White Paper

Pure Storage's Evergreen Storage Continues to Be the All-Flash Array Market's Customer Experience Program to Beat

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IDC OPINION

The legacy model for how enterprise storage vendors interact with their customers during product acquisition, 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 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 a new tack of trying to copy it. Some aspects of the program were easy to copy, but others were not. Program features, such as the Right-Size Guarantee, White-Glove Support, Capacity Consolidation, and Upgrade Flex, 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.

Pure Storage has continued to evolve the program since its introduction in 2015, and recent additions to Evergreen Storage have raised the bar even further. While the program applies to all Pure Storage all-flash arrays (AFAs) – FlashArray as well as FlashBlade – architectural differences between the two platform types did result in slight differences in program applicability. Investment protection during technology refresh has been a critical differentiator for the FlashArray platform, but the FlashBlade scale-out architecture does not have discrete controllers that can be upgraded independently. This is because the storage processors (or "controllers") are embedded in the platform's storage devices themselves (the DirectFlash-based "blades"). A recent program modification now provides better investment protection for FlashBlade customers, allowing the customers an option to upgrade both storage processing power and media density through a FlashBlade-specific version of the program's Capacity Consolidation feature.

As the AFA market has matured and five-year compound annual revenue growth rates have subsided to under 10%, Pure Storage continues to grow revenue much faster than the overall market growth rate (while some of its competitors are struggling). This is driven by the vendor's high percentage of quarterly revenues that come from new customer logos (i.e., competitive takeaways or wins), which is higher than that of its established enterprise storage competitors. An industry-leading CX, fostered in large part by Pure Storage's Evergreen Storage program, drives these types of wins even as it also encourages a very high repurchase rate from existing customers.

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 program. 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 new features and broader platform coverage that have increased 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 program, which was again expanded in late 2019, 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 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 requirements 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, newer much higher-performance and more efficient NVMe technologies cannot be 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, or 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 into individual systems). Storage virtualization can allow data to be migrated online, 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 non-production 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 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 the Evergreen Storage program 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 the direction of this model 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 Upgrade Models
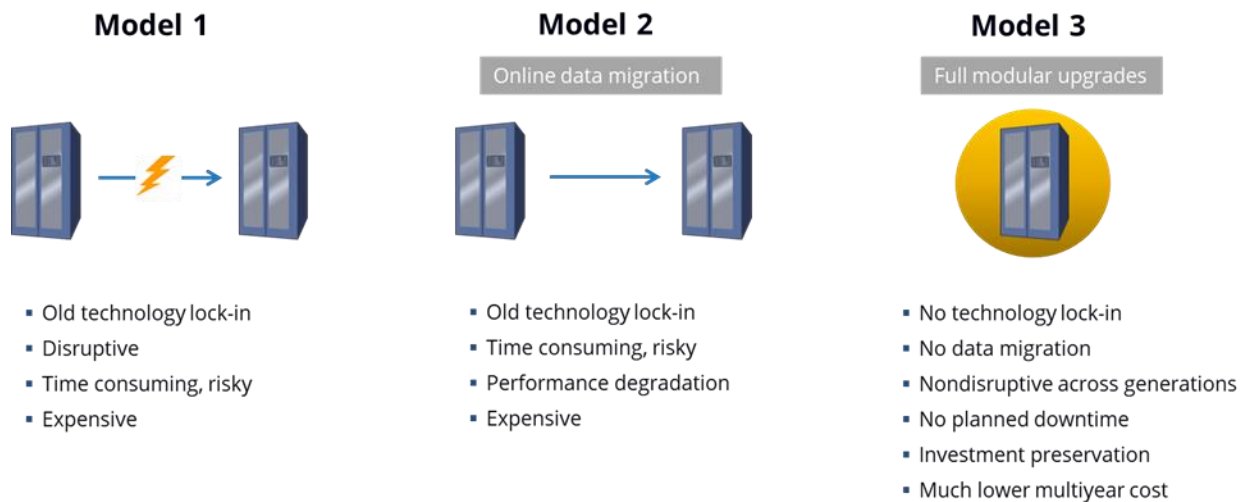
Source: IDC, 2020

