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# Without Agile Storage, There's No Agile IT

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**PURE**STORAGE

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# About this paper

A Pathfinder paper navigates decision-makers through the issues surrounding a specific technology or business case, explores the business value of adoption, and recommends the range of considerations and concrete next steps in the decision-making process.

## ABOUT THE AUTHOR



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# Executive Summary

For businesses, agility means the ability to react quickly to changes, for example, by rapidly bringing new services to market or adopting new business models. Throughout its history, IT has made businesses more agile. But over the last two decades, the pace at which this has been happening has accelerated to such an extent that agility is now a key business quality, needed not just for success, but often for survival. This, in turn, has increased the pressure on IT organizations themselves to be agile, and to develop and implement new applications and business processes rapidly. Since applications and processes cannot exist without data, this cannot happen unless data storage systems are also agile.

Alongside compute and networking, data storage is one of the three pillars of IT. Although storage system suppliers are reacting to their customers' needs for greater agility, the rate at which they have done so has varied from vendor to vendor, and indeed has been a measure of their own agility. IT organizations need to be aware that their agility is impacted by a number of qualities of the storage systems on which they base their infrastructure. These qualities range from the fundamental architectural features of the systems to the business terms on which the systems are acquired or provided as an on-premises service.

## Key Findings

- The level of disruption in terms of performance and capacity that occurs when storage systems are upgraded varies greatly based on vendors' design priorities. The greatest disruption occurs when wholesale system replacement is necessary to increase storage capacity or performance, but even when systems can be upgraded in place, the level of disruption can vary significantly among suppliers.
- Long-standing vendor business models have been a limiting factor on the agility of datacenter storage systems; however, recent entrants to the market have led the creation of alternatives to these practices.
- Modern agility calls for application and data portability across hybrid clouds. A small number of storage system vendors enable this by creating common storage environments and data services that span on-premises and cloud environments.
- The emerging field of AI-enhanced infrastructure management and operations is improving agility by reducing operational overhead. Advanced offerings in this area include modeling features that boost agility by improving infrastructure efficiency and ensuring that SLAs are met.

