Evergreen Storage Continues to Drive Industry-Leading Customer Experience as a Differentiator for Pure Storage

Sponsored by: Pure Storage

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IDC OPINION

The legacy model for how enterprise storage vendors interact with their customers during product acquisition, deployment, ongoing management, and technology refresh is giving way to a much better model that is strongly preferred by end users. Pure Storage's Evergreen Storage was the catalyst for this positive change, and competitive vendors' response to the subscription program not only validated its value but also improved overall customer experience (CX) across the industry. Competitors first tried to downplay Evergreen Storage as "just a program," but in light of irrefutable customer affection for it, they have taken the approach of trying to copy it. Some aspects of the subscription were easy to copy, but others were not. Features such as the *Right-Size Guarantee, Proactive and Predictive Support, Capacity Consolidation,* and *Ever Agile* and the ability to comprehensively and nondisruptively upgrade installed, production systems to next-generation technology without planned downtime or data migrations continue to provide differentiating value to customers that is difficult for competitors to copy.

In December 2021, Pure Storage introduced a new higher-end FlashArray system dubbed the "XL." FlashArray//XL brings more performance and capacity into a single system, extending the vendor's ability to compete at the high end with the few storage vendors that have traditionally competed in that space (Dell EMC, Hitachi Vantara, Huawei, IBM, and NetApp). The FlashArray//XL is covered under Evergreen Storage just like the rest of the vendor's storage platform portfolio (FlashArray//X, FlashArray//C, and FlashBlade), and the CX that Pure Storage brings to the table will be a clear differentiator against those vendors in that higher-end market.

As the all-flash array (AFA) market has matured and five-year compound annual growth rates have subsided to under 10%, Pure Storage has expanded into new markets and continues to grow revenue much faster than the overall market growth rate while some of its competitors have struggled. The vendor's CX has been a strong contributor to this market performance, driving the vendor's high percentage of quarterly revenue that comes from new customer logos (i.e., competitive takeaways or wins) and high repurchase rate from existing customers (which hovers above 65%). Prospective enterprise storage customers would do well to understand exactly how Pure Storage's Evergreen Storage subscription drives value and take this value into account as they evolve their storage infrastructure to provide a modern data experience.

IN THIS WHITE PAPER

Purchasers of enterprise storage have historically dealt with an upgrade cycle that was expensive, disruptive, inherently risky, time consuming, and strongly driven by vendors' technology refresh cycles and pricing. In June 2015, Pure Storage challenged customer preconceptions about the enterprise storage upgrade cycle with the introduction of its Evergreen Storage subscription. Evergreen Storage has been tremendously popular with customers and has driven targeted responses from all other major enterprise storage players. Over the years, Pure Storage has continued to enhance Evergreen Storage with broader platform coverage and new features that increase its already extremely high customer satisfaction. This White Paper assesses the impact Evergreen Storage has had on the enterprise storage industry and discusses the technical, financial, and business implications of the subscription program (which was again expanded in late 2021) from a customer point of view.

SITUATION OVERVIEW

The legacy enterprise storage upgrade cycle is familiar to most storage administrators. An enterprise purchases a new storage array, which includes a given storage capacity that may be expanded over the life of the product, but the maximum storage performance achievable by the system is fixed based on the capabilities of the controllers and the internal array bandwidth at the time the product is shipped. Regardless of how much capacity may be added over time, the maximum performance potential in terms of storage latency, throughput, and bandwidth does not increase.

Successful enterprises tend to grow their businesses over time. As new workloads are added and their data grows, their storage performance and capacity requirements grow. A typical legacy enterprise storage platform's life cycle varies but is generally somewhere in the range of three to five years. Ultimately, the fixed storage performance of this legacy system no longer meets requirements, and the business is forced to perform a forklift upgrade to gain access to the newer technologies in controllers and storage media necessary to meet its requirement most cost effectively. Even if a business is not outgrowing the performance of its storage, media density, power consumption, and maintenance costs on older products may become sufficiently onerous to also drive a company to want to upgrade to newer technology. This cycle repeats over time.

Frankly, this legacy technology refresh model is inflexible, disruptive, time consuming, and expensive:

- **The model locks customers into older technology.** When a legacy enterprise storage array is developed, it can be designed to include the latest in controller, backplane, and storage media technology. Firmware and software upgrades over the life cycle of the product can provide incremental performance improvements, but customers are locked into the limitations of that technology as originally designed for the life of the product. For example, much newer higher-performance and more efficient NVMe technologies cannot be most effectively used in legacy systems designed around SCSI. Although capacity can be added, often all drives can be only of the type available when the system was first purchased. Customers do not necessarily have access to major advancements that provide order of magnitude improvements in performance, storage density, and cost.

- **Forklift upgrades are disruptive.** Moving to the next generation in controller, backplane, and storage media technology requires a completely redesigned array with typically much higher internal bandwidth to take full advantage of performance and density advancements in storage-related technologies. This means that a completely new array must be brought in to replace the existing array, and that often means downtime as well as data migration.

- **Application and data migration is time consuming and risky.** During the upgrade, all the applications and data in the old array must be migrated to the new array. Today, even the smallest enterprises are dealing with at least tens of terabytes of data, and most are dealing with hundreds of terabytes and looking at managing petabytes of data soon (if they are not already doing so). Even if data is migrated over high-performance networks such as Fibre Channel (FC), migrating that much data can easily take days (if not weeks or months) for many enterprises. Customers may also have extensive snapshot trees and replica libraries that will be lost if they cannot be migrated to the new system. Often, newer systems use a new higher-performance or more efficient on-disk format, so customers can incur conversion risk during the migration as well. How long the upgrade will take and what sort of impact it will have on application services are key questions that must be answered as enterprises plan for the migration.

- **Upgrades are extremely costly.** A customer must buy the new hardware and any required software as well as rebuy capacity. Generally, none of the hardware and software from the older array can be transferred to the new array, so all of the capital expenditure (capex) must be repeated even if the customer wants just the same basic features ("x" amount of capacity, snapshot, and replication software, etc.). And then, to help this inherently risky process go more smoothly, many enterprises hire outside professional services firms to plan and execute the technology refresh, a decision that can easily add tens of thousands of dollars in services cost to what is already considerable capital expense.

