
# 2019 Facts and Review
# 30 vendors

December 2019

Philippe Nicolas
StorageNewsletter

# List of Companies

## Summary of vendors' review

In addition to vendors 2020 predictions we'll publish in a few days, we wished to collect vendors' 2019 facts and review and what they saw on the market.

With a rapid consolidation and analysis of answers here are what we collect :

1. By far, everything about Cloud (multi, hybrid, on-premises, private, repatriation)
2. Object storage and S3 (private, public)
3. NVMe and NVMe over Fabrics
4. Various SaaS dynamics – Security – File Storage
5. AI

## Actifio (Ash Ashutosh, CEO)

1. The internet turned 50 years old.

2. The Capital One breach, involving data stored in AWS, sent a chill through boardrooms and CIO staffs everywhere. More enterprises are moving to build their own private clouds for their own security as “cloud repatriation" becomes a hot topic.

3. Digital nationalism became a reality as more countries instituted data localization requirements in the name of national security, protectionism or censorship.

It all points to the fact that data has become the new oil. Data drives everything and being able to manage it seamlessly across different clouds and apps and databases, access it instantly for any purpose, will be a major competitive differentiator in the new decade.

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## Atempo (Luc d’Urso, CEO)

1. The resurgence of cyberattacks

2. American embargo on Huawei

3. Cloud Dominance

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## Caringo (Adrian Herrera, VP Marketing)

1. S3 won the RESTful interface protocol battle... for now.

2. For many orgs it became clear that a cloud only strategy, from a storage perspective, isn’t economically sustainable.

3. Throughput performance benchmarks established object storage as a viable high performance tier for use cases that require RESTful access.

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## Cloudian (Neil Stobart, VP Global System Engineering)

1. **Organisations reconsider public cloud as panacea**
   In 2019, the dominant status of public cloud was challenged. Research from Nutanix showed that almost three-quarters of organisations (73%) are moving applications

from public cloud to on-premises, with more than one in five (22%) moving five or more applications. In response to the growing appetite for hybrid IT deployments, the UK government confirmed in May 2019 that it's public cloud-first policy was under review, taking into account factors such as unexpected costs and growing security concerns in the public cloud. In addition, new offerings are enabling customers to create private clouds that provide the scale and flexibility previously only available from hyperscalers, with the performance, access, security and control advantages of on-premises storage (e.g., joint solution created by Cloudian and Seagate).

2. **Object storage gains traction**
   As more and more users discovered that traditional SAN and NAS systems could not keep up with increasing data demands over the past year, there was growing momentum behind S3-compatible object storage. In fact, the S3 API has now become the de facto standard for both public and private cloud storage. In 2019, Veeam joined other data protection vendors in adding support for S3-compatible object storage platforms, and VMware and Cloudian announced a jointly engineered object storage solution for vCloud Director environments. In addition, there was growing adoption of object storage for use cases beyond backup and archiving, including Hadoop data lakes, Big Data-as-a-Service, and file sync and share. A leading Japanese telecommunications and media company also deployed object storage software in a unique all-flash hardware configuration to meet the evolving needs of its video streaming service, and a local transportation agency incorporated object storage to address the need for real-time mobile video data collection and rapid data search.

3. **VMware Cloud on the rise**
   When it comes to leading cloud providers, attention typically focuses on Amazon AWS, Google Cloud Platform and Microsoft Azure. In 2019, however, VMware has established itself as the 4th major cloud player, serving over 4000 VMware-based cloud providers, who now host more than 10 million VMs. For the most recently completed quarter, the company reported that its hybrid cloud subscription and SaaS recurring revenue grew approximately 40% year-over-year. One reason for this strong growth is that many organisations are already operating in a VMware environment, making VMware cloud providers a convenient choice, with the ability to seamlessly move workloads from on-premises to the cloud. For the cloud provider, the new S3-compatible object storage platform – managed from within the VMware environment -- makes it simple and cost effective to support these growing cloud workloads.

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## Clumio (Chadd Kenney, VP & Chief Technologist)

1. **Enterprise SaaSification**
   Enterprise workloads are being 'SaaS-ified' because enterprises can no longer afford the time, complexity, and expense of building and managing heavy on-prem hardware and software solutions alongside their digital transformation objectives.

