



Licensed for Distribution

Top Trends in Enterprise Data Storage 2023

29 June 2023 - ID G00789370 - 22 min read

By Chandra Mukhyala, Julia Palmer, [and 1 more](#)

Cloud-inspired operating models, advanced flash technologies, cybersecurity and data insights are among the top enterprise storage trends of 2023. Infrastructure and operations leaders must prioritize those technologies and storage platforms to stay ahead of business demands.

Overview

Opportunities

- STaaS, container-native storage and cyberstorage for protection, detection and recovery of ransomware are seeing increasing deployments to address requirements for cloud-like operating model and ransomware protection.
- Advances in flash technology — including use of QLC-based flash, NVMe over TCP/IP and Captive NVMe drives with onboard compute — are stretching the applicability of Flash to both extreme performance and cost-sensitive use cases.
- Modern unstructured data storage solutions can enable better business insights and analytics workflows, among other benefits, by supporting both file and object services on a single platform, a global namespace and metadata-based data categorization.

Recommendations

- Modernize your enterprise storage to address cybersecurity, cloud-like and cloud-native operating requirements by investing in cyberstorage, STaaS and container-native storage capabilities.
- Expand the deployment of flash-based storage for superior application performance, rack density and energy savings by leveraging modern flash storage and NVMe over TCP.
- Eliminate unstructured data silos to enable faster analytics workflows and better data management by consolidating all your unstructured data on a single platform with a global namespace.

Strategic Planning Assumptions

By 2028, consumption-based STaaS will replace over 35% of enterprise storage capex, up from less than 10% in 2023.

By 2028, 100% of the storage products will include cyberstorage capabilities focused on active defense beyond recovery from cyber events, from 10% in early 2023.

By 2027, enterprises will use QLC in 25% of their SSD flash media, up from 5% in late 2022.

By 2028, 70% of file and object data will be deployed on a consolidated unstructured data storage platform, up from 35% in early 2023.

By 2028, large enterprises will triple their unstructured data capacity across their on-premises, edge and public cloud locations, compared to mid-2023.

By 2027, 60% of I&O leaders will implement hybrid cloud file deployments, up from 20% in early 2023.

By 2027, at least 40% of organizations will deploy data storage management solutions for classification, insights and optimization, up from 15% in early 2023.

By 2027 25% of enterprise organizations will deploy NVMe-oF as a storage network protocol, up from less than 10% in mid-2023.

By 2026, Captive NVMe SSD will replace over 30% of deployed on-premises capacity, up from less than 5% mid-2023.

What You Need to Know

Organizations looking to modernize their storage infrastructure are experiencing a few common challenges: some are unique to block or primary storage deployments, some unique to file and object storage deployments and some are common to all storage types. The challenges arise from managing the explosive growth of enterprise data, the business need for an on-premises cloud-like consumption model to mitigate cyberattack risks, or leveraging latest storage technologies like QLC or NVMe over fabric for better cost and/or performance. Modern storage offerings provide solutions to these challenges while continuing to deliver on increasing performance and lower total cost of ownership (TCO). These modern offerings and technologies enable I&O leaders to proactively respond to business demands by building flexible and agile storage platforms. Figure 1 summarizes the top trends under each category of storage.

Figure 1: Top Enterprise Storage Trends for 2023



Top Trends in Enterprise Data Storage 2023

|  Universal Storage Trends |  Enabling Business Insights |  Capitalizing on Flash and Container Storage |
|--|--|--|
| <ul style="list-style-type: none"> • Storage-as-a-Service • Cyber Storage • QLC Flash | <ul style="list-style-type: none"> • Single Platform for File and Object Storage • Data Storage Management Services • Hybrid Cloud File Data Services | <ul style="list-style-type: none"> • NVMe Over Fabric • Container Native Storage • Captive NVMe SSD |

Storage Platform Innovation

Source: Gartner
789370_C

Gartner

Common Storage Trends:

The first common storage trend is storage-as-a-service, which brings the cloud-like consumption model to on-premises storage thereby retaining the enterprise feature set, performance and availability without the burden of life cycle management or upfront CAPEX. Secondly, the lower cost and energy and cooling savings of QLC flash further reduces the gap between Flash and HDD, providing a cost-effective path to eliminate hybrid or HDD based systems. And thirdly, modern cyberstorage technology further improves on prevention, detection, identification of cyberattacks on production storage and providing fast recovery from immutable snapshots or backup copies.