- **Delaying upgrades may be even more costly.** As legacy systems near their performance thresholds, it becomes relatively more expensive to increase performance further. More "older technology" resources are required to meet increased requirements, relative to denser and higher-performance "newer technology" options. Added "older technology" resources can bring lower performance and capacity density, making it relatively more expensive to scale system capabilities with them (more devices are needed, which consume more energy and floor space). Maintenance costs also often increase on older systems, providing an additional vendor-driven incentive for customers to look at upgrading to newer technology.

IDC refers to this legacy approach as **Model 1.** Some legacy enterprise storage suppliers, looking to minimize the impact of technology refresh, have introduced an overarching software layer that allows storage to be more completely virtualized across multiple arrays. In this federated model, systems of disparate types can be combined into loosely coupled clusters that may all support a single global namespace. These clusters allow newer and older systems to be combined so that their resources can be more flexibly allocated in logical pools that are less restricted by hardware limitations, providing an easier way to incorporate new technology into clusters (rather than individual systems). Storage virtualization can allow data to be migrated online (albeit at relatively slow network speeds), significantly minimizing the disruption associated with the data movement required when replacement systems are deployed. IDC refers to this more scale out-oriented approach as **Model 2.**
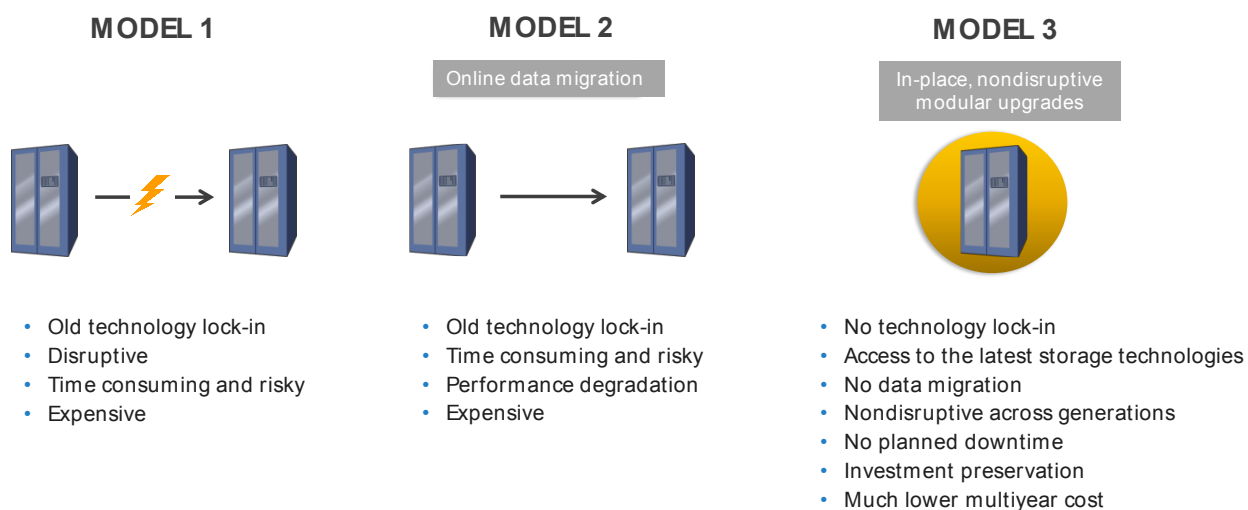
While **Model 2** addresses some of the issues of **Model 1,** it still suffers from significant problems from a customer's point of view. While new arrays can be added to the IT infrastructure, customers are still locked into underlying older technologies with the existing systems. Many customers use the online data migration to move the newer array into production and, once the new array is serving production data, retire the older array. Data migrations still take time and often impose performance degradation on production applications during the migration process, which will generally occur more slowly than it would if the data were migrated between two nonproduction systems. Snapshot trees and replica libraries may or may not be lost, depending on vendor implementation. Any risks incurred by a conversion to newer on-disk formats are still present. And customers still have to repeat their hardware

and software purchases when buying the new system, losing their capital investment on the original array.

A third model, referred to as **Model 3** by IDC, provides a much better template for how enterprise storage vendors interact with their customers not only during technology refresh but also during initial product acquisition, deployment, and ongoing management. The benefits of this model are briefly described in Figure 1 as **Model 3.** This model was originally introduced by Pure Storage as Evergreen Storage in mid-2015, and while it includes a new technology refresh approach, it goes far beyond just that. It has, in fact, changed the way customers think about not only technology refresh but also the entire CX. The attractiveness of this model has prompted Pure Storage's competitors to move in this direction as well, generating at least somewhat of a windfall for enterprise storage customers overall (even if they are not Pure Storage customers).

FIGURE 1

Enterprise Storage Technology Refresh Models

MODEL 1

MODEL 2
> Online data migration

MODEL 3
> In-place, nondisruptive modular upgrades

- Old technology lock-in
- Disruptive
- Time consuming and risky
- Expensive

- Old technology lock-in
- Time consuming and risky
- Performance degradation
- Expensive

- No technology lock-in
- Access to the latest storage technologies
- No data migration
- Nondisruptive across generations
- No planned downtime
- Investment preservation
- Much lower multiyear cost

Source: IDC, 2022

Pure Storage and the Evergreen Storage Subscription

Pure Storage is a $2+ billion enterprise AFA vendor with a broad portfolio of all-flash offerings that cover primary and secondary as well as structured and unstructured workloads. The FlashArray//X and XL lines cover primary storage, the FlashArray//C addresses tier 2 and other secondary workloads, and FlashBlade covers unstructured (file/object) workloads. Over the past 10 years, Pure Storage has introduced many features and programs that have differentiated its offerings from those of the legacy enterprise storage providers and driven real changes in the industry:

- Pure Storage pioneered the use of AFAs to run enterprise workloads, addressing head-on the two major concerns at the time in using flash media with write-intensive applications: cost per gigabyte and endurance. To address the cost issue, Pure Storage built its arrays using multilevel cell flash media (offering increased density and lower cost than the single-level cell media that was widely used at the time) and implementing inline data reduction (to provide a

capacity multiplier that further lowered the cost of flash media relative to hard disk drives [HDDs]). Write endurance concerns were dealt with in software successfully enough that Pure Storage could provide a lifetime (of the array) guarantee on flash media endurance. IT practitioners should take note, however, that while all major AFA vendors provide lifetime flash media guarantees, there are significant differences between vendors in how they measure and report data reduction ratios, which can be misleading and can have a huge impact on the value a vendor solution provides.