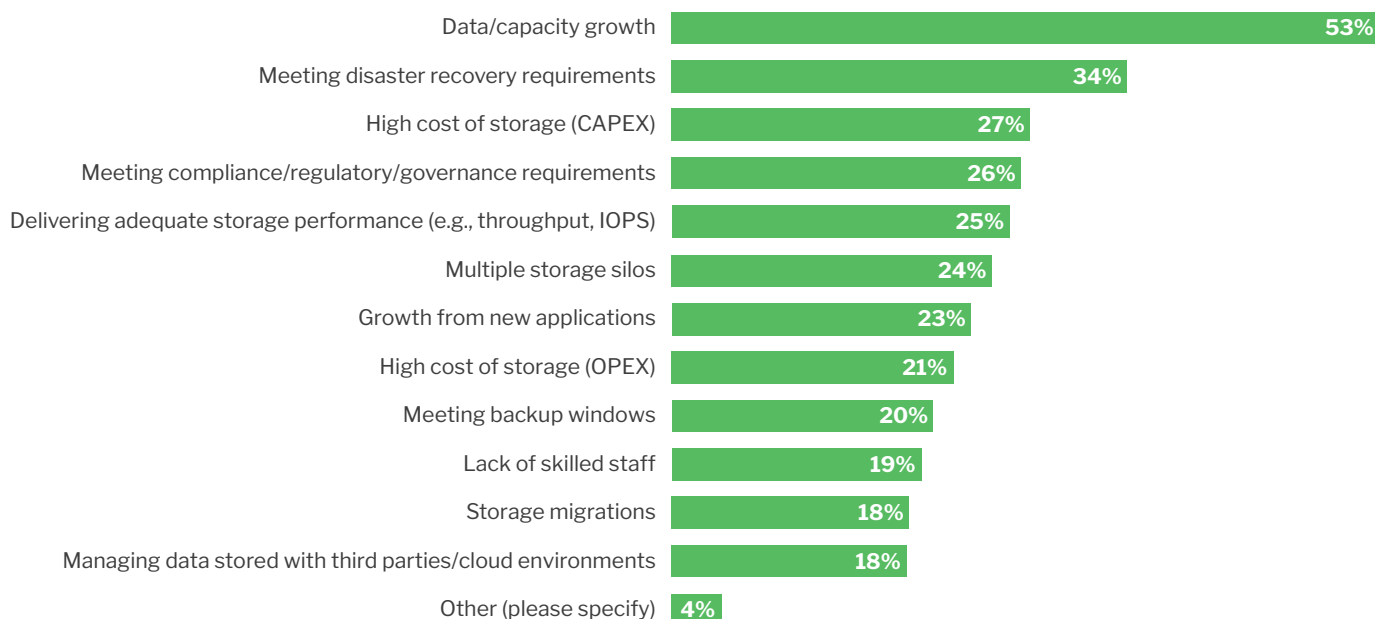
# Agile Storage System Architectures

Enterprise data is growing at an accelerating rate, and this is by far the most significant storage challenge facing IT organizations. In a recent 451 Voice of the Enterprise survey (Figure 1), over half of respondents identified data growth as their biggest storage problem. In the past, the biggest drivers of this growth were data archiving and backup, but growth is now also coming from new workloads, the overall increase in the digitization of business, and the take-up of data-intensive applications such as real-time analytics and machine learning. The rate of increase is not always easy to forecast; for example, new projects or business mergers can result in huge changes to infrastructure requirements overnight. As a result, achieving IT agility requires the ability to upgrade storage systems non-disruptively and rapidly, increasing performance, data capacity, or both.

Figure 1: Enterprise storage pain points

Source: 451 Research's Voice of the Enterprise: Storage, Budgets & Outlook 2020

Q: What are your organization's top pain points from a storage perspective? Please select all that apply. (n=451)



Non-disruptive upgrades for some products may simply be impossible – for example, when a system requires more performance, but its controllers cannot be replaced. This typically happens when the system is already fitted with the fastest controllers within its generation or series, and components can't be mixed across product generations or families. This is not uncommon, and it crushes agility because it forces customers into wholesale system replacements.

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Replacing a primary storage system requires the migration of large volumes of live or working data from that system to its successor. This is a highly disruptive and labor-intensive task. Because of the complexity of the process, vendors commonly advise IT departments to engage third parties to plan and complete the data migration. Without expert planning, production applications can be disrupted, and disaster recovery and backup mechanisms can be compromised or disabled.

The disruption, workload and risk associated with such storage migrations can be reduced by investing in storage systems that have been designed to allow upgrades across multiple generations and product families. Even when a system does not need wholesale replacement and can be upgraded by replacing controllers or by expanding its capacity, the level of difficulty varies among products. Ideally, controller upgrades can be completed during daylight production hours with no impact on applications or end users. This is a common practice for some storage systems. For others, the process is complex and labor-intensive, and it is completed outside of production hours to reduce disruption in the event of errors.

Capacity expansion is usually simpler than controller upgrades, but here, too, there are differences that affect agility. When expanding capacity by moving to newer, higher-capacity drives, or switching from SAS flash drives to faster NVMe drives, some arrays include software that will move data to the new drives in the background, with no disruption to applications. And in the quest for agility, every point at which complexity is removed is key.

# Vendor Business Terms Affect Agility

Until recently, storage vendors enjoyed a long-established business model in which most primary storage systems were replaced (i.e., repurchased) every three to five years when maintenance contracts were renewed. When customers were reluctant to replace storage systems on this schedule, suppliers encouraged them to do so with steep increases in the maintenance contract prices for existing systems. This suited suppliers because it provided them with relatively predictable revenue. But on the other side of the fence, it severely reduced customers' agility because the data migrations that were needed to replace storage systems were highly disruptive processes. Thankfully, business models have been changing for two interrelated reasons.