Unstructured Data Storage Trends:

The first trend in unstructured data is that modern solutions provide a common platform for running both file and object data services. The second trend is the application of data storage management solutions for data classification and creating custom metadata to enable IT and/or business insights, and outcomes such as storage optimization, data life cycle enforcement, security risk reduction and faster data workflows. Thirdly, global namespace solutions provide a common view of all file or object data across geographic locations, including the cloud and edge — either through a centralized storage and edge caching appliances, or with a virtual global file system.

Block Storage Trends:

The first trend in block storage is the use of NVMe-oF. NVMe-oF brings the benefits of microsecond latency to external storage on standard TCP/IP networks and more scalable architectures for use in distributed, hybrid platforms. The second trend is that container-native storage is becoming the

preferred storage for large-scale container deployments by combining container granularity storage operations with enterprise storage capabilities of data protection, data management and integration with container orchestration tools like Kubernetes. Thirdly, captive SSDs offload the I/O function from the storage controller’s compute to free up the resources to accelerate storage application, including efficient usage of flash capacity to reduce overall cost.

The following trend profiles explain each top trend, along with its implications and followed by specific actions that I&O leaders must take to innovate with modern storage technologies.

Trend Profiles

Click links to jump to profiles

Table 1: Gartner’s Top Trends in Enterprise Data Storage 2023

| Common | Unstructured Data Storage | Block Storage |
|---|---|--|
| Storage-as-a-Service | Single Platform for File and Object | NVMe Over Fabric |
| Cyberstorage | Hybrid Cloud File Data Services | Captive NVMe SSD |
| QLC All-Flash to Replace Hybrid Storage | Data Storage Management Services | Container-Native Storage |
| | | |

Source: Gartner (June 2023)

Common Trends: Storage-as-a-Service

[Back to top](#)

Analysis by Jeff Vogel

SPA: By 2028, consumption-based STaaS will replace over 35% of enterprise storage capex, up from less than 10% in 2023.

Description: Managed storage as a service (STaaS) is a service in which the storage provider finances and supplies, through a subscription, the customer with access to a data storage platform for consumption. STaaS is a way for enterprises to manage storage capacity and workloads without the overhead costs of upfront capital for storage hardware and software, or staff time. The service

can be delivered on-premises or colocated in a hybrid platform from infrastructure that is dedicated to a single customer, or it can be delivered from the public cloud as a shared service purchased by subscription and billed on a pay-per-use license.

Why Trending: Managed STaaS eliminates upfront asset capital (capex) costs, improves return on assets by maximizing asset utilization elastically against workload demands and simplifies overall management. It also lowers storage usage costs by leveraging vendor investments in automation, AIOps and support. Managed STaaS is powered by storage vendor's software and/or appliances, which bring the enterprise feature set, availability and performance — while delivering a cloud-like consumption model.

Implications: Will eliminate storage capex, simplify budgeting and sourcing processes, eliminate IT refresh/renewal cycles and relieve subject matter expertise talent issues by augmenting them with vendor AIOps management tools.

Actions:

- Canvas STaaS vendors' offerings before the next storage refresh, renewal or update cycle, to determine which is a good fit for your environment and replace capex workload infrastructure.

Further Reading:

[Quick Answer: How Can I Use Storage as a Service to Reduce IT Spend?](#)

[Infographic: 6 Ways to Procure and Deploy Enterprise Storage](#)

Common Trends: Cyberstorage

[Back to top](#)

Analysis by Julia Palmer

SPA: By 2028, 100% of the storage products will include cyberstorage capabilities focused on active defense beyond recovery from cyber events, from 10% in early 2023.

Description: Cyberstorage solutions deliver active technologies to identify, protect, detect, respond and recover from ransomware and other cyberattacks on structured and unstructured enterprise data storage solutions.

Why Trending: Ransomware and other cyberattacks have become a significant threat to businesses of all sizes. Given the valuable data enterprise storage systems store for the customers, storage devices are becoming a prime target for such attacks. Ransomware or insider cyberattacks are becoming so common that I&O leaders and storage professionals are forced to assume data cybersecurity responsibility and adopt new approaches for active defense. Initially, storage leaders

were not equipped to deal with data security, but the new Cybersecurity Framework (CSF) created by the National Institute of Standards and Technology (NIST) provides organizations with guidance on how to identify, protect, detect, respond and recover from cyberattacks. In October 2020, it released Special Publication (SP) 800-209, Security Guidelines for Storage Infrastructure, which includes comprehensive security recommendations for storage infrastructures. A result of the increased focus in storage security has led to an emergence of new cyberstorage products and add-on data services that are designed to identify, detect, protect, respond to and recover from ransomware attacks.