- After shipping the FlashArray product to the primary flash market for four years and establishing itself as an industry leader, Pure Storage brought the benefits of "all flash" to unstructured data storage with the introduction of FlashBlade in 2016. As the industry's first purpose-built, scale-out, enterprise-class, all-flash unstructured data storage platform, FlashBlade opened up an additional multibillion-dollar market for Pure Storage around big data analytics, artificial intelligence (AI), machine learning (ML) and, surprisingly, data protection. The product pioneered the use of custom flash modules (which the vendor dubbed DirectFlash Modules [DFMs]) instead of solid state disks (SSDs) as the individual storage devices, a decision that brought performance, density, endurance, rapid new media adoption (such as triple-level cell flash), and cost advantages to customers. The use of DFMs proved so popular that the vendor transitioned its FlashArray systems away from off-the-shelf SSDs toward the use of DFMs as well. With its support for both file- and object-based storage, FlashBlade was tremendously successful, growing revenue even faster than the original FlashArray had.

- In 2018, Pure Storage introduced its first Pure as-a-Service offerings, which brought the "cloud experience" (including both pay-as-you-go and transparent technology refresh) to on-premises infrastructure, and has since expanded it to include all of its systems. Pure as-a-Service includes other key features: a service catalog that simplifies the use of storage that is particularly attractive to constituencies such as developers, data scientists, application managers, and others who are not traditional storage managers; a self-service, autonomous storage-as-code platform that provisions, manages, and scales enterprise storage anywhere called Pure Fusion; and coverage of all deployment models by Pure1 and META, the vendor's AI-assisted data management and self-driving storage platform. It is interesting to note that unlike some other storage vendors' managed services offerings, Pure as-a-Service includes service-level agreements (SLAs) for both performance and availability, ensuring that customers get the outcomes that they expect.

- In 2019, Pure Storage announced the FlashArray//C, a system that used quad-level cell (QLC) flash media to significantly drop the cost per gigabyte of all-flash storage, opening up the opportunity to use it for secondary storage workloads. This was the first all-flash array in the industry specifically built for these less latency-sensitive workloads. Software defined was one of Pure Storage's original design tenets, a fact that allowed the company to easily introduce new storage device types with its original design and rapidly integrate new media types into its offerings. Both the DFMs and the FlashArray//C are good examples of that.

- The customer-focused Pure Storage culture generates extremely high CX ratings that have kept Pure Storage literally at the top of the class in terms of Net Promoter Scores[1] (NPS) for enterprise array vendors. Pure Storage has maintained this high-quality CX even as the company has grown to be a $2+ billion vendor. Pure Storage's NPS score is and has been in

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[1] The Net Promoter Score (NPS) is a standardized measure of customer satisfaction that is broadly used across 220+ industries to provide an independent rating, based on customer response, of the quality of experience a vendor delivers to its customers. For further information about NPS, see *Net Promoter Score Becoming an Important Metric for Enterprise Storage Managers to Understand* (IDC #US43896818, June 2018).

the low- to mid-80s since it was first published in 2016, making it consistently the highest score for an array vendor and the industry's only certified (by an independent third party) NPS score. The company's work in this area has set a new bar for the external enterprise storage industry and is driving change among its competitors that is benefiting all AFA customers (not just Pure Storage ones) across the board.

Pure Storage's introduction of the Evergreen Storage subscription forever changed customer expectations around not only technology refresh but also enterprise storage life-cycle management. It is the most comprehensive program of its type in the industry, applying to all of the vendors' storage solutions, and is a key part of the vendor's ability to deliver enterprise-class storage capabilities with the "cloud experience" consistently across hybrid cloud environments that include both on-premises and hyperscaler-based storage infrastructure at providers such as Amazon, Microsoft, and Google. It provides meaningful differentiation that lowers cost and simplifies storage platform ownership, and its success with customers has driven direct responses from Pure Storage's competitors, an outcome that again benefits all AFA customers across the board.
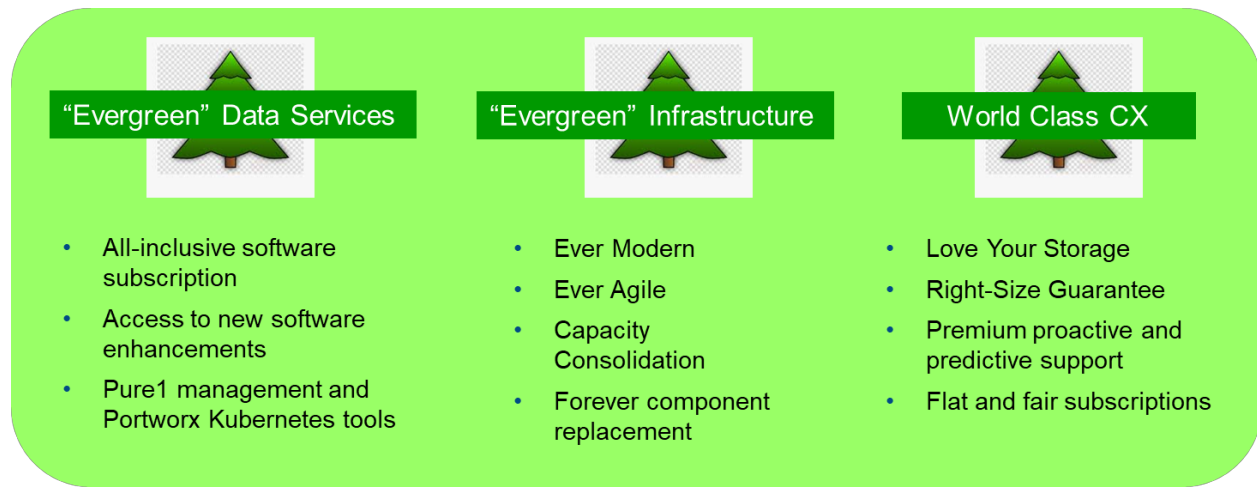
The Enhanced Evergreen Storage Subscription