The first is the take-up of all-flash storage. Alongside the high cost of renewing maintenance contracts, IT organizations have also been encouraged to replace disk-based storage every three to five years because that is the practical service life of disk drives in most environments. Beyond this point, disk drive failures become more frequent, driving up the cost of replacing failed units and even risking data loss.

However, flash drives have far longer working lives than disk drives. While enterprise disk drives carry three-year warranties as standard, equivalent flash drives carry five-year and, in some cases, even indefinite warranties. This has made IT organizations far more reluctant to repurchase all-flash storage systems at the same frequency as disk-based systems.

The transition to all-flash storage also introduced new suppliers to the market that recognized that existing business models fell short of customers' agility needs. Those suppliers pioneered subscription-based programs that boosted business flexibility by including controller upgrades at maintenance contract renewal or even on demand. These upgrades boost storage system performance while protecting customers' investments in the flash capacity of those systems and avoiding unnecessary system replacements. Some programs also include guarantees of flat maintenance contract pricing, making costs more predictable.

These storage vendors could well be described as applying agile and disruptive behavior to the market because the popularity of the programs forced larger vendors to introduce similar programs of their own. Now, every mainstream vendor offers some sort of subscription model, but there are still major differences.

The programs that do the most to promote agility allow enterprises to protect their existing investments by upgrading only the system components they wish to, whether software or hardware, and to do so at a cost that is predictable and affordable. When evaluating competing programs, organizations should compare program charges with the cost of simply buying new storage system controllers or capacity when needed. When making these comparisons, organizations should take into account the possibility of multiple unplanned upgrades. The best programs won't restrict agility by limiting the number of upgrades or the value of any trade-in credits for displaced hardware.



Under some programs, the terms of such credits are declared up front when customers enroll and can be as much as 100% of the original purchase price. There may be a limit on the total trade-in credit, calculated as a percentage of the spending on an overall upgrade. Other programs give credits based on whatever the vendor determines to be the market value of the displaced hardware at the time of trade-in. Obviously, those credits will be significantly lower. However, beyond the financial differences that impact agility, those arrangements also reduce visibility and predictability by preventing customers from readily calculating the bottom-line cost of an upgrade. Other programs may limit upgrades to once per subscription contract or put limits on which controller generation or model a customer can upgrade to.

IT organizations should consider these issues not just for controller upgrades, but also for storage capacity upgrades. Despite the longer life of flash drives compared to disk drives, customers may want to retire flash drives before the end of their rated service lives to reduce the physical footprint by taking advantage of higher-capacity flash drives, or to boost performance by moving from SAS to faster NVMe-connected drives. Programs with the right consolidation and trade-in terms will contain the cost of making such upgrades and limit the extent to which customers will be repurchasing flash capacity that they had already bought.

One further point that IT organizations should consider is the history and track record of a vendor's business model, and whether customer references are readily available to back up the marketing claims. Many vendors have only recently begun to offer some of the features described here, making it more difficult to compare vendor claims against their performance.

