

## REPORT REPRINT

# Pure Storage pitches price-slashing QLC flash storage

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The company has become the first major player to offer a storage system designed to use the emerging lower-cost QLC version of flash, at prices up to 40% lower than existing devices. The aim is to widen the use of all-flash storage. Has Pure timed this move right?

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### Introduction

At its recent annual Accelerate conference, Pure Storage launched multiple new products and services, which will be covered in a separate report. These included a version of its mainstay FlashArray all-flash storage system engineered to use QLC flash – the first such offering from a major datacenter vendor. QLC costs less than the currently dominant TLC variant of flash, and the company's new system is priced up to 40% less than the existing TLC-powered FlashArray. QLC is also slower than TLC flash and has a shorter write-life. Pure is making no bones about the lower performance of its new system, but says it has achieved 'basically' the same effective write-life as its existing FlashArray, allowing the new system to carry the same service warranties.

Called the FlashArray//C, the new system is intended to complement the company's existing FlashArray//X. The two are fully interoperable and share the same OS, data management and administration tools, and even physical enclosure. Target applications for the //C include disaster recovery, dev-test, long-term snapshot storage, and VMs for applications that don't require TLC levels of performance. Ironically, the system is initially being powered by TLC flash. Pure says this is because QLC is not yet mature and is currently in limited supply (it says it hasn't decided whose QLC it will eventually buy). However, the vendor says it will switch to QLC relatively soon, when it will also have finished tuning the //C to make the most efficient use of the latest form of flash.

### 451 TAKE

The flash revolution hasn't ended, and flash prices are continuing to fall faster than disk prices. QLC is the latest development driving this trend, and we're not surprised that Pure Storage is leading the charge into the new form of flash while most of its incumbent rivals are holding back. The company was also first into NVMe, and because its portfolio includes no disk products, the impact of QLC on its addressable market is larger than it will be for the incumbents. But we are surprised that the //C has begun shipping as a TLC-powered device. Although that won't matter to customers because they will be paying low prices from day one, it may reduce Pure's margins. We don't entirely buy the vendor's claim of 'SATA economics' for the new system, but we do believe the //C will be popular, especially among the larger IT organizations that Pure wants more of as customers. Its FlashBlade NAS and object system showed good instincts, as its recently disclosed sales numbers show. We think this early move into QLC is more of the same.

### QLC as the latest flash price reducer

Over the past six years, datacenter flash has moved rapidly from SLC flash that stores one data bit per memory cell, through MLC flash storing two bits per cell, to the current three-bit TLC flash, which now accounts for over 90% of all flash shipments. Each move lowered the per-GB cost of flash but also delivered diminishing price reductions, while introducing increasing technical challenges maintaining flash performance, reliability and write-life.

Compared with TLC, QLC stores 33% more data per memory cell, but that does not make QLC flash drives or modules one-third cheaper. Because of costs incurred compensating for QLC's lower quality, the first QLC drives that shipped last year were closer to 10% cheaper. As the technology develops, the price gap is expected to widen, but even so the long-term prospects for QLC are not as strong as

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they were for TLC. That is not only because of the diminishing returns from bit-count increases, but also because the introduction of TLC coincided with an industry move from 2-D to 3-D physical flash chips. That change in physical structure significantly offset the lower quality of TLC flash and helped it replace MLC flash. This time around, there is no such parallel development to help QLC replace TLC.

Nevertheless, there are forecasts that QLC will see significant usage in datacenters. At one end of the spectrum, an executive at a very large chipmaker confidently told 451 Research last year that QLC will repeat history by becoming the new TLC. Western Digital has publicly predicted that QLC will account for only about half of all flash capacity shipments by 2025.

Similarly, Pure Storage says it does not expect QLC to fully replace TLC at any time in the near- or even midterm future, and perhaps never. But it projects that QLC will allow flash to displace yet more disk. Among Pure's major competitors, one has said privately that it will adopt QLC in its datacenter storage systems within the next few months, but others have said that at present, the new flash variant is not yet cheap enough to justify the move.