2. **Public Cloud First Mindset**
   The public cloud brought huge values in simplicity, scale, and agility, but data protection requires a new mindset to alleviate data loss vulnerabilities with storing production data and backup data together. Enterprises with a public cloud first mindset are leveraging a secure airgap cloud data protection solution, outside their production environment, to protect themselves in a multi-cloud world.

3. **Cyber Crime is on the Rise**
   New threats challenged enterprises and the criminals are getting smarter with going after critical data assets for higher profits. According to Trend Micro, ransomware attacks surged 77% in the first half of 2019 and there is no slow down in sight.

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## Commvault (Don Foster, VP Storage Solutions)

1. **Consolidation EVERYWHERE**
   Enterprises today have to support an ever-increasing number of siloed infrastructures, hypervisors and platforms as they move towards a modern hybrid environment. 2020 will be the year of consolidation. The complexity of grappling with data across multiple generations of infrastructure, applications, locations, and protocols will kickoff a number of consolidation efforts globally to reduce this self-imposed complexity. Organizations must BE READY for increasingly sophisticated ransomware attacks and living in a highly fragmented environment negatively effects this ability. Simplicity is now a top priority and consolidating legacy infrastructure silos with new software defined technologies will cut through the mounting complexity. The next decade will require an efficiently run organization to keep pace with the speed of the digital enterprise.

2. **First Steps to Unification of Data and Storage Management**
   The last decade saw the proliferation of applications, infrastructures, and the growth of multi-cloud environments. This resulted in increased fragmentation across IT and caused a number of challenges. As of today, many organizations have lost control of their data and their storage environments. Closing the gap between data and storage is the first step to simplifying and unifying this disconnected IT challenge. Declaring how data will be managed at the moment storage is provisioned will enable customers to own the future of their infrastructure and data together. Open APIs will be the key to a tightly integrated, data-focused and storage-aware solution. The growing adoption of software defined infrastructures will make this a reality as customers accelerate down the path to a new unified experience to managing data and storage together.

3. **Digital Assistants in IT – a helpful reality**
   Did you ever think you would ask Alexa for your backup SLAs? Ever wonder if Google could tell you how your restore went? Did you ever think you could interact with your IT systems without a traditional user interface. 2020 will bring the next level of maturity for natural language processing solutions into the IT realm. Vendors and customers alike have been testing and playing with these

technologies. The next killer interface will be the one that simply talks back and doesn't require any mouse clicks to get the job done.

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## CTera Networks (Aron Brand, CTO)

1. **Costly Ransomware attacks have exposed basic misconceptions about data protection**
   - Ransomware attacks have reached epidemic proportions, as criminals refine their techniques to target the most valuable data and extract higher payouts. In June 2019, two Florida municipalities have paid a total of $1.1 million to cybercriminals to regain access to their IT systems and data following ransomware attacks. In May, the city of Baltimore was hit by a similar attack and decided not to pay the ransom. The result: after 36 days of remediation efforts at a cost of $18 million, the municipality's systems were still not fully restored.
   - The truth is that many people don't really grasp the concept of backup, and this lack of understanding could end up costing them a bundle. Effective protection must meet two critical requirements:
     - It must retain previous versions of your files for a specific retention period (minimum of 30 days), and those files must be in a read-only repository so that they cannot be deleted by a malicious software.
     - The archived copy must be physically separated from the main copy of your data.

2. **Hybrid Edge to Cloud**
   As the 2010s come to an end, virtually all large distributed enterprise companies are in the process of modernising their networks with hybrid cloud solutions that combine local computing for latency and downtime sensitive applications, backed by infrastructural services hosted in a public or private cloud.

3. **Organisations are deploying cloud storage gateways to solve a wide variety of ROBO IT challenges**
   According to a recent IDC survey, 91 percent of enterprises have deployed or are planning to deploy a cloud storage gateway at their remote sites to reduce costs, centrally manage users and data, and consolidate infrastructure at the edge.