# Right-Sizing Storage Capacity Increases Agility

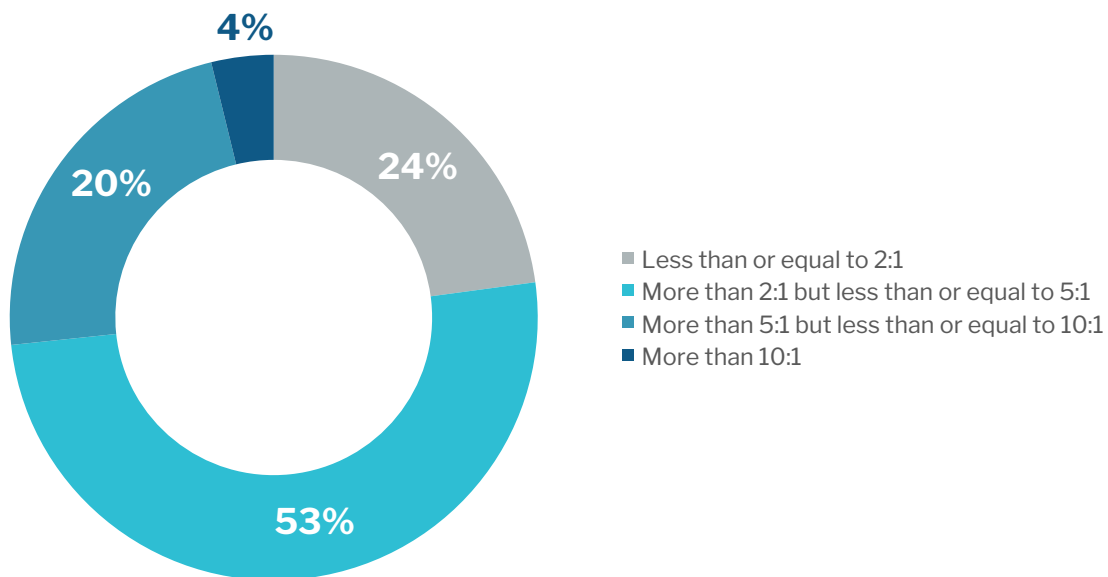
The transition from disk-based to all-flash storage for primary workloads is well underway. More than a third of enterprises have now implemented all-flash storage systems, and this percentage will continue to rise as flash prices continue to fall. The transition would have been considerably slower without the impact of inline data deduplication and compression, which slash the effective cost of flash storage by dramatically reducing the size of data.

The catch is that the extent to which they do so varies greatly, as Figure 2 shows, and is hard to predict. While some data will reduce only marginally in size, other data will see very large reduction ratios. This makes life hard for IT organizations that must attempt to judge the amount of raw flash capacity needed to meet their requirements. This impacts agility in multiple ways. If raw flash capacity needs are overestimated, the unnecessary overspending will have diverted budget from innovation or new applications. If they are underestimated, capacity will not be available for new projects, which will therefore be delayed.

Figure 2: Deduplication and compression reduction ratios seen in the field

Source: 451 Research's Voice of the Enterprise: Storage, Workloads & Key Projects 2019

Q: Approximately, what is the overall flash storage space-saving effect you have experienced from deduplication/compression? (n=112)



The solution to this problem has been simple: vendors offer guarantees of various types that entitle customers to remediation, sometimes including additional storage capacity free of charge if data-reduction ratios or effective capacities have not reached a promised level. The most common guarantee is a promise of a 4:1 data-reduction ratio for sight-unseen data (if vendors know what data will be stored, they may guarantee higher ratios.) Such guarantees appear straightforward, but buyers should ensure that they understand how vendors calculate the ratio.

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Alongside the direct data-reducing mechanisms of data deduplication and compression, some vendors include the space-saving effects of thin provisioning and incremental snapshots in their calculations. Doing so heavily inflates data-reduction ratios to values far beyond what would be expected from dedupe and compression alone (which have the largest impact on actual storage efficiency and effective capacity). This makes 4:1 guarantees that are based on this method of calculation uncompetitive compared to other guarantees based on deduplication and compression alone. It also introduces more variability because the results of the calculation are affected by the number of snapshots stored by customers, as well as the customers' choice of thin provisioning oversubscription ratio.

An alternative and simpler form of guarantee that avoids this difficulty is not based on the data-reduction ratio but on the total effective capacity of the specific storage system being purchased. Other refinements to capacity guarantees that help protect customers' investments and promote agility include the extension of those guarantees even after a storage system has been upgraded in capacity, up to the life of the array.

## Hybrid Clouds Need Agile Storage

The IT industry is now firmly in the era of hybrid cloud computing, in which IT organizations host workloads both on-premises and in public clouds. Agility requires that workloads be portable across those locations, and this in turn requires portability of data between on-premises storage and public cloud storage. One way to help meet this need is to provide the same storage infrastructure in both locations, and a small number of advanced storage vendors have done this.