Implications: Cyberresilience defense should be multilayered and not be limited to endpoint protection or backup recovery. Even today, most organizations rely on backups to recover from ransomware attacks. Recovery can be devastatingly slow, isn't 100% reliable and will not protect you from data extortion, exfiltration or advanced attacks. A new active defense approach must include data cyberstorage capabilities to effectively identify, protect, detect, respond and recover from any cyber anomalies or events on devices responsible for data services and data storage. Most major storage vendors are actively working on cyberstorage capabilities, which might be included with storage systems or enabled as a separate product. In addition, most innovative startups are releasing products that can support heterogeneous solutions to protect enterprise data for block, file and object storage.

Actions:

- I&O leaders must evaluate cyberstorage solutions as a new active defense mechanism to protect their most critical data. Cybersecurity evaluation of storage must focus on advanced features in identify (such as vulnerability testing), protect (such as zero trust architecture and logging), detect (such as anomaly IO and data detection), respond (such as alerting and blocking) and recover (such as forensic analyses and smart recovery) pillars of cybersecurity framework.

Further Reading:

[The Cybersecurity Leader's Guide to Ransomware](#)

[2022 Strategic Roadmap for Storage](#)

[Common Trends: QLC All-Flash to Replace Hybrid Storage](#)

[Back to top](#)

Analysis by Jeff Vogel

SPA: By 2027, enterprises will use QLC in 25% of their SSD flash media, up from 5% in late 2022.

Description: Quad-level cell (QLC)-based storage arrays, augmented with software-enabled ASIC or FPGA logic (to overcome life cycle limitations, enhance durability and improve performance), are now

deployed for general purpose block storage use cases. They are also deployed for backup and disaster recovery use cases where performance is not as critical in replacing TLC media device arrays. QLC-based storage arrays are increasingly leveraged in place of HDD disk arrays for file and object use cases such as analytics, backup and disaster recovery where the premium flash price to hybrid arrays can be justified on performance reasons and simplicity. QLC-based arrays are becoming increasingly popular for very dense multipetabyte use cases.

Why Trending: To leverage the advantages of lower cost flash media for use against a broader array of applications, storage vendors are using software and custom logic to overcome QLC media limitations. The cost delta advantages of QLC versus triple-level cell (TLC)-based arrays, coupled with enhanced durability and performance, provide enterprises with sufficient long-term benefits (e.g., the rapid restoration of backup data in the event of a ransomware event recovery).

Implications: QLC-equipped arrays have the potential to displace an increasing percentage of TLC-based flash arrays and hybrid HDD arrays as the growth in unstructured data drives the demand for higher density SSD drives. The net effect on traditional hybrid HDD arrays costs is a decrease in market share, while growth is accelerating for unstructured data. This effect will lower the average sale price of general purpose block storage arrays while elevating the average sales price of object storage arrays.

Actions:

- Clients should reassess their application infrastructure environment against use case and workload demands and determine the overall price and performance advantages in using QLC-based storage over hybrid HDD and TLC-based storage.

Further Reading:

[Magic Quadrant for Primary Storage](#)

[2022 Strategic Roadmap for Storage](#)

[Unstructured Data Storage Trends: Single Platform for File and Object](#)

[Back to top](#)

Analysis by Chandra Mukhyala

SPA: By 2028, 70% of file and object data will be deployed on a consolidated unstructured data storage platform, up from 35% in early 2023.

Description: The modern unstructured data storage platform can support both file and object workloads from a single platform using a common key-value storage repository and running file and object services that provide read and write multiprotocol access over NFS, SMB and S3 protocols. The storage layer, data services and protocol access layers are all tightly integrated and scalable without requiring any external gateways or third-party products.

Why Trending: Modern application workflows ingest, process, analyze, share and retain data over multiple protocols and rely on both file and object services. End-user organizations find it difficult to separate workloads into file-only or object-only storage silos. A single platform for file and object data enables consolidation of all unstructured data workloads – which not only simplifies storage operations, but also storage sourcing activities.

Implications:

Unified and single platforms for file and object data will speed up modern application workflows. Speed occurs when applications can freely access data in any protocol, eliminating the need for copying data. I/O leaders will also be able to eliminate siloed or specialized storage products that solely provide object or file storage except for niche use cases. With previous generation products, sourcing activities were separate for file and object storage products. The modern unified and single unstructured data storage platform simplifies that to a single sourcing activity.

