of primary hybrid storage arrays, the systems can be configured with a combination of HDDs and SSDs in a single array.

The primary storage arrays evaluated in this research include hybrid storage arrays and solid-state arrays that scale up, scale out and may have unified storage architectures. Since these arrays have different availability characteristics, performance profiles, scalability, ecosystem support, pricing and warranties, they enable users to tailor solutions for operational needs, planned new application deployments, forecast growth rates, and/or asset management strategies.

Exclusion Criteria

Storage arrays designed to support only unstructured data workloads managed by dedicated scale-out distributed file systems and object storage protocols are not included for evaluation in this Magic Quadrant.

Evaluation Criteria

Ability to Execute

Ability to Execute reflects the market conditions and, to a large degree, it is our analysis and interpretation of what we hear from the market. Our focus is assessing how a vendor participates in the day-to-day activities of the market.

Table 1: Ability to Execute Evaluation Criteria

Evaluation Criteria ↓	Weighting ↓
Product or Service	High
Overall Viability	Medium
Sales Execution/Pricing	High
Market Responsiveness/Record	Medium
Marketing Execution	Medium
Customer Experience	High
Operations	Medium

Source: Gartner (September 2019)

Completeness of Vision

Completeness of Vision distills a vendor's view of the future, and of the direction of the market and its role in shaping that market. We expect the vendor's vision to be compatible with our view of the market's evolution. A vendor's vision of the evolution of the data center and of the expanding role of primary storage is an important criterion.

Table 2: Completeness of Vision Evaluation Criteria

Evaluation Criteria ↓	Weighting ↓
Market Understanding	Medium
Marketing Strategy	Medium
Sales Strategy	High
Offering (Product) Strategy	High
Business Model	Medium
Vertical/Industry Strategy	Low
Innovation	High
Geographic Strategy	Medium

Source: Gartner (September 2019)

Quadrant Descriptions

Leaders

Vendors in the Leaders quadrant have the highest composite scores for their Ability to Execute and Completeness of Vision. A vendor in the Leaders quadrant has the market share, credibility, and marketing and sales capabilities needed to drive the acceptance of new technologies. These vendors demonstrate a clear understanding of market needs. They are innovators and thought leaders with well-articulated plans that customers and prospects can use when designing their storage infrastructures and strategies. In addition, they have a presence in the five major geographical regions, consistent financial performance and broad platform support.

Challengers

Vendors in the Challengers quadrant participate in the broad primary storage market and execute well enough to be a serious threat to vendors in the Leaders quadrant. Challengers have strong products, as well as a sufficiently credible market position and resources to sustain continued growth. Financial viability is not an issue for vendors in the Challengers quadrant; however, they lack the size and influence of vendors in the Leaders quadrant.

Visionaries

Vendors in the Visionaries quadrant deliver innovative products that address operationally or financially important end-user problems on a broad scale, but have not yet demonstrated the ability to capture market share or sustainable profitability. Visionary vendors are frequently privately held companies and acquisition targets for larger, established companies. The likelihood of acquisition often reduces the real versus perceived risks associated with installing their systems.

Niche Players

Vendors in the Niche Players quadrant are often narrowly focused on specific markets or vertical segments, such as data warehousing; HPC; low-cost, disk-based data retention; and other areas that are generally underpenetrated by the larger disk array vendors. This quadrant may also include vendors that are ramping up their disk array offerings, or larger vendors that are having difficulty developing and executing on their vision.

Context

This Magic Quadrant represents vendors offering hybrid storage arrays, solid-state arrays or both, developed internally or acquired through an OEM agreement. Integration with public clouds, ease of management using AIOps, a comprehensive set of data services to increase availability, and efficiency are some of the technical attributes I&O leaders must consider when choosing a primary storage system. I&O leaders must also ensure that primary storage systems are acquired at the right price points using industry benchmarks, while choosing the appropriate acquisition model — capex or opex — for the organization. Preference should be given to vendors that provide availability, efficiency and performance guarantees and those that have a competent partner network that ensures solution design and installation is flawless and hardware replacements are carried out in a timely manner. Internally, I&O leaders must work with application owners to understand application performance and availability requirements as well as roadmaps. They must choose among, or choose a combination of, hybrid arrays, SSAs or hyperconverged infrastructure (HCI) platforms, based on these application requirements.