Evergreen Storage is a comprehensive storage platform life-cycle investment program that impacts customers positively with a subscription that covers data services and hardware modernization as well as services and guarantees focusing on CX (see Figure 2). The subscription ensures that customers can acquire and maintain their storage via a set of included and coordinated components:

- **"Evergreen" data services.** *All-Inclusive Software Subscription* makes all new software functionality (including updates) available at no additional charge, including both storage operating system software and the Pure1 management platform and the Portworx Essentials Kubernetes storage platform.

- **"Evergreen" infrastructure.** *Ever Modern, Ever Agile*, and *Capacity Consolidation* rely on innovations in product architecture to be able to nondisruptively accommodate technology refresh across all key components: controllers, storage devices, software, and backplanes (this latter capability enables an in-place nondisruptive migration from SAS to NVMe as the storage protocol, whereas all other storage vendors required a forklift upgrade to do that).

- **World-class CX.** *Love Your Storage, Right-Size Guarantee,* premium *Proactive and Predictive Support,* and *Flat and Fair Subscriptions* all combine to ensure that customers have storage solutions that predictably deliver on their performance, availability, and cost expectations over the life of the infrastructure.

FIGURE 2

Pure Storage's Evergreen Storage Subscription

"Evergreen" Data Services	"Evergreen" Infrastructure	World Class CX
• All-inclusive software subscription • Access to new software enhancements • Pure1 management and Portworx Kubernetes tools	• Ever Modern • Ever Agile • Capacity Consolidation • Forever component replacement	• Love Your Storage • Right-Size Guarantee • Premium proactive and predictive support • Flat and fair subscriptions

Source: IDC, 2022

Since Pure Storage shipped its first AFAs in 2012, the company has supported multigenerational technology refresh for over 9,000 systems via the Evergreen subscription, each of which avoided what for many other vendors would have been a forklift upgrade. The vendor has over 10,000 systems in its installed base, but the newer systems have not had to be upgraded yet.

Evergreen subscriptions take the place of a standard warranty, maintenance, and support contract while delivering many additional features and value. Because Pure Storage customers have the opportunity to nondisruptively upgrade to newer technologies at any point in the ownership life cycle with trade-in credits that are guaranteed at the time the system is purchased, the vendor characterizes the Evergreen experience as a "subscription to innovation." New hardware is made available to Evergreen customers either as part of *Ever Modern* (where customers get upgraded to the latest controllers every three years), *Ever Agile* (where they can upgrade to new hardware using preestablished trade-in credits whenever they want), or *Capacity Consolidation* (where they can trade in older storage devices for newer, faster, and denser storage devices at costs subsidized by trade-in credits).

If hardware fails for systems covered by Evergreen, Pure Storage will replace it with the latest version, not the old version, at no additional charge. New data services and software features are made available to Evergreen customers at no charge as part of their subscription, further supporting Pure's claim that Evergreen is a "subscription to innovation." Evergreen turns the storage ownership experience into something more akin to "storage as a service" (because of the system's ability to support easy, nondisruptive hardware and software technology refresh).

"Evergreen" Software

From day 1, Pure Storage has included all array software as part of the Evergreen subscription price. Legacy array vendors historically charged separately not only for software features, such as snapshots and replication, but also, in many cases, by capacity under management. For many customers, the

bundling of all array software with the array not only saved them a lot of money over the life of the array but also made it much easier to do business with the vendor. If a customer doesn't need a software feature at first, but then later wants to use it, it can immediately do so – there is no need to contact vendor sales and involve finance in a purchasing decision.

This packaging decision has clearly driven change in the enterprise storage industry (again to the benefit of all customers) as most of Pure Storage's major competitors have moved in this direction. It is now typical for Pure Storage's competitors to offer two "software" packages with their flagship arrays – a basic package that comes with the price of the array and a second "extended functionality" package that includes other features. Some of these competitors also offer additional advanced software functionality (such as stretched cluster support or a telemetry analytics package) à la carte, charging separately for it above and beyond the price even of the "advanced package." Not so with Pure Storage, whose *All-Inclusive Software Subscription* bundling approach in Evergreen subscriptions continues to include *all* array software options as well as new array features as they become available over time at no extra charge.

For example, in 2017, Pure added synchronous replication to its Purity operating system via a new software feature called ActiveCluster. Any Pure customer with an active Evergreen subscription was able to turn on the new feature without the need for an additional purchase or license agreement. In fact, Pure claims that one-third of the arrays that currently use ActiveCluster were purchased before the feature was added. Pure's ransomware remediation feature with immutable snapshots, SafeMode, was also released to customers in the same way, via the company's Evergreen subscription. Other Purity enhancements delivered via subscription have included extensions for third-party technologies such as VMware and improvements in data reduction ratios.

Also included in the subscription are tools such as Pure1 for AIOps management and support, which will be discussed in more detail in the section that follows. Pure now also includes a custom version of Portworx Essentials in all Evergreen subscriptions, allowing customers to start creating persistent storage for their container-based Kubernetes applications.

"Evergreen" Infrastructure

For technology refresh, Evergreen Storage provides a "subscription to innovation" over time that delivers a cloudlike ownership experience for on-premises infrastructure. In the cloud, software and technology upgrades happen in the background without disruption, keeping the infrastructure updated over time as new technology emerges. That's the point of the "evergreen" name: customers can easily incorporate the latest storage technologies into their arrays nondisruptively while preserving existing investment – making them "evergreen," if you will.