Those vendors have created cloud-hosted versions of the storage OS software that powers their on-premises storage systems. This creates virtual versions of those storage systems within public clouds, offering the same data services as the on-premises systems, and a consistent storage and data-access environment, regardless of where applications run. It also provides a consistent platform for managing and protecting the data. Eliminating the need to refactor applications with respect to data access promotes application portability and, hence, agility.

The data snapshot and replication tools offered by such systems extend from customers' premises to the public clouds and provide a built-in mechanism for transferring data between the two environments. Creating a virtual version of an on-premises storage system also reduces costs by bringing incremental snapshots, data deduplication and compression to public clouds, significantly cutting the amount of data stored in public clouds, and hence terabyte-per-month storage fees.

# AI-Powered Predictive Maintenance Boosts Agility

IT infrastructure management and technical support are being transformed by the emergence of AI for IT operations (AIOps). This is the application of big-data analytics and machine learning to telemetry data collected and aggregated from the installed base of customers' on-premises equipment (the telemetry data is metadata about the operating status and performance of storage systems, and not the data itself that those systems are storing).

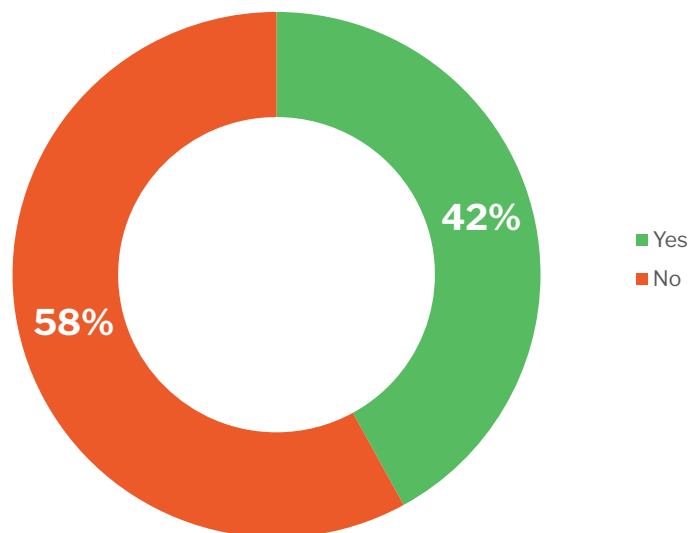
Most major storage vendors have added some flavor of AIOps to their storage operating system because of its potential benefit to their customers, and this has made the field a competitive hotspot. The key benefit is being able to increase storage availability and efficiency while reducing labor overhead. AIOps also boosts agility by increasing customers' ability to forecast loads and predict the impact of changes to infrastructure.

One early feature of many AIOps platforms was predictive maintenance, or the ability to automatically detect and warn customers of issues or potential failures in their systems, using the patterns of system behavior identified by big-data analysis. Vendors claim that predictive maintenance allows organizations to identify as much as 90% of impending failures before they become problems. This boosts agility by heavily reducing administrative overhead, allowing IT staff to spend more time implementing new applications rather than simply keeping the lights on and the systems running. For the 42% of enterprises suffering shortages of skilled infrastructure administrators (see Figure 3), this is a major benefit. But it is far from the only contribution that AIOps can make to increasing agility.

Figure 3: Enterprise infrastructure skills shortages

Source: 451 Research's Voice of the Enterprise: Storage, Organizational Dynamics 2018

Q: Does your organization currently face a skills shortage for infrastructure-based personnel? (n=575)



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AIOPs platforms created originally for storage systems have been extended to collect data from networks and host servers to diagnose performance problems across a wider infrastructure, including detailed diagnosis of individual virtual machines. This again boosts agility by reducing administrative overhead. The scope and depth of this feature varies across products. Vendors with the strongest position in this area claim that over half of the problems diagnosed by their AIOPs platforms originate from outside of storage.