### Pure's //C expectations

Pure Storage says the block-level external or SAN storage market can be considered as being approximately split into two segments, with one-third of purchases being driven by performance needs and the remainder focusing on capacity. It classifies the //C as being part of the latter sector, and as a result does not expect it to cannibalize sales of the faster //X.

Our prediction that the //C could be especially popular among larger organizations is based in part on Pure's statement that SaaS providers have been particularly interested in the new system. The vendor reports that some of those SaaS providers have been considering the //C as a backup target, and that although the new system offers less bandwidth than its FlashBlade device, its read bandwidth is still very strong. ServiceNow has been a //C beta tester and has publicly endorsed the new system on Pure's website. This also fits with our expectation that exactly as with the original uptake of all-flash storage, the first customers to deploy the //C as secondary storage will be those with the biggest needs and deepest pockets.

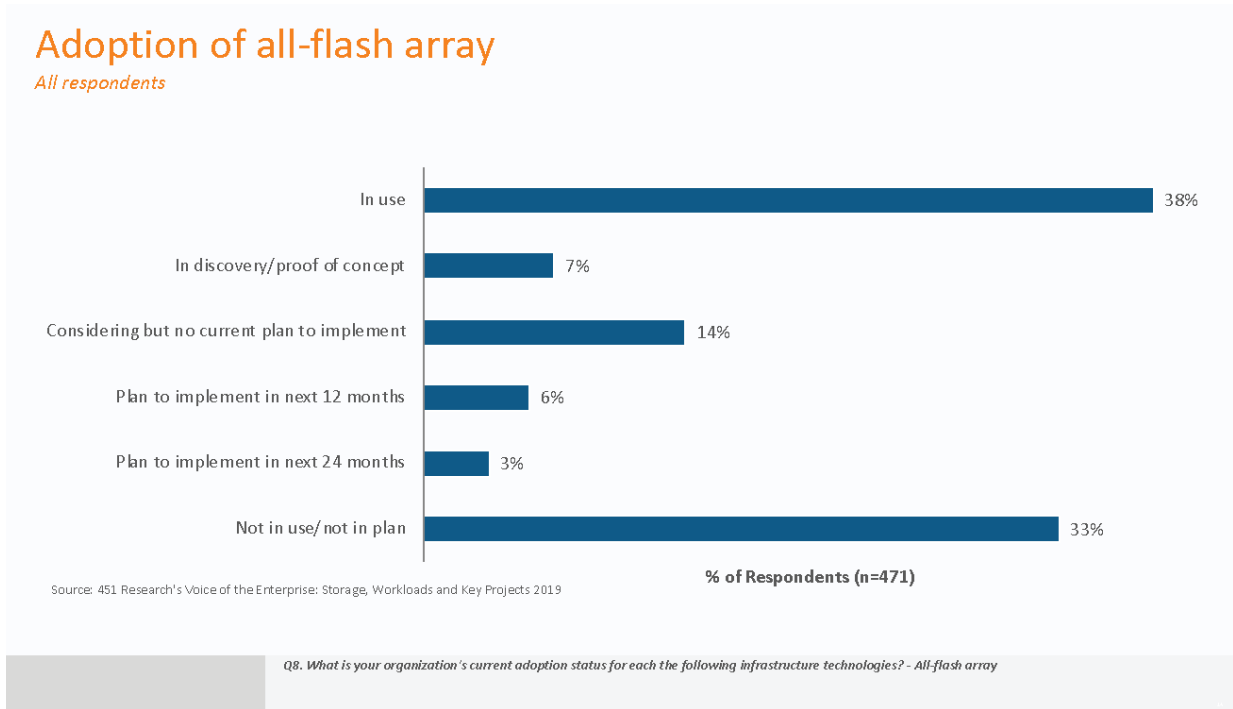
### Pricing and performance

Even though QLC delivers an absolute maximum theoretical price reduction of 33% versus TLC, Pure Storage says the FlashArray //C is up to 40% cheaper than its existing TLC-powered FlashArray//X. That's because the overall system has been designed to deliver lower cost per GB of capacity not only by eventually switching to QLC flash, but also by using less-expensive x86 processors and less DRAM, and by employing the flash capacity differently.