Pure Storage and the Evergreen Storage Program

Pure Storage is a $1.6 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 line covers primary storage, the FlashArray//C addresses tier 2 and other secondary workloads, and FlashBlade covers unstructured (file/object) workloads. Over the past eight 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 and endurance. To address cost, Pure Storage built its arrays using consumer-grade flash (whose high-volume production and usage in the consumer space promised rapid and consistent price decreases) and implementing inline data reduction (to provide a capacity multiplier that further

lowered the price-per-gigabyte cost of flash media relative to hard disk drives [HDDs]). Write endurance concerns were dealt with in software and were successful enough that Pure Storage could provide a lifetime (of the array) guarantee on solid-state disks (SSDs). 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 that 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 introduced the industry's first purpose-built, scale-out, enterprise-class, all-flash unstructured storage platform with FlashBlade in 2016. With its support for unstructured workloads, 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 by the vendor (that has since moved away from off-the-shelf SSDs across its entire product line) and has been tremendously successful, growing revenue even faster than the original FlashArray. In building and using its own DirectFlash-based "blades" (what Pure Storage calls its custom flash modules), the company argues that it can provide better performance and media endurance and higher storage device density, along with faster time to market for new solid-state media types and lower cost than off-the-shelf SSDs.

- 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 Score[1] (NPS) for enterprise array vendors. Pure Storage has maintained this high-quality CX even as the company has grown to be a $1.6 billion vendor. Currently, Pure Storage's NPS score is 86.6 (on a scale that goes from -100 to +100), which in addition to being the enterprise storage industry's highest published score is also the industry's only certified 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 AFA customers across the board.

- Pure Storage's introduction of the Evergreen Storage program 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 and provides meaningful differentiation that lowers cost and simplifies storage platform ownership. Its success with customers has driven direct responses from Pure Storage's more established competitors, which is again benefiting AFA customers across the board.

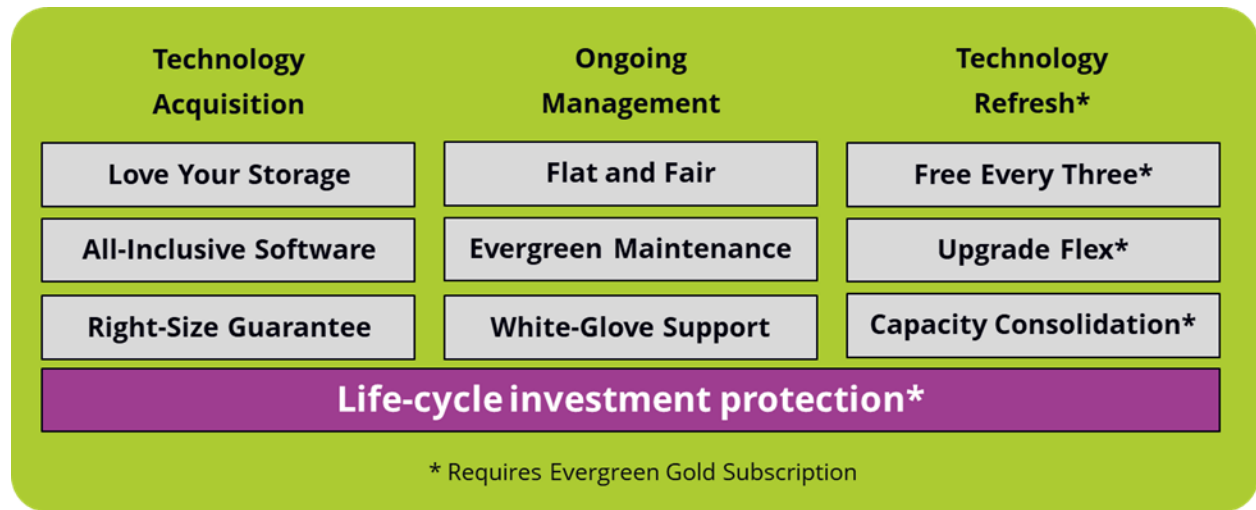## The Enhanced Evergreen Storage Program