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## Data Dynamics (Piyush Mehta, CEO)

1. **Object adoption far slower than anticipated**
   Although object continues to garner greater visibility, its adoption continues to be slower than expected. The ability to rewrite applications as well as transform data from legacy protocols to S3 is not easy despite the value that object based storage provides.

2. **Azure is becoming the preferred public cloud provider for Enterprise Companies**
   We continue to see faster adoption of Azure within large enterprises. Their familiarity with Microsoft and its eco-system has led to Azure winning large swathes of enterprise business. With products such as Office 365 leading the charge we see enterprises moving massive workloads to Azure.

3. **NetApp and Dell continue to hold market share in the NAS market**
   Despite the many entrants that are trying to break through into the NAS arena, whether they be software defined, full stack platforms or a cloud based solution we continue to see market domination by NetApp in EMC/Dell in the file based storage market.

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## DataCore (Gerardo Dada, CMO)

1. **The line between primary and secondary storage blurs**
   They are now shades of gray. A single storage system can manage multiple storage tiers and make intelligent decisions based on performance, availability, and economics.

2. **Diversity accelerates adoption of SDS**
   More enterprises realize the power of Software-Defined Storage to manage different storage systems and then realize how SDS makes all storage smarter, more efficient and more powerful.

3. **AI, Metadata, and SDS enable intelligent data placement**
   Richer metadata drives better data intelligence, which combined with AI empower software to make better data placement decisions including automatic movement to the cloud

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## DDN (Alex Bouzari, CEO)

1. High Performance Computing started to shift from file system enabled Processing/Networking/Storage layered infrastructures to Highly Distributed, Software Enabled Intelligent Infrastructures

2. Real time, predictive application analytics powered by High Performance Computing infrastructures gathered momentum across a myriad of industries and use cases

3. In 2019 DDN exceeded three important milestones –
   - $100 Million per quarter
   - 10,000 customers
   - 1,000 team members

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## FujiFilm Recording Media US (Peter Faulhaber, President)

1. **Cost per TB and Total Cost of Ownership improved in 2019 for tape-based storage and archive**
   Contributing factors included the release of higher-capacity media (12.0 TB LTO-8 and 20.0 TB 3592 JE), higher-performing drives, and new integration points, e.g. Ethernet attached tape. Tape's areal density advantage provides the technical ability to meet future roadmaps and the capacity intensive needs of the market.

2. **2019 was the year tape got firmly entrenched in all the major U.S. Hyperscale Data Centers (HSDCs)**
   With the focus on competitive cloud storage pricing combined with tape's scale, reliability, low cost per TB and TCO, tape became a natural choice at the largest HSDCs for backup, active archive, and cold archival applications.

3. **The "Tape Air-Gap" -- with its ease of removability from the network -- became a compelling tool in combating cybercrime**
   The cloud's "always on, always accessible" nature made it a soft target for ransomware and cyber-attacks. Cybercrime is projected to cost businesses nearly $6.0 trillion over the next two years. Offline storage, like tape, is far less susceptible to attack and has already proven effective in helping customers recover from ransomware.

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## Hammerspace (Brendan Wolfe, VP Product Marketing)

1. Despite the strong growth from cloud providers, there is still a huge amount of applications and data on-premises that customers want to lift into the cloud. The struggle is real, many are stuck at the data migration phase of their cloud journey.

2. The market for Kubernetes storage is heating up as most of the large integrators make acquisitions in this space.

3. Hadoop and HDFS is falling out of popularity as people look towards more real-time solutions.

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## Hitachi Vantara (Hu Yoshida, CTO)

1. **Storage vendors saw a decline in revenues (and stock prices)**

This has not been a good year for storage vendors due to accelerated movement to cloud, deferred revenue models, and economic uncertainties. Storage vendors are partnering with the cloud service providers to survive. Hitachi Vantara adopts an open edge to core to multi-cloud strategy to help customers optimize their workloads across the IT spectrum.

2. **Early NVMe storage vendors are running into controller bottlenecks**
   Early NVMe storage vendors who jumped on the NVMe bandwagon are running into controller bottlenecks as NVMe performance drives the bottlenecks up from the devices to the controller processors and software. Hitachi Vantara rearchitected their VSP storage controller to eliminate the bottlenecks before delivering NVMe in their VSP 5000.

