ESG Brief

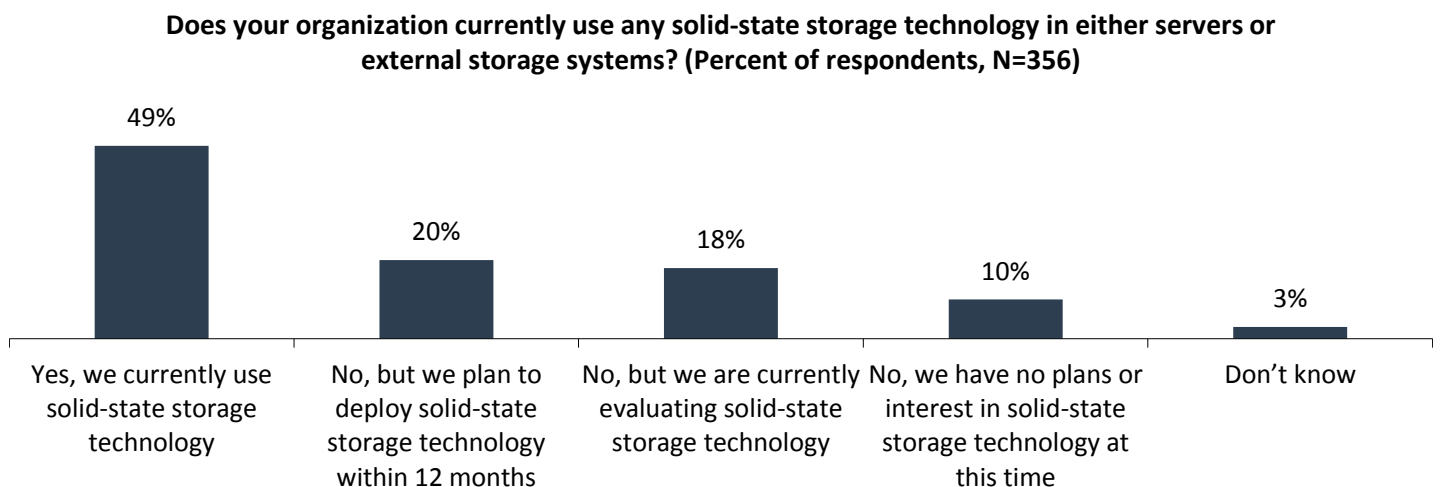# Flash Storage: Growth, Acceptance, and the Rise of NVMe

Date: September 2017 **Authors:** Mark Peters, Practice Director & Senior Analyst; Scott Sinclair, Senior Analyst; and Bill Lundell, Director of Research

Abstract: Solid-state storage (that's invariably flash today) continues to be adopted across IT, delivering not only performance benefits, but also other key data center benefits such as reliability, cost per I/O, and TCO savings. In terms of the overall storage environment, however, flash still has room to grow, as storage decision makers currently perceive that solid-state-level *performance* is only required by a subset of their workloads. Looking ahead, the industry is anticipating NVMe-based solid-state implementations, with the expectation that these new storage offerings will overtake not only the more traditional solid-state…but possibly even the larger storage networks themselves.

