EXECUTIVE SUMMARY

The All-flash Data Center Is Imminent

Flash Anchors the Efficient Storage Infrastructure of the Future

Introduction

Pure Storage® believes that by 2028, practically no new all-hard disk drive (HDD) storage systems will be sold for enterprise data center computing. This may be a surprise for those who compare the cost per gigabyte of raw HDD capacity in the $0.01-$0.015 range with the cost of raw flash capacity that is currently ten to fifteen times higher. How can Pure Storage be touting the all-flash data center and forecasting the end of HDDs?

Simply put, it's because of the combination of quad level cell (QLC) NAND flash media and the maturation of our DirectFlash® technology. Our DirectFlash Modules (DFMs) have four to six times larger capacities than the HDDs that would actually be deployed in a production system by enterprises, are up to 10 times more efficient in terms of energy and power consumption, are 10 times more reliable, and have twice the useful life now.

Pure Storage is shipping a 75TB DFM today. By the time the industry is widely shipping 25-30TB HDDs and 30-60TB SSDs in 2026, we expect to ship 300TB DFMs. We agree with the industry pundits who compare HDDs to commodity off the shelf (COTS) solid-state disks (SSDs) and are skeptical that this displacement could occur by 2028. Our statement is based on a comparison of HDDs with our DirectFlash technology, which is what poses an existential threat to HDDs in enterprise data centers, not COTS SSDs.

A storage device's size provides critical leverage to increase infrastructure density and lower energy and floor space consumption as well as manufacturing carbon dioxide emissions and e-waste disposal. Today, for multi-petabyte systems configured to hit a particular performance and capacity target, Pure Storage needs 80%+ fewer storage devices. This means that our systems require a lot less supporting infrastructure (controllers, enclosures, fans, power supplies, switches, and cables), energy, and floor space, driving down both manufacturing and shipping costs. And our Pure//E™ family of systems enable us to meet or beat the acquisition cost of all-HDD systems that would actually be deployed in production for multi-petabyte configurations.

Specification	All-HDD Systems	All-flash SSD Systems	FlashArray//E™
Device capacity	12TB	15TB	75TB
Target capacity	4096TB	4096TB	4096TB
Number of devices	342	274	55
Enclosures	1 base, 14 expansion (assumes 2U24)	1 base, 11 expansion (assumes 2U24)	1 base, 1 expansion
Rack space	34U	24U	6U

TABLE 1   Pure Storage FlashArray//E has an 84% lower storage device count than a comparably configured all-HDD system and an 80% lower device count than a comparably configured system using COTS SSDs.

Focus on Cost per Effective Gigabyte and Total Cost of Ownership

The HDD industry has focused since its inception on the cost per gigabyte of raw capacity as a key metric. Experienced storage managers know, however, that it isn't the raw capacity that determines how much data can be stored but the effective capacity. Factors like formatting, data reduction, on-disk data protection (RAID or erasure coding), and how much data can be stored in a device without unduly impacting performance together determine the effective capacity. Outside of data reduction (which increases effective capacity), these other factors all impose capacity overhead on all-HDD systems, lowering the effective capacity. Storage devices with a lower effective capacity force customers to buy more devices to hit a certain performance and capacity target.

The total cost of ownership (TCO) of a storage system results from a combination of capital, operational, technology refresh, and e-waste disposal costs. The capital costs of a Pure Storage system purchase are reduced not only by the significantly smaller system sizes but also by the fact that the effective capacity utilization is much higher with our DFMs than with all-HDDs, another factor driving up the higher device count for all-HDD systems. All-flash systems are much easier and less expensive to manage because they require almost no time for performance tuning and other tasks associated with managing slow devices with low capacity utilization (i.e. HDDs). The much smaller all-flash kit has lower shipping and deployment costs as well as much lower maintenance and e-waste disposal costs (again, due to the storage device count).

Evergreen Architecture from Pure Storage: Technology Refresh Done Right

All-HDD systems typically exhibit a three- to five-year useful life, after which they are replaced through a forklift upgrade, requiring enterprises to re-buy storage capacity, re-license software, migrate data over slow external networks, and re-provision storage. Pure Storage Evergreen® Architecture allows systems to be non-disruptively upgraded in place without forklift upgrades, re-buying of storage capacity, re-licensing of software, migrating of data over external networks, or re-provisioning of storage (although any new capacity added over time will require initial provisioning). Evergreen Architecture delivers a ten-year plus lifecycle, and 97% of the systems that we have ever sold are still in production use and are hardware- and software-identical to our latest generations of products. This results in a huge cost reduction compared to all-HDD systems that require forklift upgrades two or three times over a 10-year period with significant cost, time spent, and potential risk.

Learn More

If you have all-HDD systems coming up for technology refresh and are interested in better understanding the cost savings available to you in a move to the Pure//E family of all-flash systems, we'd like to meet to discuss the business we can deliver.

- **Get in touch:** Book a meeting

- **Read the full white paper:** "The All-flash Data Center Is Imminent"