Market Overview

Total external controller-based (ECB) storage revenue unexpectedly expanded by 10% in 2018 to \$21.7 billion, and the ECB primary storage segment displayed a 2.4% annual increase to \$17.8 billion. While buoyed by a 7.1% increase in solid-state array revenue, Gartner believes total ECB revenue will re-enact the recent patterns of gradual decline, contracting on average over the next five years by 3.5% as alternative enterprise storage solutions continue to gain ground. There will be steady growth in the secondary and backup/restore ECB markets, but the primary storage segment will still account for 70% of the total ECB market in 2023. SSAs will be the driver of ECB revenue and will grow to account for 88.9% of the total primary ECB storage market in 2023, up from 47.6% in 2018. Although total primary storage revenue will decline by 6.2% and primary hybrid ECB revenue will decline by 31.3% from 2018 through 2023, there will be an enduring strategic niche of greater than \$1 billion for hybrid ECB primary storage arrays.

The multiple proven total cost of ownership (TCO) benefits provided by SSAs — reductions in space, power and management costs, coupled with enhancements in reliability, performance, ease of installation, flexible configuration, and storage efficiency — can be clearly compelling for many global organizations. These TCO benefits will help ameliorate the pace of on-premises data migration to the cloud, but the growth and acceptance of cloud data services will be inevitable and inescapable. Cloud service providers will continue to take on-premises, mission-critical data share from ECB systems by providing sophisticated off-premises data management and reliability practices that rival the best on-premises data administration technologies. However, the enterprise storage infrastructures will continue to be defined and redefined by hybrid, multicloud architectures, and primary ECB arrays will continue to play a crucial role in enabling resilient and reliable data mobility.

Evaluation Criteria Definitions

Ability to Execute

Product/Service: Core goods and services offered by the vendor for the defined market. This includes current product/service capabilities, quality, feature sets, skills and so on, whether offered natively or through OEM agreements/partnerships as defined in the market definition and detailed in the subcriteria.

Overall Viability: Viability includes an assessment of the overall organization's financial health, the financial and practical success of the business unit, and the likelihood that the individual business unit will continue

investing in the product, will continue offering the product and will advance the state of the art within the organization's portfolio of products.

Sales Execution/Pricing: The vendor's capabilities in all presales activities and the structure that supports them. This includes deal management, pricing and negotiation, presales support, and the overall effectiveness of the sales channel.

Market Responsiveness/Record: Ability to respond, change direction, be flexible and achieve competitive success as opportunities develop, competitors act, customer needs evolve and market dynamics change. This criterion also considers the vendor's history of responsiveness.

Marketing Execution: The clarity, quality, creativity and efficacy of programs designed to deliver the organization's message to influence the market, promote the brand and business, increase awareness of the products, and establish a positive identification with the product/brand and organization in the minds of buyers. This "mind share" can be driven by a combination of publicity, promotional initiatives, thought leadership, word of mouth and sales activities.

Customer Experience: Relationships, products and services/programs that enable clients to be successful with the products evaluated. Specifically, this includes the ways customers receive technical support or account support. This can also include ancillary tools, customer support programs (and the quality thereof), availability of user groups, service-level agreements and so on.

Operations: The ability of the organization to meet its goals and commitments. Factors include the quality of the organizational structure, including skills, experiences, programs, systems and other vehicles that enable the organization to operate effectively and efficiently on an ongoing basis.

Completeness of Vision

Market Understanding: Ability of the vendor to understand buyers' wants and needs and to translate those into products and services. Vendors that show the highest degree of vision listen to and understand buyers' wants and needs, and can shape or enhance those with their added vision.

Marketing Strategy: A clear, differentiated set of messages consistently communicated throughout the organization and externalized through the website, advertising, customer programs and positioning statements.

Sales Strategy: The strategy for selling products that uses the appropriate network of direct and indirect sales, marketing, service, and communication affiliates that extend the scope and depth of market reach, skills, expertise, technologies, services and the customer base.

Offering (Product) Strategy: The vendor's approach to product development and delivery that emphasizes differentiation, functionality, methodology and feature sets as they map to current and future requirements.

Business Model: The soundness and logic of the vendor's underlying business proposition.

Vertical/Industry Strategy: The vendor's strategy to direct resources, skills and offerings to meet the specific needs of individual market segments, including vertical markets.

Innovation: Direct, related, complementary and synergistic layouts of resources, expertise or capital for investment, consolidation, defensive or pre-emptive purposes.

Geographic Strategy: The vendor's strategy to direct resources, skills and offerings to meet the specific needs of geographies outside the "home" or native geography, either directly or through partners, channels and subsidiaries as appropriate for that geography and market.