Solid-state (Flash) Storage Usage Trends and What's Behind Them

ESG recently surveyed 356 IT professionals responsible for evaluating, purchasing, and managing data storage technologies at midmarket (i.e., 100 to 999 employees) and enterprise (i.e., 1,000 or more employees) organizations in North America. As part of the survey, respondents were asked about their organizations' usage of solid-state storage, and Figure 1 reveals that nearly half (49%) are leveraging the technology in some form today.
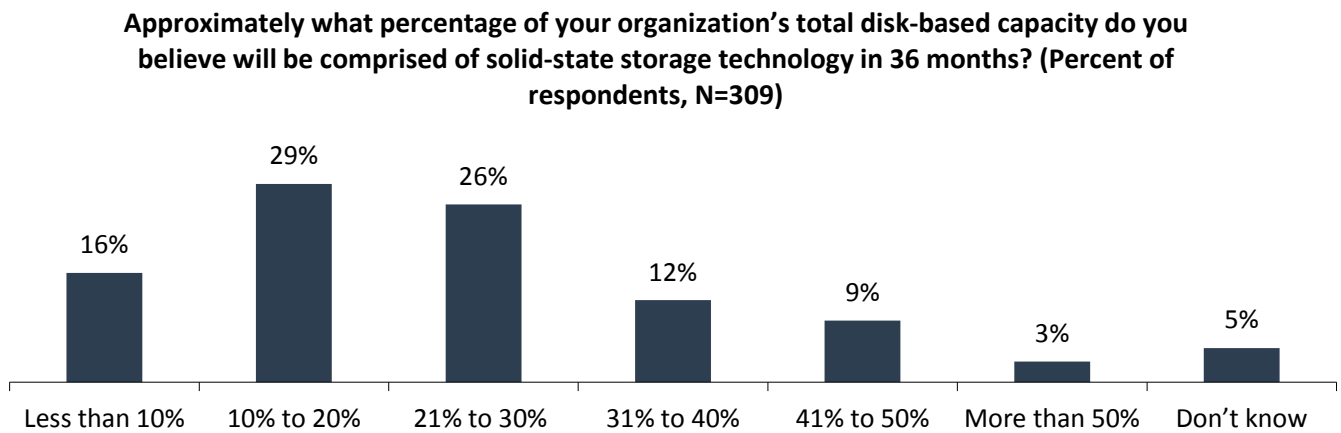
Figure 1. Solid-state Storage Usage Trends

Does your organization currently use any solid-state storage technology in either servers or external storage systems? (Percent of respondents, N=356)

Yes, we currently use solid-state storage technology	No, but we plan to deploy solid-state storage technology within 12 months	No, but we are currently evaluating solid-state storage technology	No, we have no plans or interest in solid-state storage technology at this time	Don't know
49%	20%	18%	10%	3%

Source: Enterprise Strategy Group, 2017

With solid-state storage deployment quickly approaching the majority of users, the next question to address is the percentage of workloads that solid-state can, or should, serve across the data center. In other words, to what extent will solid-state deployments replace traditional spinning disk drives? With that in mind, ESG asked respondents at organizations currently using solid-state, as well as those considering the technology, to estimate the amount of total storage capacity that will be comprised of solid-state media 36 months from now. According to Figure 2, the plurality (29%) of current and potential users expects this number to be between 10% and 20%. There is, however, a significant difference in the solid-state storage outlook between current users and potential adopters. Specifically, those organizations that have already deployed solid-state resources are twice as likely as their non-adopter counterparts (30% versus 15%) to speculate that more than 30% of their total capacity will likely be comprised of solid-state technology in three years' time (see Table 1). This *strongly* suggests that experience with the technology increases the understanding of its capabilities and opens the door for additional use cases.

Figure 2. Expected Penetration Rate of Solid-state Storage Technology in 36 Months

Approximately what percentage of your organization's total disk-based capacity do you believe will be comprised of solid-state storage technology in 36 months? (Percent of respondents, N=309)

	Less than 10%	10% to 20%	21% to 30%	31% to 40%	41% to 50%	More than 50%	Don't know
	16%	29%	26%	12%	9%	3%	5%

Source: Enterprise Strategy Group, 2017

Table 1. Current Solid-state Users See a Larger Opportunity for the Technology

Approximately what percentage of your organization's total disk-based capacity do you believe will be comprised of solid-state storage technology in 36 months?	By solid-state storage usage status	
	Current solid-state users	Potential solid-state users
More than 30% of storage capacity	30%	15%