Evergreen Storage offers upgrades to the latest generation of controllers every three years (on subscription renewal) with *Ever Modern. Ever Agile* offers the opportunity to upgrade to new controllers at any time to move either to a higher-performing AFA (e.g., upgrade the //X70 controllers to //X90 ones) and/or to next-generation controllers within a similar model (e.g., upgrade the SAS-based //M50 controllers to the NVMe-based //X50 controllers) at any time by purchasing a qualifying capacity pack for the array. Under *Ever Agile,* customers will get a full list price trade-in credit on each controller to defray the cost of the upgrade. It is important to note that these controller upgrades are nondisruptive and multigenerational and do *not* require a forklift upgrade like the competition.

Pure Storage has an established track record of offering cross-generational upgrades, and customers have nondisruptively upgraded from SAS-based FA-400 Series systems (the original systems the

vendor shipped back in 2012) to FlashArray//M systems to NVMe-based FlashArray//X systems. 97% of the arrays that the vendor has ever shipped are still in operation because customers can take advantage of major new technology advances (e.g., SAS to NVMe and SSDs to DFMs) without a forklift upgrade. This feature is unique in the industry, and it is only because Pure Storage has specially architected the hardware of its systems to support in-place upgrades of every component – storage devices, controllers, media shelves, cache cards, fans, power supplies, and host connections. For a detailed discussion of the vendor's architectural designs that support this level of nondisruptive, multigenerational upgradability, see *Architectural Design Decisions Directly Support a Better Customer Experience for Pure Storage FlashArray Users* (IDC #US46800220, September 2020).

In addition, Evergreen Storage includes features that help protect existing investments while allowing customers to modernize their flash media over time. Under *Capacity Consolidation,* data in older media shelves can be consolidated into new, denser-capacity media while getting trade-in credits against the hardware being upgraded. Pure Storage uses an in-place data migration that is handled automatically by the system across the backplane (rather than at network speeds), a feature that makes capacity consolidation particularly fast and easy. Pure Storage is still unique in the industry in allowing customers to nondisruptively move from SAS to NVMe technology so that customers can get the full performance benefit of new technology in controllers and solid state media.

To make things easier for customers, even as the array is upgraded to NVMe, customers can choose to stay with their SCSI host connections (running over FC or Ethernet). Pure Storage offers NVMe over Fabrics host connections for its NVMe-based arrays (which today include the FlashArray//X, XL, and C) using an Ethernet transport (RoCE), but customers can upgrade the host connections to NVMe on a separate schedule than the array itself. To move to RoCE, a FlashArray//X customer will need to install RDMA-capable Ethernet NICs (likely at additional cost) and upgrade to at least Purity 5.2 (a storage operating system upgrade that can be done nondisruptively and at no charge).

Hardware upgrades operate slightly differently for the FlashArray and FlashBlade product lines because of the different architectural approaches. The FlashArray design includes two discrete controllers to which all the storage capacity in a system is attached, while the FlashBlade, true to its scale-out design, places compute power (the "controllers," if you will) on each DFM. The DFM is the custom flash module that Pure Storage uses (instead of SSDs) as the storage devices across its arrays, and for FlashBlade, each blade includes both compute and storage resources. With FlashBlade, as customers add storage capacity, they also add processing power to manage that storage capacity, and they cannot add the two resource types independently. DFMs for FlashBlade are slightly different than those for FlashArray (because they include their own compute power) and are currently available in two capacity sizes: 17.6TB and 52.8TB.

While FlashBlade is covered under the Evergreen Storage subscription, its architecture means that the two features for upgrading controllers (*Ever Modern* and *Ever Agile*) do not apply to it in the same manner. That does not mean, however, that FlashBlade customers do not have investment protection when upgrading their hardware. For technology refresh on FlashBlade, customers can use the *Capacity Consolidation* option. Under FlashBlade *Capacity Consolidation,* the customer would get a trade-in credit for the purchase price of the older DFM (e.g., an 8.8TB DFM) toward the purchase of a newer DFM (e.g., the 52.8TB DFM) and, with that choice, would also receive the latest generation of "controller" technology on the module. For FlashBlade, there are no separate *Ever Modern* or *Ever Agile* options to just upgrade the "controllers" because there aren't any discrete controllers.

World-Class CX

Pure Storage provides a formalized, 30-day money-back guarantee on new system purchases, which the company calls *Love Your Storage.* In the past, this was unheard of from a storage vendor, but now competitors are starting to improve what they offer in this area (something that would not likely have happened had Pure Storage not taken the lead here).

Sizing system capacity requirements prior to acquisition has traditionally been difficult, with the risk typically borne by the customer. Pure Storage's *Right-Size Guarantee* changed all that by guaranteeing effective storage capacity and overall data reduction and total efficiency ratios. During the sales process, Pure Storage collects information from customers about their performance and effective capacity requirements by workload and then leverages data collected from Pure1 to size the system based on real-world data reduction ratios that actual customers are getting on similar workloads. This approach draws on anonymous real-world production workload data collected across the vendor's entire installed base over years of usage and designates a blended, overall data reduction ratio for the entire workload mix, which Pure Storage then guarantees (along with the resulting effective storage capacity).

IT practitioners should note that because the data reduction ratio is closely tied to the workload mix, the guaranteed ratios will vary across different customers (as each has their own unique workload mix). For that reason, Pure Storage does not provide a "blanket" data reduction ratio like some vendors (i.e., 4:1, 3:1, or whatever), but the company will put its combined data reduction technologies (e.g., compression, deduplication, and write minimization) up against any other vendor in the industry in a direct bakeoff. The company's competitive experiences and Pure1 data analytics over the past 10 years have consistently shown higher data reduction ratios than competitors on similar workloads. If a Pure Storage array does not deliver on the guaranteed data reduction ratio and effective capacity, then the vendor will provide additional solid state storage capacity, nondisruptively and at no charge, to make it right for the customer.