3. **Enterprises realize that Digital Transformation requires the operationalization of their data through DataOps**
   DataOps is a methodology, a technological and cultural change to improve the organization's use of data through better data quality, shorter cycle time and superior data management. It is data management for the AI era. It has led to tools that automate and streamline data management, low code tools that democratize building of AI pipelines and platforms, and agile methodologies that accelerate the time to value.

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## HYCU (Simon Taylor, CEO)

1. **Multi-cloud is the New Normal**
   It has really become a multi-cloud world out there. We saw more interest now in multi-cloud than ever before. With more than four clouds in use at enterprises globally on average, multi-cloud infrastructure has become the new normal. Customers were looking for data protection solutions that helped complement their cloud of choice while simplifying key processes like data migration and disaster recovery. That was a big driver for why we introduced HYCU Protégé. HYCU allows customers the freedom to use their cloud, their way, with their control. With HYCU Protégé customers now get a management framework that leverages the best of the on-premises and public cloud environments they use and complements it with cross-cloud data management capabilities.

2. **Consistency was Key**
   For our customers, it was important that the experience they had within each specific cloud, be it on-premises or public, did not change when they used their cloud of choice. In addition, consistency was important from an application perspective. It was important to deliver a data protection and management solution that delivered application consistent data migration and disaster recovery (DR). And of course, delivering consistent support and services for both customers and partners alike was extremely important.

3. **Cloud-native, as a service on the Rise**

With the adoption of multi-clouds, and more interest in selecting clouds to best address workloads, customers began to think beyond infrastructure for the cloud and importantly, in the cloud. They wanted to leverage more and more of the native Cloud Services to enhance their agility. The first ones from an infrastructure perspective we saw customers using were Database as a Service and from a collaboration perspective Google Suite and O365. Adoption continued to expand rapidly for these services. Additionally, we saw when customers were using one public cloud for infrastructure, migration was typically a one-time event, painful, but a necessary evil and they put up with it. With the rising adoption of multi-clouds, customers ended up having the need to migrate the data not once, but multiple times and for a variety of reasons. So, the traditional approach of having a huge consulting engagement or a complex migration process was not working well.

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## Infinidat (Stanley Zaffos, SVP Product Marketing)

1. **A Reverse Migration**
   While companies continue to move workloads to the cloud, a growing number of companies have started to migrate workloads back to on-premises environments. Frequently cited reasons include hybrid cloud's promises of improvements in manageability, application integration and cost savings falling short of expectations even as the cloud makes satisfying local regulatory requirements and maintaining security more difficult.

2. **Compliance Concerns Provide Friction**
   Concerns about complying with security requirements based on Europe's General Data Protection Regulation (GDPR), the California Consumer Privacy Act (CCPA) and New York's Stop Hacks and Improve Electronic Data Security (SHIELD Act) regulations have forced companies to put the brakes on a variety of new business initiatives. Based on a poll conducted in August 2019, 56% of U.S. businesses said they didn't expect to meet the California compliance standard by Jan. 1, 2020 – mainly due to the costs involved.

3. **A Move to New Data Platforms**
   2019 revealed the beginnings of a shift from older Hadoop-style initiatives to newer analytics-based data projects leveraging technologies like Splunk and the ELK stack (Elasticsearch, Logstash and Kibana). This, in turn, is accelerating the demand for modern affordable petabyte-scale storage systems.

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## iXsystems (Mike Lauth, CEO)

1. **100GbE is the new SAN**

100Gb iSCSI outperforms 6/32Gb FC and provides the ability to share files on the same ports and switches via NFS and SMB.

2. **ZFS is the open enterprise-grade file system of choice across multiple OSes**
   FreeBSD and Linux have converged on OpenZFS 2.0. MacOS and Windows support for OpenZFS are in development. Ubuntu has adopted ZFS, while btrfs has been removed from maintenance post RHEL 7.4.

3. **S3 is the Archive API**
   Virtual Tape Libraries (VTL) and NDMP markets have dried up, S3 APIs to AWS, other clouds, and local object storage have replaced them.