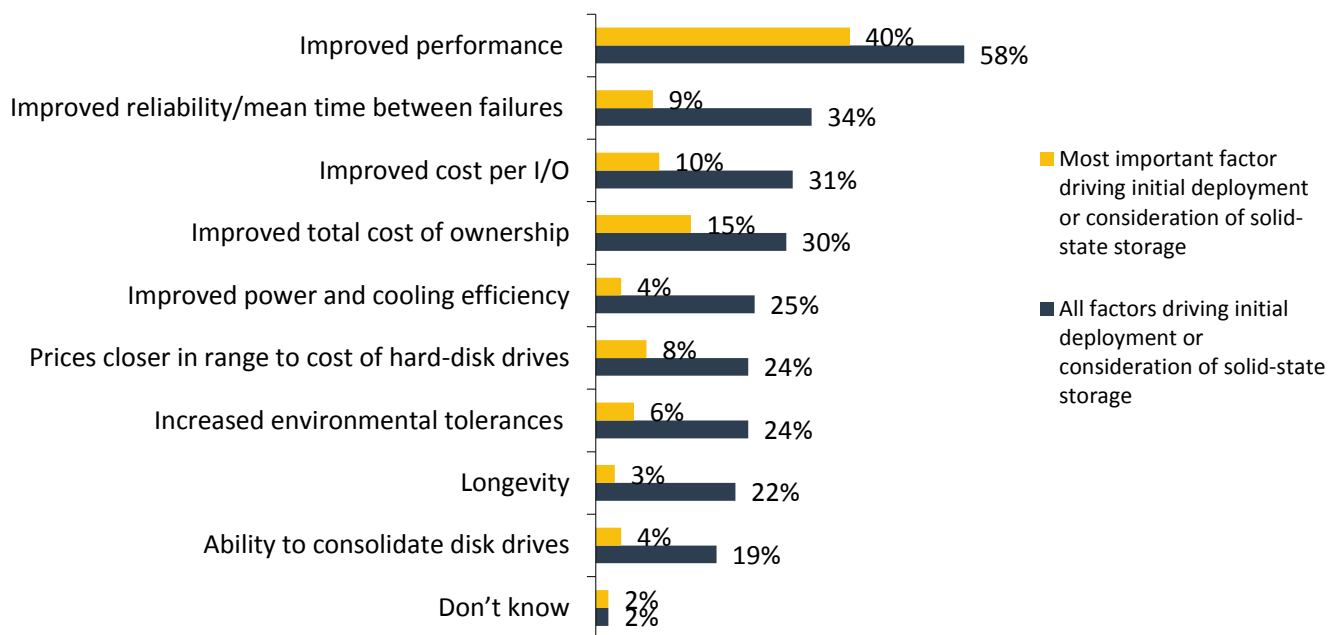*Source: Enterprise Strategy Group, 2017*

At this point, it pretty much goes without saying that improved performance is by far the single most recognized advantage that solid-state storage provides over traditional hard disk drives. It logically follows then that more than half (58%) of current and potential users identified enhanced performance as a factor in the decision to deploy solid-state storage and—more significantly—40% cited it as the *most important* initial adoption driver (see Figure 3). *However*, improved performance is far from the only advantage that IT professionals see with flash; indeed (also in Figure 3), the sum of all the *primary* "non-performance reasons" for flash adoption actually exceeds that 40%. Digging deeper, nearly half of the respondents identified cost as an influence in their solid-state decision in the form of improved cost per I/O (31%) and/or improved TCO (30%), and one-quarter recognized one of these two as the most important decision criteria for them. Both

responses point to the ability of solid-state technology to deliver—amongst other things—cost optimization to data centers through the efficient delivery of application performance, and operational improvements.

After the performance and cost considerations, improved reliability (9%) was the next most-recognized consideration driving solid-state storage adoption. Solid-state storage is typically more reliable since there are no spinning platters and actuators to cause mechanical challenges, as there are with hard disk drives.

Figure 3. Drivers for Initial Deployment (Current Users) or Consideration (Potential Adopters) of Solid-state Storage