The *Right-Size Guarantee* is included at no extra charge and lasts for 12 months, typically more than enough time for new customers to put their workloads on the array and confirm that they are getting the effective capacity guaranteed by Pure Storage. However, workloads evolve, not only individual ones but also as new applications are added to a storage platform. The *Right-Size Guarantee* has the flexibility to accommodate change while maintaining coverage protection. As a customer purchases additional storage capacity to add new workloads, a fresh *Right-Size Guarantee* can be calculated and applied to the expanded array, lasting another 12 months from the date of the expansion purchase.

This coverage can be expanded indefinitely as additional capacity is purchased. With each expansion, Pure Storage will reevaluate the data reduction ratio, based on the latest workload mix and workflows, prior to extending this coverage. Pure Storage's AFA platforms can be nondisruptively upgraded in place across multiple technology generations so the life of these products is much longer than that of legacy arrays, and they will be covered by an accurate data reduction ratio guarantee during that entire period.

Pure Storage's approach to data reduction technologies has evolved the industry to a point where all primary storage arrays have to offer at least some of these capabilities now to compete. Pure Storage's compression and deduplication algorithms have tended to generate higher data reduction ratios than many competitors' implementations without performance trade-offs. This has led other vendors to include additional storage efficiency technologies (not true data reduction) when calculating and reporting a "storage efficiency ratio" for competitive purposes. While Pure Storage was reporting a

data reduction ratio based purely on compression and deduplication, other vendors were reporting their "storage efficiency ratios" based on not only compression and deduplication but also thin provisioning (which often assumes an additional 2:1 storage efficiency multiplier) and some assumed usage of space-efficient snapshots. Pure Storage supports these features but was not taking them into account as part of its "data reduction ratio."

As long as just workloads are considered, evaluating a data reduction ratio based on compression and deduplication will be quite accurate, but if thin provisioning and space-efficient snapshots are also included without taking into account relevant workflows, it can result in a highly inaccurate prediction. These two features (thin provisioning and space-efficient snapshots) can contribute to real space savings though, so it's not inappropriate to present a storage efficiency ratio that includes them. It is critical, however, that a customer understands exactly what assumptions are being made about space savings (and implied workflows) if thin provisioning and snapshots will be used to calculate an overall storage efficiency ratio.

This has caused some confusion in the industry when comparing Pure Storage's more stringent data reduction ratios with other vendors' broader "storage efficiency" ratios as both are reported in an "x:1" format. Such confusion extends to calculating the true effective capacity that a platform could deliver in production usage as well as its effective cost per terabyte. As a result, Pure Storage offers customers two views: a "data reduction ratio" that just includes compression and deduplication and a "total efficiency ratio" that also includes thin provisioning (but not space-efficient snapshots). The vendor still views adding space-efficient snapshots into a general-purpose estimate as too dependent on specific customer workflows and use cases, but it can certainly provide input on the impact of space-efficient snapshots on a case-by-case basis prior to purchase (backed by empirical data collected from its installed base by Pure1). The vendor's *Right-Size Guarantee* ensures that whatever the method of calculating and comparing these types of ratios, Pure Storage will deliver on any sizing and effective capacity promises made during the sales process.

Pure Storage provides *Flat and Fair Subscription* pricing, a program that delivers predictable costs over the life of the system. Under this guarantee, subscription rates on a per-device basis will not increase over the life of the system, which under Evergreen Storage may well be in the range of 8-10 years, and may go down in some cases. Under *Forever Component Replacement,* any failed components are replaced with the latest version of that component at no additional charge over the life of the array (controllers, storage devices, media shelves, power supplies, fans, etc.). This means that *Forever Component Replacement* also effectively includes a lifetime flash endurance guarantee. Pure honors this policy even if the original component being replaced is no longer available, thus minimizing the dread of managing obsolete storage that is past its "end of life."

Proactive and Predictive Support is also part of the Evergreen Storage subscription. A variety of different features that drive value for customers are included. Proactive support is enabled by Pure1 and its META AI/ML analytics engine and is often cited by Pure Storage customers as valuable in saving them time and effort by alerting them to potential array problems before they can impact operations. In fact, more than 70% of the support tickets are generated proactively by Pure1, which means technical support has already resolved (or is already working to resolve) the problem before the customer often even knows about it.

Pure1 is a cloud-based service that collects and acts as a secure repository for all data that is collected (and has been collected) from Pure Storage's installed base, which includes over 10,000 arrays. Pure1 leverages AI/ML-driven analytics to help drive higher performance and availability,

prevalidate upgrades (to minimize risk), provide easy web-based access from anywhere into any device in a customer's fleet of Pure Storage arrays, and help best practices be more rapidly disseminated across the installed base. All data is anonymized for security reasons but nonetheless provides the data foundation that fuels Pure Storage's self-driving data management paradigm.

Pure1 also helps drive faster resolution of issues. A Sev 1 response SLA of 15 minutes on a 24 x 7 basis, combined with first-call L2 support access in the event of an issue, drives faster response and recovery. Managed upgrades, based on hardware/software configurations validated by Pure1 across the installed base and actually performed by Pure Storage, can be approved for use with customer acceptance. Onsite break/fix SLAs are clear about the fact that a trained technical resource empowered to solve the problem will be onsite within four hours, as an example, not just that a replacement part may be shipped within four hours.

Pure1 is included with the Evergreen subscription for all of Pure's storage arrays (FlashArray//X, FlashArray//XL, and FlashArray//C as well as FlashBlade) and is a significant booster of the positive CX Pure Storage customers enjoy. Pure1 monitors all aspects of system performance, collecting metrics to ensure that performance, availability, and data reduction SLAs are met. The platform helps enforce policies established by administrators, automatically resolves many issues as they arise, aids in performance and capacity planning, can be used to perform upgrade prevalidation and "what if" analyses and, with its predictive fault management, ensures that problems are handled very quickly. Data collected by Pure1 is what allows support calls to go directly to an L2 resource, with all the information to begin immediately addressing the issue. In 2017, the vendor introduced META, its AI/ML-infused adjunct to Pure1, to enable self-driving storage for increased productivity, again including this enhancement with all active Evergreen subscriptions. The objective here is to make it as easy as possible to manage storage to established performance, availability, governance, and compliance requirements.