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## Kaminario (Eyal David, CTO)

1. All flash storage achieving price parity with HDV arrays.

2. More and more people have been looking to move their business-critical applications to the cloud.

3. Hardware-based storage vendors began to provide more public cloud connectors.

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## Kaseya (Michael Sanders, GM of Unitrends and Spanning)

both Kaseya companies

Cloud gains importance in Backup and Disaster Recovery in 2019 while SaaS backup remains stagnant.

Backup to the cloud in combination with the other media is among the top five business continuity and disaster recovery (BCDR) strategies, adopted by 33 percent of the respondents of Kaseya's 2019 State of IT Operations for Small and Midsize Businesses. Concerningly, however, only 29 percent of respondents back up their SaaS application data (Microsoft Office 365, G Suite, Salesforce, etc.), showing no improvement from 2018. The data indicates a continued lack of ownership and understanding that SaaS data backup for anything longer than 30 days is typically the customer’s responsibility. As companies entrust their critical apps to run in the cloud, they are leaving themselves at major risk by not backing up their SaaS application data.

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## Komprise (Krishna Subramanian, President & COO)

At the beginning of 2019, we had predicted that we will see a more widespread adoption of AI-driven data management platforms that can think outside the box and analyse data patterns. With intelligent software, organisations can move away from the time intensive, and often inaccurate rule-based policy management, and set goal-based objectives. AI will also allow us to improve on search and discovery, paving the way for big data.

Looking back at 2019, here is what we saw - Policy-based data management that moves data based on analytics and goals set by the customer is becoming a standard versus low-level rule-based block tiering because it is simpler to use and delivers the best savings as its tailored to the data. And, businesses are adopting search/find across data silos as they strive s to become data-driven by creating and using virtual data lakes for new applications such as AI, Big Data and Compliance.

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## Lightbits Labs (Eran Kirzner, CEO)

Most notable fact from Lightbits point of view was the ratification of the NVMe/TCP standard and integration with REH 8.1.

With the ratification of the NVMe/TCP protocol in late 2018, many companies began their push for creating standards-based, commercial NVMe/TCP products in 2019.

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## Minio (Anand Babu Periasamy, CEO)

1. Kubernetes has won the computing side of private cloud, driving object storage as the standard for the private cloud.

2. Enterprise adoption of object storage is accelerating. This includes public and private clouds - and often multiple public clouds given the fact that object storage is the de factor standard for the cloud.

3. Bulk of the new enterprise data is in log format and runs to the petabytes. Economics dictate object storage as the logical target and performance enhancements ensure that.

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## NGD Systems (Scott Shadley, VP Marketing)

1. **Composable Infrastructure is becoming real**
   Companies like HPE and Dell are highlighting solutions that they have available, and up and coming startups like Liqid are gaining traction and funding

2. **NVMe has hit the cross over point in storage**
   After several years of hype and attention, NVMe solutions have finally reached the tipping point in SSD storage deployments and now have many new startup and corp-based solutions that require only NVMe

3. **True SSD Only Server/Storage are gaining ground**
   With the advent of EDSFF and push from Whitebox vendors, the OEM system vendors are losing traction with HDD/SSD platform solutions

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## Pure Storage (Matt Kixmoeller, VP Strategy)

1. **Customers Demand Seamless Cloud-like Simplicity**
   The pendulum of the cloud in enterprise IT has moderated and hybrid cloud is a reality that's here to stay. Customers see the public cloud as another set of tools to work with, but not as the panacea or their entire strategy. Customers are looking to use the cloud for flexibility and agility, but data gravity, concerns over cost and differences in governance, security and enterprise capabilities create real challenges. For most, hybrid cloud is the reality and the future - and they are looking to get the best out of both worlds; to drive simplicity and automation from their on-premise infrastructure so they can manage it like they manage the cloud, and to get the same enterprise capabilities and control in the cloud, as they have on-premise. This is the essence of what Pure's Cloud Data Services aim to deliver - seamless functionality and connectivity between on-prem and cloud and delivered through a transportable license - allowing customers to deploy and move applications between environments as needed.