A developing area for AIOPs is to model and predict storage systems' ability to handle new or changing workloads. Until this ability emerged in some vendors' AIOPs platforms, customers or vendors' support engineers could only use personal experience to predict what hardware upgrades would be needed to handle workload and capacity growth. The modeling allows customers to explore multiple options such as redistribution of workloads, and separate or combined controller and capacity storage system upgrades.

## Storage as a Service Enhances Agility

Over the last few years, vendors of on-premises storage systems have been offering a growing number of OPEX or consumption-based payment schemes. The increasing demand for OPEX payment models has been driven by multiple factors, including changes in accounting rules concerning equipment leases, the influence of public clouds and, more recently, the uncertain economic outlook resulting from the COVID-19 pandemic.

These pricing models vary in the degree to which they are truly consumption-based. Some are only variations on leasing deals, while others involve true consumption-based pricing for storage capacity provided on-premises as a service that is fully managed by the vendor. The latter can even be combined with storage capacity bought with the traditional CAPEX model to provide a high degree of agility as the consumption of storage is scaled up and down to meet changing requirements.

Every organization has its own cost models for OPEX versus CAPEX. Vendors that supply storage systems on a CAPEX basis but also offer on-premises storage as a service say that cumulative cost-crossover between those two models typically occurs in the second or third year after services begin. This can make the service model an attractive contingency option that boosts agility, even for customers that prefer the CAPEX model for the majority of their storage.

While storage as a service increases direct costs by handing off management to a third party, it avoids the overprovisioning that is common with CAPEX purchases of storage systems at the beginning of their working lives. It also allows organizations to avoid the management of the storage, as well as management and planning of the CAPEX purchases themselves. Storage as a service extends IT agility into the financial realm while keeping many of the benefits of traditional on-premises storage.

# Recommendations and Conclusions

Enterprises would benefit from shifting their perspective on storage; rather than considering it as a disposable or point purchase destined for obsolescence, they should recognize it as a long-term platform and investment that should grow and change to suit business needs. The biggest reason for doing this is to avoid disruptive storage system replacements and data migrations, which are heavily damaging to IT agility. Choosing the right storage platform can significantly reduce or eliminate these disruptions. Even when systems and data remain in place while components such as controllers are upgraded, the resulting operational impact and level of disruption varies greatly from system to system.

Maintenance subscription programs offered by all major vendors boost agility, but they do so to varying extents. To maximize agility, enterprises should look for business terms that provide predictable cost while protecting existing investments and allowing system upgrades to occur when needed, rather than at vendor-defined intervals.

IT agility requires right-sizing storage systems. Overspending by purchasing unneeded storage capacity diverts budgets from innovative projects, but falling short of needed capacity causes delays to new initiatives. For all-flash storage, right-sizing requires a full understanding of storage vendors' data-reduction and capacity guarantees, some of which may not meet customers' expectations.

Hybrid cloud operations are continuing to grow. To maximize agility, hybrid clouds must provide portability of workloads across on-premises and cloud execution environments. This can be achieved using on-premises storage systems for which cloud-based virtual instances are also available. Such systems provide a consistent storage environment in both locations, alongside built-in tools for transferring data between the two environments and mechanisms for heavily reducing cloud storage costs.

The developing field of AIOps contributes to overall IT agility. By increasing availability, AIOps reduces operational overhead and, therefore, allows more staffing resources to be dedicated to new projects. The workload modeling features in some AIOps platforms boost infrastructure efficiency as well as provide visibility into consumption trends, which again reduces baseline costs and allows more budget to be dedicated to the development of new applications.

The extent to which agility can be brought to the financial realm varies with the extent to which different vendors' OPEX-style payment schemes offer truly consumption-based pricing. The ability to combine on-premises managed storage services using the same storage systems that were bought as traditional CAPEX purchases can boost agility by allowing spending to scale up or down to meet changing business needs while keeping many of the benefits of traditional on-premises storage. Storage as a service avoids the overprovisioning that is common with CAPEX purchases of storage systems, and it eliminates capacity planning and purchase management overhead.



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