Analysis and Implications

Evergreen Storage is more than just an updated "technical support" program. In putting the offering together, Pure Storage looked at the entire CX – from reviewing workload requirements and building short lists to buying, deploying, managing, supporting, upgrading and, ultimately, technology refreshing an enterprise storage array – and sought to improve all aspects of this journey.

With Evergreen Storage, Pure Storage has crafted a comprehensive set of functionality and programs that in one subscription deliver a strongly differentiated CX across the entire storage life cycle. Up-front guarantees ensure that customers know exactly what they will be getting and that there are no surprises, that the systems will perform as advertised, and that the system can be easily moved to next-generation technologies as necessary, all the while preserving the hardware and software investments that a customer has already made. All upgrades can be done nondisruptively with minimal risk (this is where upgrade prevalidation with Pure1 proves its value), and Evergreen Storage purposefully provides the financial incentives for customers to move to newer technologies very quickly (by offering generous trade-in credits, not by increasing maintenance or subscription costs on older systems). The high percentage of Pure Storage's installed bases across all platforms (FlashArray and FlashBlade) that are running the latest hardware, firmware, and software releases is a strong driver of the company's high NPS score – it also drives higher performance, better availability, increased functionality, and improved efficiency of operation.

What separates Evergreen Storage from other vendor programs is the engineering behind it. Pure Storage designs its arrays to enable the fully modular, nondisruptive upgrades – including components

that other vendors cannot upgrade, such as the backplane – that make technology refresh simple, easy, and low risk, even across generations. As noted previously, Pure Storage is the only vendor that can support an in-place, nondisruptive field upgrade from older SAS-based systems to NVMe, a critical feature for existing customers that have not yet moved to NVMe. While other vendors can add controllers of the same generation to expand system performance, the Pure Storage FlashArray supports nondisruptive upgrades to next-generation controllers, increasing infrastructure density for more efficient operation. The design offers independent performance and capacity upgrades, allows solid state device geometries to be mixed in the same system for maximum configuration flexibility, and supports simple, rapid in-place data migration during capacity consolidation operations. These are all features that are difficult for other vendors to build into their systems over time without major architectural changes.

The nondisruptive nature of the upgrade options in Evergreen Storage requires some additional explanation. Although the FlashArray products have always been built around a dual controller architecture, they do not use the typical active/passive controller design. During normal operation, both controllers are in use, accepting I/O from the host side, while all I/O to solid state devices (or DFMs) internal to the array are handled by just a single controller. The controllers are designed such that a single controller can deliver the maximum performance at which the array is rated, which means that during normal operation, each controller would be no more than 50% loaded on the host side. In the event of a controller failure, all I/O on both the host side and the array side is handled by the single remaining controller, with no impact on performance (note that host multipathing is included at no extra charge as part of the *All-Inclusive Software Subscription* feature). This not only handles controller failures transparently but also supports nondisruptive controller upgrades.

The persistent storage devices exhibit significant resilience as well. Protected by a dual-parity RAID implementation, any failed devices can be hot plug replaced, and the system can tolerate two failed devices simultaneously without loss of application services or data integrity. Rebuilds occur as a transparent background process once a failed device is replaced. When capacity from older devices is consolidated onto newer, denser devices, a new shelf with the new media is added to an existing system; data is migrated as a background process, with no impact on application performance; and then the older shelf or shelves can be removed without shutting the system down. Note, however, that because device geometries can be mixed, data does not have to be migrated off older drives as newer ones are added. This nondisruptive, in-place data migration is a feature that today is still unique to Pure Storage. This flash resiliency is also key in Evergreen's nondisruptive controller upgrades as the existing flash in an array will work with the new (even next-generation) controllers. This means that there is no need for customers to rebuy existing flash storage when upgrading controllers.

With technology refresh **Models 1** and **2,** on-disk format changes that require data conversions can introduce risk, often require downtime, and consume time and effort on the part of the customer. Pure Storage's AFAs use an adaptive metadata structure that is scalable, versioned, and hierarchical. When any major metadata updates occur, the old metadata structures can be left intact and referenced by the new metadata. The natural background optimization processes of the array migrate the older metadata to the new format over time, without the need for any explicit data migration tasks and without any application downtime or performance impact. The use of variable-sized data segments allows structures to be updated to add features transparently, without any data migration or application downtime. This is not a theoretical argument – Pure Storage has enhanced its metadata structures and data layout segments in every major release since its initial GA product in 2012 without requiring downtime or data migration. Fixed metadata structures and segment sizes in competitive AFAs

introduce limitations that generally preclude the ability to make these types of major changes without data migration, introducing risk, effort, and downtime.

The unique ability of Pure Storage to perform an entire array upgrade in place without downtime drives key advantages for **Model 3:**

- First, data never *has* to be migrated during the process, giving customers the flexibility to migrate data as part of a capacity consolidation project on their own schedule, reducing risk and saving time.
- Second, customers preserve any capital investments they have made even as they migrate to newer technologies. They never need to buy another frame, rebuy storage capacity, or relicense any snapshot, replication, or other software that they have already licensed on a Pure Storage AFA, and they continue to pay the same subscription base rate (including maintenance and support) at a device level that they were paying on the original system.
- Third, there is no downtime or performance degradation associated with the technology refresh process, making it easy to keep systems updated with the latest enhancements. This extended array life has other financial benefits as well, since organizations can extend depreciation schedules to reduce annual costs and avoid the large capital outlay to replace an array every four to five years.

The point to all of this is that customers, not the vendor, get to decide *on their schedule* when the time is right to perform an upgrade.