2. **Flash has Defied the Impossible**
   Since the introduction of flash, it's largely been one-size fits-all (SLC, eMLC, cMLC, TLC, etc…) but with new flash technologies such as Storage Class Memory (SCM) and QLC coming online and stratifying the memory space, flash is really poised to break out and address whole new swaths of data. On the high-end, with the combination of SCM and high-speed protocols like NVMe-oF, shared storage arrays can now provide direct-attached storage (DAS) like performance to the most latency sensitive applications. This set of applications is one of the last holdouts sitting on DAS which can now get all of the data-services common to shared storage (data protection, data reduction, etc) - it's now possible to get top-end performance and rich data services. At the same time, the impending introduction of QLC is bringing flash to tiers of storage that have largely stayed on magnetic disk to date.

3. **Object Storage Strikes Again**
   Object Storage has shaken off its roots as cheap-and-deep cold storage and has started to emerge as the new form of primary storage. Originally conceived to support the management of extremely large datasets (beyond what traditional file systems could handle), Object Storage has become the storage standard for cloud-native applications - for its ability to support highly parallel and distributed access to large data sets. As applications are developed or replatformed for cloud-friendly architectures, Object Storage has become the natural choice for enabling applications to decouple and disaggregate applications and their compute resources from a pool of shared storage. This pattern has taken hold not only in custom SW development, but also with large software vendors such as Splunk and Vertica.

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## Quantum (Eric Bassier, Senior Director of Product Marketing)

**1. Video-based data grew exponentially, across all industries**
Use cases like surveillance, corporate video for training and marketing, and of course the entertainment industry continue to generate, process, stream, and store video content at large scale.

**2. NVMe adoption even faster than originally predicted**
The value of NVMe to deliver faster response times and faster throughput than traditional SAS SSDs have driven adoption faster than anticipated. This trend will only accelerate as NVMe prices come down.

**3. Tape is more relevant than in prior years, for cold storage and offline protection**
This year, for the first in many years, tape storage saw increased relevance – but not for backup, instead for cold storage of inactive data. Since the majority of the data being created will be eligible for cold storage (much of this is video and image data stored in the cloud), we expect tape to continue to be relevant for many years.

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## Qumulo (Molly Presley, Global Product Marketing Director)

1. **IDC increased the scale-out file market size in 2021 from a previous forecast of $6.1 billion to $10.1 billion**
   It is apparent that the scale-out market is growing faster than anticipated as businesses become increasingly dependent on leveraging unstructured data to gain competitive advantage. The advent of modern, cloud ready, scalable file storage enables organizations to keep unstructured data in a file system single tier instead of offloading to object storage for retention.

2. **ESG found that « more than half of organizations formulating hybrid cloud strategies cited seamless compatibility with their on-premises infrastructure**

**as the most important consideration » ESG Hybrid Cloud Trends, May 2019**
No longer does scale-up or scale-out in the data center solve user's needs for file storage. Hybrid IT needs Scale-Across File Systems which deliver unification across on-prem and the cloud.

3. **Qumulo was the only Leader in the Gartner Distributed File Systems and Object Storage Magic Quadrant to move up and right. All other leaders moved backward.**
For the second year in a row, Qumulo place in the Leaders' quadrant in the Gartner MQ. In 2019, Qumulo was the only company in the Leaders' quadrant that improved its position with its agile, simple, scalable file storage for unstructured data.

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## Scale Computing (Alan Conboy, office of the CTO)

1. Gartner Magic Quadrant leaders are yesterday's news

2. Niche players are driving innovation, simplifying IT operations and adding the most value to the HCI industry

3. Customers are moving away from VMware and its quasi-vendor agnostic approach

If the 2019 Gartner Magic Quadrant has taught us anything, it's that VMware has reached a dead-end. Niche players are where the innovation happens in the industry by driving innovation in the HCI space. Customers have decided they no longer want a 20-person team to manage an IT network and are embracing the concept of simple, easy to use technology instead. They are switching to niche players that offer cost effective, easy to deploy, and innovative technology that is truly agnostic.