Actions:

- Identify stand-alone NAS, file servers and object storage in production and build a requirements list for a consolidated platform
- Identify single platform solutions that are built on a common data repository for all unstructured data and allow multiprotocol access with no dependencies on external gateways
- Prioritize solutions that can be deployed anywhere: on-premises, public cloud or at the edge
- Select solutions with the enterprise feature set and APIs required for unstructured data workloads

Further Reading:

[Magic Quadrant for Distributed File Systems and Object Storage](#)

Unstructured Data Storage Trends: Hybrid Cloud File Data Services

[Back to top](#)

Analysis by Chandra Mukhyala

SPA: By 2027, 60% of I&O leaders will implement hybrid cloud file deployments, up from 20% in early 2023.

Description: Hybrid cloud file data services provide data access and data management across edge, cloud and core data center locations through a single global namespace.

Why Trending: Increasingly, enterprises are creating, ingesting and accessing data in edge locations, factories, field offices and retail locations. The data services to analyze or enhance data are typically present in the public cloud, but the workers who collaborate on the data are spread across many geographic locations, raising the demand for a single global namespace.

Implications: Hybrid cloud file services will eliminate the need to copy data to several locations either for data manipulation, enhancement or simply to provide access to users collaborating on the data. This will consolidate unstructured data to a single copy, enabling centralized management around the protection and security of the underlying data, thereby simplifying operations while consolidating use cases.

Actions:

- Decide if you want to keep existing storage in the various locations while still getting global access, or if you prefer centralized storage with access everywhere.
- Invest in hybrid cloud file solutions to access unstructured data across edge locations, cloud and on-premises from a single global namespace.

Further Reading:

[Modernize Your File Storage and Data Services for the Hybrid Cloud Future](#)

[Market Guide for Hybrid Cloud Storage](#)

[Unstructured Data Storage Trends: Data Storage Management Services](#)

[Back to top](#)

Analysis by Chandra Mukhyala

SPA: By 2027, at least 40% of organizations will deploy data storage management solutions for classification, insights and optimization, up from 15% in early 2023.

Description: Data storage management services (DSMS) categorize data based on the attached metadata and optionally analyze file or object content to identify specific information or patterns. Data classification or categorization helps improve IT and business outcomes such as storage optimization, data life cycle enforcement, security risk reduction and faster data workflows. Data

classification and insights solutions are typically vendor storage agnostic, and work on any data that can be accessed over a file or object access protocols like NFS, SMB or S3. This includes data in SaaS offerings such as Box, Dropbox, Google and Microsoft 365. Solutions can be SaaS-based offerings or on-premises software that can run on any server or hypervisor. The underlying data itself can be on-premises or in the public cloud.

Why Trending: Increasingly, I&O leaders are concerned with understanding and effectively managing all the data the organization stores across on-premises, cloud and edge locations. Not doing anything will expose too much risk around security and regulatory compliance. With the total amount of unstructured data expected to triple in size over the next five years, I&O leaders are looking for solutions to get a handle on the storage costs. In addition, they need solutions to ensure the protection and life cycle management of data, but also to make the data more productive to enable business outcomes. This is a complex problem compared to core storage tasks of adding additional capacity, performance or protection, which are problems with well-understood solutions.

Implications:

Typical outcomes include cost optimization to align the cost of the storage with the value of the data; data governance to ensure sensitive data has the right protection and retention policies applied; data security to enable the right level of permission and access level controls; and enhanced analytics workflows that leverage data classification and optional tag the data with custom metadata.

Actions:

- Create an inventory of all sources of unstructured data across the organization, whether present on-premises, in the public cloud or in a cloud office such as OneDrive, Dropbox and Box.
- Work with the business to understand how sensitive data is defined and how its life cycle, such as storage location and retention policies, should be managed.
- Retention policies should be modernized or updated to address the multiple sources of information in use, and to enable specific actionable outcomes that can be enforced with DSMS solutions.
- Create a list of questions that must be answered, including from business, to understand all the data that the organization stores.
- Work with the analytics teams to speed up workflows by leveraging standard metadata or integrating custom metadata in the data.

Further Reading:

[Hype Cycle for Storage and Data Protection Technologies, 2022](#)

Block Storage Trends: NVMe Over Fabric

[Back to top](#)

Analysis by Jeff Vogel

SPA: By 2027 25% of enterprise organizations will deploy NVMe-oF as a storage network protocol, up from less than 10% in mid-2023.