The cost implications of Evergreen Storage are much more advantageous than legacy approaches. Relative to the other two models where array maintenance may be increased by the vendor to encourage customers to upgrade and arrays may be replaced as often as every three years, hardware and software must be repurchased, and data must be migrated via disruptive and/or time-consuming processes, Pure Storage's model dispenses with all of that. The actual cost savings will vary significantly based on the size of the system and the actual life cycle a customer chooses to implement, but even assuming only one technology refresh over a six-year life cycle, capital costs will be one-half to one-third as much, while subscription costs will be roughly half as much as legacy maintenance. The costs with Evergreen Storage are front-loaded — the big savings occur due to lower costs at each potential technology refresh point. Yet even up-front costs are comparable with the initial purchase costs of other AFAs.

There is one other benefit that needs to be taken into account. *Ever Agile* gives customers the option to perform technology refreshes more often than the three-year renewal schedule inherent in *Ever Modern* while preserving their existing investments and without impacting application services. For FlashBlade customers, the *Capacity Consolidation* option provides a similar opportunity. Over the past ten years, Pure Storage has released new, faster controllers about every 12-18 months based on the latest Intel chipsets. It is Pure Storage's product strategy to continue to innovate at this rate going forward, in effect allowing customers to ride the Intel processor technology curve very closely. Evergreen subscription customers can still choose to wait for their *Ever Modern* controller upgrades, but they also have the option with *Ever Agile* to take advantage of the latest controller technology — even next-generation controllers — more often with trade-in credits (whose value is guaranteed up front), which preserves their existing controller investment. This is not the occasional trade-in credit program that some vendors put in place when quarterly revenue is down — this is a formal program that is always available with known trade-in credits to Pure Storage customers when they need it, and it gives customers the flexibility to determine their own upgrade schedule.

CHALLENGES/OPPORTUNITIES

As previously mentioned, Evergreen Storage changed customer expectations around enterprise storage solution acquisition, deployment ease, ongoing management, and technology refresh. Competitive vendors were forced to respond, typically choosing those aspects of the subscription that were relatively easy to copy on paper (and did not require modifying their system architectures). Today, many AFA vendors offer guaranteed storage efficiency ratios (although how these ratios are measured varies between vendors), lifetime solid state media endurance guarantees, guaranteed fixed maintenance costs on a per-device level, and nondisruptive data migration between systems (although at much slower network speeds and not in place) and have started to bundle more add-on software with array purchases. Many of the established enterprise storage vendors have introduced cloud-based, AI-driven systems management platforms, although there is still significant difference between the amount of value vendors drive for their customers with these platforms. Fewer vendors have upped their "money-back guarantees" and provide guaranteed trade-in credits in a manner that provides predictable costs across an array's entire useful life. These developments have lessened the difference between Evergreen Storage and competitive offerings in these areas, but they are clearly a win for customers across the board.

There are still major advantages, however, to the Evergreen Storage subscription. No other major enterprise storage vendor provides the *All-Inclusive Software Subscription* that Pure Storage does for its storage operating system software, especially where future product features are concerned. *Ever Agile* is unique in providing anytime, full-value controller trade-ins across model types and/or technology generations, putting customers in the driver's seat when it comes to upgrade timing. It would also require changes to competitors' hardware architectures to turn what today is a disruptive forklift upgrade into a simple, nondisruptive upgrade. Improving a system's storage density is simpler with Pure Storage's *Capacity Consolidation* option, buttressed as it is by an in-place data migration process that occurs at backplane rather than network speeds. And the *Right-Size Guarantee* goes beyond just a "data reduction" or "storage efficiency" guarantee with its ability to keep customers focused on the storage outcome they need over time even as workloads and workload mixes evolve. The predictability that these subscription features provide to customers, in terms of expectations as well as costs, is a key benefit that should not be overlooked.

While Pure Storage's customers "get" the difference with Evergreen Storage and understand the value it provides, it is harder to communicate how different this approach is for new customers. Marketing descriptions of various vendor programs can sound very similar, but the proof is in the pudding for existing Pure Storage customers. The challenge for Pure Storage is communicating the meaningful difference in CX an Evergreen Storage subscription drives up front for customers that have only ever experienced the more traditional enterprise storage life-cycle experience.

CONCLUSION

Since the introduction of Evergreen Storage in 2015, Pure Storage has addressed key issues enterprise storage customers have been complaining about in the legacy enterprise storage life-cycle experience for decades: an inability for purchased solutions to live up to sales promises, more predictable performance and costs over the life of a growing system (in effective capacity terms), and the expense and difficulty with which technology refresh is performed. Although competitors continue to dismiss Evergreen Storage as just a "program," all the key AFA vendors have tried to emulate at least parts of it. This has closed the gap between Pure Storage and other vendors in some areas. But

there are still clear areas of meaningful advantage that an Evergreen Storage subscription offers to customers, especially ones that are based on the architectural designs of systems (e.g., anything related to multi-generational technology upgrades) and are thus not easy to copy.

Other advantages are based on how Pure Storage leverages Pure1 for AI-driven data management and self-driving storage to deliver value not only for customers but also for itself as a vendor. This is based on not only the functionality of that platform (Pure1 plus META) but also the vendor's ability to cover all deployment models (traditional on premises, private cloud, and public cloud) and leverage the platform to drive differentiating value for its hybrid, multicloud customers that want a modern data experience. This is something that will take time for vendors to emulate, and it is very different than just being able to confirm that they too offer a cloud-based application that collects telemetric data and uses AI and/or ML to somehow analyze that data.

Despite competitive moves that have improved enterprise storage CX for all, Evergreen Storage still offers compelling advantages not available from other vendors. Evergreen Storage is a key driver of Pure Storage's industry-leading NPS and high CX as well as the vendor's extremely high repurchase rate from within its installed base. The vendor's own customers often tell it that it undersells the value that the Evergreen Storage subscription drives for them, a very credible indication of the importance of this program for Pure Storage customers. IDC expects that as more competitors come to understand just how far reaching the implications of Evergreen Storage are for customers, they will begin to alter the design of their future systems to drive a better CX for both technology refresh and other aspects of the enterprise storage life cycle. Until that time, Pure Storage will continue to enjoy a strong differentiator that creates and maintains very happy customers.

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