Pure describes the //C as delivering all-flash performance at SATA disk prices, but this claim is clearly not a reference to every type of SATA disk array, as there are object disk systems that cost only pennies per GB. However, the latter are far slower and not intended for the same applications as the //C, and typically impose IO latencies of tens of milliseconds. The //C imposes far lower latencies, typically 2-4ms, according to the company, making it faster than any disk system. But the //C is also slower the FlashArray//X and other TLC-powered enterprise all-flash arrays, whose latencies are typically less than one millisecond.

We believe the most meaningful comparison for the //C is against hybrid disk-and-flash arrays. According to recent Voice of the Enterprise surveys completed by 451, one-third of enterprises still have no plans to buy into all-flash storage, and the largest obstacle is price (see Figures 1 and 2).

Figure 1: AFA deployment



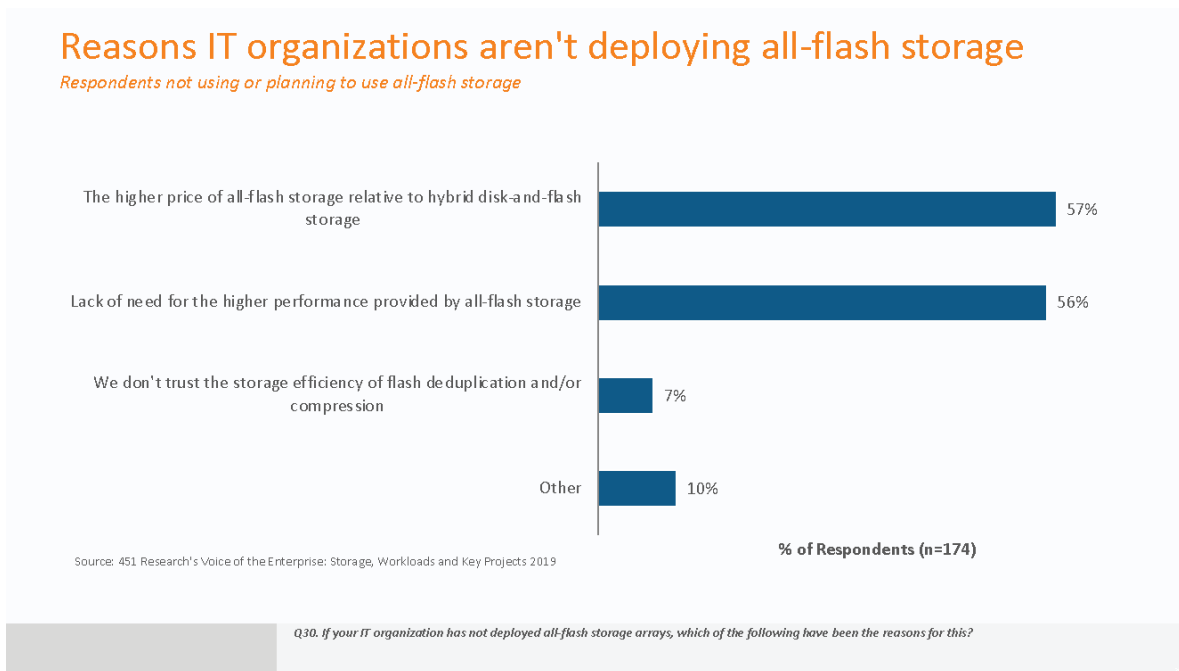
Source: 451 Research

However, the comparison is not simple. On the one hand, hybrid systems use TLC flash as the top storage tier, and therefore for most IOs they impose only sub-millisecond latencies and are faster than the //C. On the other hand, the //C offers more consistent performance because unlike a hybrid, it will never impose latency spikes of multiple milliseconds when a cache-miss or tier-miss has forced a hybrid system to retrieve data from disk. Consistency of latency is important for applications such as transactional databases, although Pure has not explicitly named those as target applications.