Description: Nonvolatile memory express over fabrics (NVMe-oF) is a network protocol that takes advantage of the parallel-access and low-latency features of NVMe Peripheral Component Interconnect Express (PCIe) devices. NVMe-oF tunnels the NVMe command to the remote subsystems. The specification defines a protocol interface and is designed to work with high-performance fabric technology — including remote direct memory access (RDMA) over Fibre Channel, InfiniBand or Ethernet with RoCE v2, iWARP or TCP. This enables a front-end interface into storage systems, scaling out to large numbers of NVMe devices and extending the distance within a data center over which NVMe supported subsystems can be accessed. NVMe-oF significantly improves data center network latency.

Why Trending: NVMe-oF offerings address use cases where low-latency application requirements are critical in combination with NVMe drives. Though requiring infrastructure changes and upgrades, the clear benefits these technologies can provide are attracting high-performance demands, and the use of scalable architectures that can leverage the underlying networking capabilities in combination with NVMe flash media. NVMe-oF protocols deliver architectures that extend and enhance the capabilities of storage in a distributed and disaggregated platform.

Implications: The NVMe-oF protocol accelerates the adoption of next-generation storage architectures, such as disaggregated storage-compute to scale capacity and compute independently, use of software-defined storage and hyperconverged and composable infrastructures. Of the NVMe-oF options, NVMe-TCP has the most to gain as on-premises where Ethernet costs and simplicity can rival both iSCSI and low-end Fibre Channel SAN bandwidth requirements at or below 16Gbps. Further, NVMe-oF can scale out to high capacity levels with high-availability features and be managed from a central location, serving dozens of compute clients.

Actions: Identify workloads where the scalability and performance of NVMe and NVMe-oF-based solutions justify the premium cost of such a deployment. Target its use for high performance applications such as AI/ML, HPC, in-memory databases, transaction processing or replacement for those iSCSI environments where managed STaaS can be used. Identify potential storage platform, network interface controller, host bus adapter and network fabric suppliers to verify that interoperability testing has been performed, and that references are available.

Further Reading:

Hype Cycle for Storage and Data Protection Technologies, 2022

2022 Strategic Roadmap for Storage

Block Storage Trends: Captive NVMe SSD

[Back to top](#)

Analysis by Jeff Vogel

SPA: By 2026, captive NVMe SSD will replace over 30% of deployed on-premises capacity, up from less than 5% mid-2023.

Description: Captive NVMe SSD drives integrate processor cores to substantially increase onboard compute capability to handle I/O functions at the drive level. Captive NVMe drives are increasingly replacing standard SSD drives as a way to provide customers with storage system level capabilities that improve application capabilities across a broad spectrum of storage system benefits. Captive NVMe SSD drive vendors design and build their storage arrays from the NAND up, along with software to optimize the storage environment. The primary function of Captive NVMe SSD drives is to offload input/output (I/O) from the storage controller CPU.

Why Trending: Increasingly, storage is viewed as a strategic lever for solving and enabling critical storage system features. Captive NVMe drives take advantage of vendors' ability to procure and integrate compute and analytic capabilities to increase the relative intelligence needed to optimize the drive across many critical operational factors. Future enhancements substantially lower hardware administrative and support costs and enhance data management through the use of advanced AIOps features in conjunction with drive intelligence. Captive NVMe drives pave the way for more efficient and scalable storage system architectures, such as software-defined disaggregated storage-compute, leading to the adoption of NVMe-TCP.

Implications: Use of captive NVMe SSD drives provide a myriad of potentially favorable benefits ranging from enhanced storage operations and cost savings to a more cyberresilient and intelligent data storage services environment. A vendor-captive NVMe drive approach requires extensive and expensive internal engineering and procurement expertise that must be leveraged throughout the portfolio. Strategic access to next generation NAND technology and sufficient scale is obligatory to compete effectively with vertically integrated NAND/SSD vendors. Downsides to captive NVMe SSD drives include elevated risks associated with single source supply, including availability and switching costs at the storage system level in the event of a change in supply.