Evergreen Storage is a comprehensive storage platform life-cycle investment program that impacts customers positively during technology acquisition, ongoing management, and technology refresh (see Figure 2). Pure Storage has two subscription offerings for this program, dubbed Evergreen Gold and Evergreen Silver. Both subscriptions help customers acquire and maintain their storage via a set of included and coordinated program components: *All-Inclusive Software* with updates and future new array software, *Evergreen Maintenance* (including the lifetime flash media guarantee), *White-Glove Support,* and the *Right-Size* and *Love Your Storage Guarantees*. Evergreen Gold is the subscription most customers purchase and, in addition, includes the program hardware subscription components such as *Free Every Three, Upgrade Flex,* and *Capacity Consolidation.* Evergreen Silver is a value-

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[1] The Net Promoter Score is a standardized measure of customer experience 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).

priced subscription model that does not include these last three features but includes all the other standard Evergreen Storage program benefits. Evergreen Gold and Silver subscriptions take the place of a standard warranty, maintenance, and support contract while delivering additional features and value. Evergreen Gold in particular helps turn the storage ownership experience into something more akin to "storage as a service" (because of the systems' ability to support easy, nondisruptive technology refresh and inclusive software updates), albeit with the product still purchased with capex dollars.

FIGURE 2

Pure Storage's Evergreen Storage Program

Technology Acquisition	Ongoing Management	Technology Refresh*
Love Your Storage	Flat and Fair	Free Every Three*
All-Inclusive Software	Evergreen Maintenance	Upgrade Flex*
Right-Size Guarantee	White-Glove Support	Capacity Consolidation*

Life-cycle investment protection*

* Requires Evergreen Gold Subscription

Source: IDC, 2020

Technology Acquisition

For technology acquisition, 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).

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. 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 array vendor. This packaging decision has clearly driven change in the enterprise storage industry (again to the benefit of all customers) as most of their 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 other advanced software functionality (such as stretch cluster support) à la carte, charging separately for it. Not so with Pure Storage, whose **All-Inclusive Software** bundling

approach in Evergreen subscriptions continues to include *all* array software options as well as new array features as they become available at no extra charge.

Sizing system capacity requirements prior to acquisition has traditionally been difficult, with the risk borne by the customer. Pure Storage's **Right-Size Guarantee** changed that for customers 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,** the vendor's AI/ML-driven cloud-based predictive analytics platform, to size the system based on real-world data reduction ratios that 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 the vendor's AFA platform types. If a Pure Storage array does not deliver on the guaranteed data reduction ratio and effective capacity, then the company 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 now 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 individually but also as new applications are hosted on 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 for another 12 months from the date of expansion purchase. This coverage can be extended 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 upgraded in-place, nondisruptively across multiple technology generations; so the life of these products is much longer than that of legacy arrays. It's important to note that no other vendor offers any type of data reduction or effective capacity guarantee that can be extended to cover the entire life of the array in a single technology generation, let alone across multiple generations.

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 on just 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 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, space-efficient snapshots) do 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 gigabyte. As a result, Pure Storage offers customers two views: a "data reduction ratio" that just includes compression and deduplication and a "total efficiency ratio," which 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.

Ongoing Management

For ongoing management, Pure Storage provides **Flat and Fair** maintenance, a program that delivers predictable costs over the life of the system. Under this guarantee, maintenance 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 to 10 years — and may go down in some cases. Under **Evergreen Maintenance,** any failed components are replaced at no additional charge by Pure Storage over the life of the array (controllers, storage devices, etc.). This means that Evergreen Maintenance also effectively includes a lifetime flash endurance guarantee.

White-Glove Support is also part of the Evergreen Storage program. A variety of different features that drive value for customers are included under this program. Proactive support is often cited by Pure Storage customers as valuable in saving them time and effort by alerting them to potential array problems before impacting operations. In fact, the majority of Pure Storage support tickets are actually generated by the vendor itself. Proactive support is enabled by Pure1 and its Meta AI/ML engine, both of which harness system data collected from thousands of customer arrays. In addition, Pure1 provides cloud-based predictive analytics, helping drive higher performance and availability, validate upgrades (that minimize risk), provide easy web-based access from anywhere and any device into a customer's fleet of Pure Storage AFAs, and help best practices to be more rapidly disseminated across the installed base. A Sev 1 response service-level agreement (SLA) of 15 minutes, 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 used as the customer desires. 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, the vendor's cloud-based predictive analytics platform, is bundled with the base price of the arrays 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 service-level agreements 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 pre-validation 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. In 2017, the vendor introduced Meta, its AI/ML-infused adjunct to Pure1 to enable self-driving storage for increased productivity, again bundling this enhancement with all systems. The objective here is to make it as easy as possible to manage storage to established performance, availability, governance, and compliance requirements.