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## Scality (Paul Speciale, CPO)

1. **An increase in mobility of workloads and data**
Organizations that have leapt into the public cloud are beginning to understand the reality of its cost, complexity and potential for lock-in. More and more in the past year, organizations have changed their perspective from being "all-in with cloud" to wanting the ability to move between cloud and on-premises. Even staunch mono-cloud defender AWS has now announced their on-premises offering called Outpost.

2. **Cloud providers have continued to make acquisitions to build offerings in the media and entertainment industry**
   - AWS acquired these M&E companies in 2019: IGDB, Bebo, Eero
   - Azure acquired Double Fine Productions

- Google acquired Superpod, Nightcorn, Socratic, and is in the process of acquiring FitBit

3. **« Cloud » has truly become « clouds »**
   Multi- and hybrid clouds have become the new 'cloud' as the awareness of data as a major enterprise asset continues to increase.
   Today's common model is a hybrid IT approach: organizations selectively and consciously choose to use their on-premises IT resources for specific tasks, while moving other workloads and data to a public cloud, or clouds.

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## StorMagic (Bruce Kornfeld, CMO & GM-Americas)

1. **Cybersecurity and encryption strengthened at the edge**
   With 2019 on course to be the worst year on record for data breaches and more companies moving their data to the edge, IT teams have needed to implement stronger security measures. Encryption has become a necessity to secure data at the edge, but many organizations continue to struggle with expensive key managers and are looking for ways to simplify and cost reduce this important security initiative.

2. **Edge solutions became denser**
   Server vendors are now recognizing the unique requirements that come along with edge storage. Gone are the days these vendors are trying to force-fit a datacenter-class server at the edge. A new family of edge servers emerged from vendors like HPE, Lenovo and Supermicro that are smaller, more compact and incorporate 5G to accommodate edge needs.

3. **Subscription-based pricing and SaaS emerged more prominently**
   Subscription-based pricing and storage as a service (SaaS) became more popular and more important in 2019 as smaller companies began adopting edge solutions. These financial models help customers with dozens, hundreds or thousands of locations offload the work and resources needed to manage their edge sites, which are typically more cost-constrained. For example, if a local dollar store needs IT, but doesn't have a large budget at each location, SaaS or a low-level storage subscription could be their solution.

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## Weebit (Coby Hanoch, CEO)

1. Weebit and Leti demonstrated the world's first demo of Spiking Neural Networks running on ReRAM at FMS

2. ReRAM is getting closer to production mode with several ReRAM developers engaged with production fabs

3. China launched its Starboard exchange (the Chinese NASDAQ) and one of the first batch of companies listed on it was Montage – a storage company

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## WekaIO (Andy Watson, CTO)

1. Google acquired ElastiFile, providing further evidence that The Cloud is getting serious about file-based storage. Prior to 2019, the hyperscalers have been "all about" object storage, complementing it unimaginatively with block storage in service of databases but frankly not providing very exciting file-based storage solutions. It's been a blindspot. But as evidenced by AWS's November 2018 announcement of forthcoming file-based storage services like FSx for Lustre and FSx for Windows, 2019 went on to become The Year Of The File (for The Cloud). Apparently they've become aware that attracting significantly more than the roughly 40% of Enterprise data they've already captured will require significant improvement in their file-based storage capabilities.

2. NVIDIA unveiled Magnum IO, which includes the GPU Direct Storage method for bypassing traditional methods of delivering data to NVIDIA GPU's in favor of RDMA placement of data directly into GPU memory buffers. This enables breakthrough data rates able to keep up with the data appetite of an NVIDIA DGX-2 or an equivalent platform stuffed to the gills with Tesla V100 GPU's, each individually capable of ingesting data at rates of about 6 gigabytes/sec or more. (Simple arithmetic: a dozen of those GPU's would feast on almost 100 GB/s, which would exceed other mechanisms for data delivery.)

3. Intel shipped Optane DC Persistent Memory, the DIMM version of Optane the market has been waiting for. With modes enabling it to be used to extend memory or deployed as persistent data storage with sub-microsecond latency characteristics, this game-changer has been turning heads all year. Like the other two "2019 Facts" I've listed above, although this analyst-pleasing event didn't redraw the map immediately, its repercussions and consequences will be more noticeable next year and beyond.