Captive NVMe SSD drives use special logic and sophisticated AI/ML algorithms that provide the following benefits:

- Cost advantages in use of low-cost NAND flash, such as QLC

- Higher SSD drive density levels than a standard SSD drive
- Extra compute abilities to deliver greater SSD drive functionality and performance
- Computational capabilities such as efficient compression and deduplication
- Granular flash management to enhance endurance and improved resilience with limited over-provisioning
- A more efficient and flexible scale-out block storage architecture
- Advanced cyberresiliency features such as filtering, searching and scanning at the media level
- Real-time statistics about entropy changes (improved security) of the data stored on the drive itself
- Improved NVMe application-aware end-to-end security capabilities
- Improved power usage to offset CO2 emissions and intelligent power and cooling features

Actions: Customers should:

- Evaluate the role that captive NVMe drives are playing within the storage system and determine whether those benefits are critical or important to the overall vendor selection process.
- Take a proactive approach in assessing how each vendor is addressing tactical and strategic NVMe SSD requirements, and how those vendor strategies are addressing future storage system trends.
- Perform a detailed due diligence on those risk and dependency factors that may have a negative impact on sourcing and ongoing supply requirements against critical application infrastructure demands.
- Inquire as to whether the captive NVMe SSD vendor has a multiyear view of and commitment to the roadmap and a strong procurement team.

Further Reading:

[Emerging Tech Impact Radar: Semiconductor and Electronics Technologies](#)

[Forecast Analysis: NAND Flash, Worldwide](#)

[Forecast: NAND Flash Market Statistics, Supply and Demand, Worldwide, 2020-2027, 1Q23 Update](#)

[Block Storage Trends: Container-Native Storage](#)

[Back to top](#)

Analysis by Julia Palmer

SPA: By 2027, 80% of Kubernetes deployments will require advanced features for persistent containers storage compared to 30% in early 2023.

Description: Container-native storage is specifically designed to support container workloads and focus on addressing unique cloud-native scale, granularity and performance demands while providing deep integration with the Kubernetes container management systems. Container-native storage is designed to be aligned with microservices architecture principles and adhere to the requirements of cloud-native data services.

Why Trending: As Kubernetes and container adoption grows, I&O leaders are expressing interest in container-native data services that support stateful applications requiring persistent container-native data services. Data services for containers are usually integrated when deployed in the public cloud or as a part of platform as-a-service. However, when deploying on-premises, it's up for the I&O team to figure out how to design and deploy, agile, scalable, resilient storage services for unique requirements of container-native applications.

Implications: While containers are built to be stateless, the volume of deployments requiring persistent data for stateful applications is increasing. A good starting point for an initial Kubernetes deployment is traditional storage approaches, where Container Storage Interface (CSI) is abstracting the underlying storage platform. However, legacy storage platforms might not be able to fully address all requirements of the container-based application platforms. Container-native storage approach is designed to be aligned with microservices architecture principles and adhere to the requirements of cloud-native data services.

Actions: Change your traditional storage solution selection to adhere to the requirements of cloud-native data services while selecting storage solution for Kubernetes deployment. The top requirements are:

- Software-defined and hardware agnostic
- Programmable to be managed as Infrastructure-as-Code, driven by APIs and enables advanced and granular data services
- Based on distributed architecture that can be deployed at any scale
- Interoperable, certified and fully integrated with a broad set of Kubernetes distributions
- Follows a simple and predictable licensing model across environments

Further Reading:

[A CTO's Guide to Navigating the Cloud-Native Container Ecosystem](#)

[Solution Path for Cloud-Native Infrastructure With Kubernetes](#)

Emerging Tech Impact Radar: Cloud-Native Evidence

Inquiries with end-user clients describing their storage challenges and desired outcomes.

Inquiries with storage vendors to review product plans.

Briefings with storage vendors on current capabilities.

© 2023 Gartner, Inc. and/or its affiliates. All rights reserved. Gartner is a registered trademark of Gartner, Inc. and its affiliates. This publication may not be reproduced or distributed in any form without Gartner's prior written permission. It consists of the opinions of Gartner's research organization, which should not be construed as statements of fact. While the information contained in this publication has been obtained from sources believed to be reliable, Gartner disclaims all warranties as to the accuracy, completeness or adequacy of such information. Although Gartner research may address legal and financial issues, Gartner does not provide legal or investment advice and its research should not be construed or used as such. Your access and use of this publication are governed by [Gartner's Usage Policy](#). Gartner prides itself on its reputation for independence and objectivity. Its research is produced independently by its research organization without input or influence from any third party. For further information, see "[Guiding Principles on Independence and Objectivity](#)." Gartner research may not be used as input into or for the training or development of generative artificial intelligence, machine learning, algorithms, software, or related technologies.

[About](#) [Careers](#) [Newsroom](#) [Policies](#) [Site Index](#) [IT Glossary](#) [Gartner Blog Network](#) [Contact](#) [Send Feedback](#)

Gartner

© 2023 Gartner, Inc. and/or its Affiliates. All Rights Reserved.