Technology Refresh

For technology refresh, Pure Storage's Evergreen Gold subscription offers several features to minimize the cost and effort behind providing customers a modern, more cloud-like ownership experience for on-premise infrastructure. In the cloud, software and technology upgrades happen in the background without disruption, allowing customers to gain the advantages of multiple technology generations over time. That's the point of the "evergreen" name: customers can easily incorporate the latest storage technologies into their arrays nondisruptively while preserving existing investment — "evergreen," if you will.

The Evergreen Gold program offers upgrades to next-generation controllers every three years (on subscription renewal) with **Free Every Three**. **Upgrade Flex** offers the opportunity to upgrade to new controllers at any time, to move either to a higher-performing AFA (e.g., upgrade the //X50 controllers to //X70 controllers) 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 Upgrade Flex, 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. Pure Storage has an established track record of offering cross-generational upgrades, and customers have nondisruptively upgraded from SAS-based FA-400 Series systems to FlashArray//M systems to NVMe-based FlashArray//X systems. 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, and host connections — with a dual SAS/NVMe backplane design.

In addition, Evergreen Storage can include features that help protect customers' investments while allowing customers to modernize their flash media over time. Under **Capacity Consolidation**, data in older flash 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 at the backplane rather than 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 controller 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 (NVMe-oF) host connections for its NVMe-based arrays (which today include the FlashArray//X and the FlashArray//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 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 DirectFlash-based blade. DirectFlash 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. Blades are currently available in two capacity sizes: 17.6TB and 52.8TB. While FlashBlade is covered under the Evergreen Storage program, its architecture means that the two features under Evergreen Gold for upgrading controllers (Free Every Three and Upgrade Flex) do not apply to it. Therefore, Pure Storage only offers Evergreen Silver for FlashBlade. However, that does not mean that FlashBlade customers do not have investment protection when upgrading their hardware. For technology refresh on FlashBlade, customers have the Capacity Consolidation option available under their Silver subscription. Under FlashBlade Capacity Consolidation, the customer would get a trade-in credit for the purchase price of the older blade (e.g., an 8.8TB blade) toward the purchase of a newer blade (e.g., the 52.8TB blade), and with that choice would also receive the latest generation of "controller" technology on the blade. For FlashBlade, there are no separate Upgrade Flex or Free Every Three options to just upgrade the "controllers" because there aren't any discrete controllers.

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 a short list to buying, deploying, managing, supporting, upgrading and, ultimately, retiring 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 deliver a strongly differentiated CX across the entire storage life cycle. Upfront 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 nondisruptively 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 validation using 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 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 SCSI to NVMe, an important feature for customers that will be moving to NVMe in the future. 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. More efficient multi-stage storage compression and deduplication technologies drive the higher data reduction ratios that Pure Storage achieves relative to others; these technologies were what initially compelled competitors to include additional features besides just compression and deduplication in their "storage efficiency ratio" calculations. These are all features that are difficult for other vendors to build into their systems, even over time.

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 (SSDs or DirectFlash blades) internal to the array are handled through only a single controller. The controllers are designed so 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 multipathing is included at no extra charge as part of the All-Inclusive Software feature). This not only handles controller failures transparently but also supports nondisruptive controller upgrades.

Solid-state 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 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 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 re-license any snapshot, replication, or other software that they have already licensed on a Pure Storage AFA, and they continue to pay the same 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 must 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 maintenance costs will be roughly half as much. The costs with Evergreen Storage are front-loaded – the big savings in lower costs occur at each potential technology refresh point – but even then, those up-front costs are comparable with the initial purchase costs of other AFAs, and they just don't occur as often.

There is one other benefit that needs to be taken into account. Upgrade Flex gives customers the option to perform technology refreshes more often than the three-year renewal schedule inherent in Free Every Three while preserving their existing investments and without impacting application services. For FlashBlade customers, the Capacity Consolidation option provides a similar opportunity. Over the past eight years, Pure Storage has released new, faster controllers about once a year 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 Gold subscription customers can still choose to wait for their Free Every Three controller upgrades, but they also have the option with Upgrade Flex 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 preserve their existing controller investment. This is not the occasional trade-in credit program with unspecified trade-in value that some vendors put in place when quarterly revenue is down – this is a formal program that is always available to Pure Storage customers when they need it, and it gives customers the flexibility to determine their own upgrade schedules.