Comparing purchase prices for different storage systems is also highly challenging because of multiple factors that cause wide variations in per-GB prices, even for identical storage systems sold to different customers. The //C has the advantage of inline data reduction, which cannot be applied to disk. However, we're not sure that is enough to make the //C as cheap as a hybrid storage system.

For its part, Pure points out that purchase price is only one part of TCO. Flash drives are more reliable than disk drives and all-flash storage consumes less power, cooling and physical space. According to Pure, a //C offers up to 5PB of effective capacity in 9RU of physical space, or seven times greater physical density than one particular leading hybrid storage system – and it says this density advantage will grow. The company also claims that all-flash storage lowers costs by allowing consolidation, eliminating the impact of so-called 'noisy neighbor' applications on overall performance.

**Figure 2: Barriers to all-flash storage adoption**



Source: 451 Research, LLC

### A software-defined 'head start'

Pure Storage says an existing and unusual aspect of the FlashArray gave the company a head start over its rivals in adopting QLC flash. Unlike almost all competing systems, the FlashArray is not powered by conventional off-the-shelf drives. Since 2017, it has instead been fitted with custom flash modules designed by Pure. The versions of those modules used in the //C are sizeable 18TB devices, and much bigger capacities are planned.

Unlike conventional drives, Pure's flash modules are not heavily involved in the management of flash capacity and IOs, and most of that work is instead completed by a software flash translation layer (FTL) within the FlashArray's Purity OS. This is the same approach used in the open channel flash drives developed by hyperscale operators, and the vendor claims that it results in more efficient use of flash. It dates back to the original design of the FlashArray and is one of the reasons why Pure said back then that it was able to wring enterprise performance and life from very low-cost flash drives. Now, the company says this allowed it to adopt QLC ahead of its rivals.

The tuning of the FTL to suit QLC flash is also the reason why Pure says customers will see no difference between current TLC-powered //C systems and future QLC-powered versions. In another modification to suit QLC flash, Pure has increased parity protection of data to maintain enterprise-grade data durability, while offsetting the increased overhead by increasing stripe widths.

### Competition

With revenue guidance of over \$1.7bn for its current fiscal year ending in January 2020, Pure Storage is one of a small handful of suppliers dominating the all-flash storage space. The other large players are Dell EMC, Hewlett Packard Enterprise, Hitachi Vantara and IBM. As noted, one of those vendors plans to launch QLC-powered versions of its current all-flash systems in the very near future, while others say QLC is not yet cheap enough to justify deployment in datacenter systems. For example, HPE says it expects 'QLC v1' to be only marginally cheaper than TLC, with the 'real economies' showing up with 'QLC v2.'

### SWOT Analysis

#### STRENGTHS

Pure Storage has become the first major vendor offering a QLC-ready all-flash storage system.

#### WEAKNESSES

The level of demand for the //C is not yet known, and at present the company is using TLC rather than cheaper QLC flash to power the device.

#### OPPORTUNITIES

Although there is the potential for sales across all types of customers, we think large IT organizations will initially be the most attracted to the //C as a way of extending all-flash storage into secondary workloads. Pure has said that it wants to generate more business with such customers.

#### THREATS

Competitors will eventually follow suit. For now, the biggest threats are that Pure may not be able to move the //C to QLC flash as soon as it had expected, and that the device might cannibalize sales of existing TLC-based FlashArrays. Both would jeopardize Pure's margins and delay its long-promised development into a profit-making organization.