CHALLENGES/OPPORTUNITIES

As previously mentioned, Evergreen Storage changed customer expectations around enterprise storage solution acquisition, ongoing management, and technology refresh. Competitive vendors were forced to respond, typically choosing those aspects of the program that were relatively easy to copy on paper. Today, many AFA vendors offer guaranteed storage efficiency ratios (although how those ratios are measured varies between vendors), lifetime solid-state media endurance guarantees, guaranteed fixed maintenance costs on a device level, and nondisruptive data migration between systems (although not in-place or across generations) and have started to bundle more add-on software with

array purchases. Many of the established enterprise storage vendors have introduced cloud-based predictive analytics platforms, although there is still a 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 as a long-term corporate program rather than a short-term sales program. The predictability that these programs provide to customers, in terms of expectations as well as costs, is a key benefit that should not be overlooked. 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.

However, there are still major advantages to the Evergreen Storage program. Upgrade Flex is unique in providing anytime, full-value controller trade-ins. This means that customers can upgrade, with full investment protection, to higher performance, capacity, or advanced features based on their own IT needs, and not based on a vendor's own upgrade schedule. Features such as more comprehensive storage efficiency technologies that drive higher data reduction ratios and better space utilization, along with modular, data-in-place upgrades that are truly nondisruptive, require architectural support that competitors would need to build into their products, and Pure Storage still clearly leads in these areas. The Right-Size Guarantee is fundamentally different from just a "storage efficiency" guarantee and can ensure customers stay focused on the storage outcome they need – effective capacity – even as they expand their array over time and add in new workloads. The Right-Size Guarantee is one of many ways that Pure Storage leverages Pure1 (its cloud-based predictive analytics platform) to drive more value for customers than competitive cloud-based monitoring capabilities. Pure Storage is also very adept at using the data collected by Pure1 to lower its own costs to support systems in the field, and few other external array vendors are relying on their cloud-based predictive analytics platform to drive a conscious effort to maximize the percentage of the installed base that is on the latest hardware, firmware, and software versions. Pure Storage's ability to provide first-call L2 support access is largely based on the quality of the data the company collects from both an individual array and its entire installed base. This helps Pure Storage better identify, diagnose, and resolve issues.

Evergreen Storage provides differentiating value to enterprise storage customers, but it is incumbent upon Pure Storage to ensure that the market understands that value. It is not necessarily evident, and efforts of competitors to dismiss (and in some cases copy) what Pure Storage offers can confuse prospective buyers. Pure Storage needs to ensure that it continues to innovate with Evergreen Storage in ways that drive value for customers and effectively markets the program's differentiating features, clearly explaining how they provide value to customers in ways that competitive offerings do not. If prospective customers do not understand that, it will be because of Pure Storage's inability to communicate that value.

CONCLUSION

Since the introduction of the Evergreen Storage program in 2015, Pure Storage has addressed key issues enterprise storage customers have been complaining about in legacy solutions for years: 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 the Evergreen Storage program 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 advantage that Evergreen Storage offers to customers, especially ones that are based on the architectural designs of systems (e.g., anything related to upgrades) and are thus not easy to copy.

Other advantages are based on how Pure Storage leverages Pure1, its cloud-based predictive analytics platform, 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 knowledge of how to leverage it to drive differentiating value for its customers. This is something that will take time for competitors to emulate, and it is very different than just being able to confirm that they too offer a cloud-based predictive analytics platform.

Despite competitive moves that have improved the CX with external storage for all, Evergreen Storage still offers additional 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 company's extremely high repurchase rate from within its installed base. This high repurchase rate reduces the cost of sales, increasing company margins without increasing the cost to customers or impacting Pure Storage's extremely high customer satisfaction. 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 systems to support a better technology refresh model and better utilize their cloud-based predictive analytics platforms and the data they collect. Until that time, Pure Storage will continue to enjoy a strong differentiator that creates and maintains very happy customers.

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