To the best of your knowledge, which of the following factors were responsible for your organization's initial deployment or consideration of solid-state storage? (Percent of respondents, N=309)
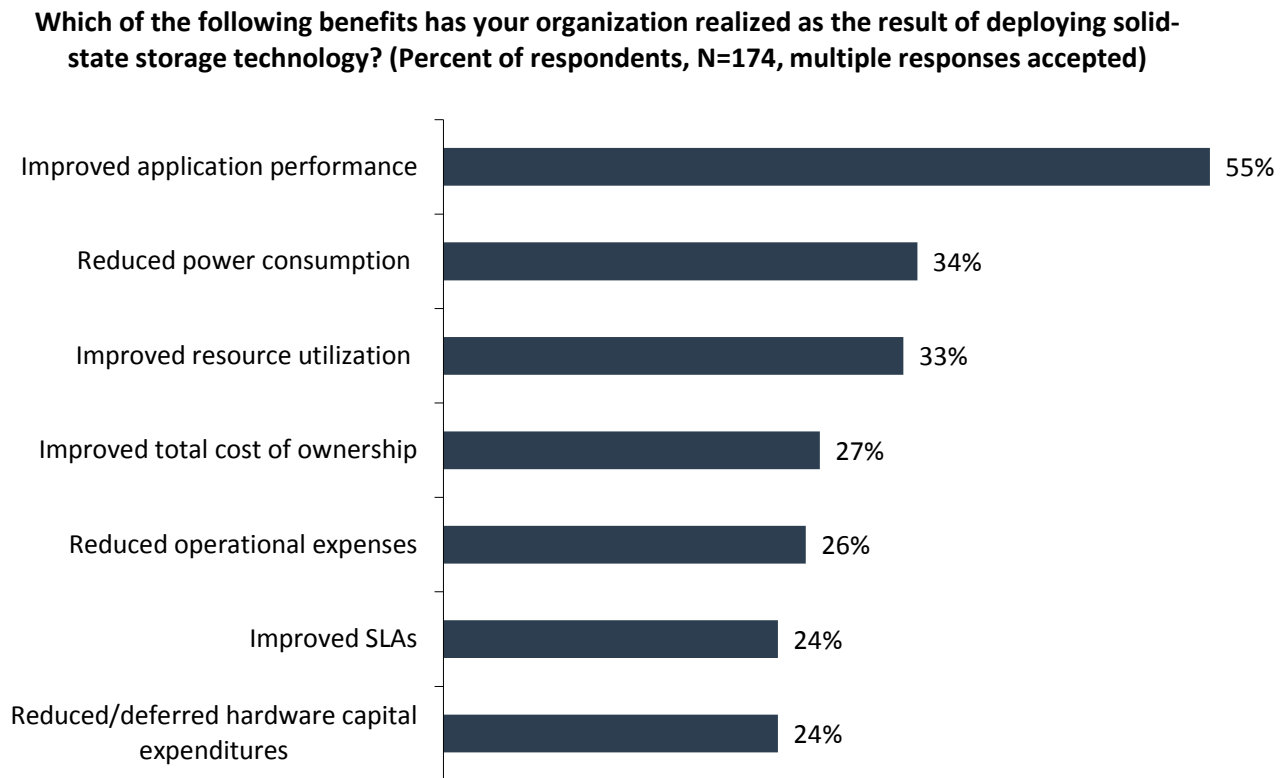

Source: Enterprise Strategy Group, 2017

So, beyond their expectations, what benefits have current users *actually* derived from their solid-state storage implementations? It's no surprise of course to find current users most focused on their improved application performance (see Figure 4).[1] The other most commonly identified benefits include reduced power consumption (34%) and improved resource utilization (33%). While the optimized power usage benefits can be attributed to solid-state media's lack of moving parts and subsequent absence of heat generation, the efficient delivery of I/O performance can also have broader storage infrastructure implications by—for instance—eliminating the need for unnaturally large deployments of short-stroked disk drives. Additionally, shifting the performance bottleneck away from the storage can materially help to improve utilization of other components along the data path, such as the servers and the networking infrastructure.

It is also certainly worth noting that *not a single* current solid-state storage user believes her organization has not received at least one benefit from this investment. Furthermore, the broad range of benefits that have been realized is another factor in solid-state's substantial market penetration. If not quite ubiquitous yet, it has certainly become a "norm." After all, if solid-state addressed only one data challenge or delivered only one benefit, it likely would have remained a niche offering and would not have the broad appeal—and acceptance—that it clearly does.

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[1] Of the current users who cited performance as a solid-state adoption driver (per Figure 3), 71% cited improved performance as a benefit.

Figure 4. Benefits Realized from Solid-state Storage Usage

Which of the following benefits has your organization realized as the result of deploying solid-state storage technology? (Percent of respondents, N=174, multiple responses accepted)

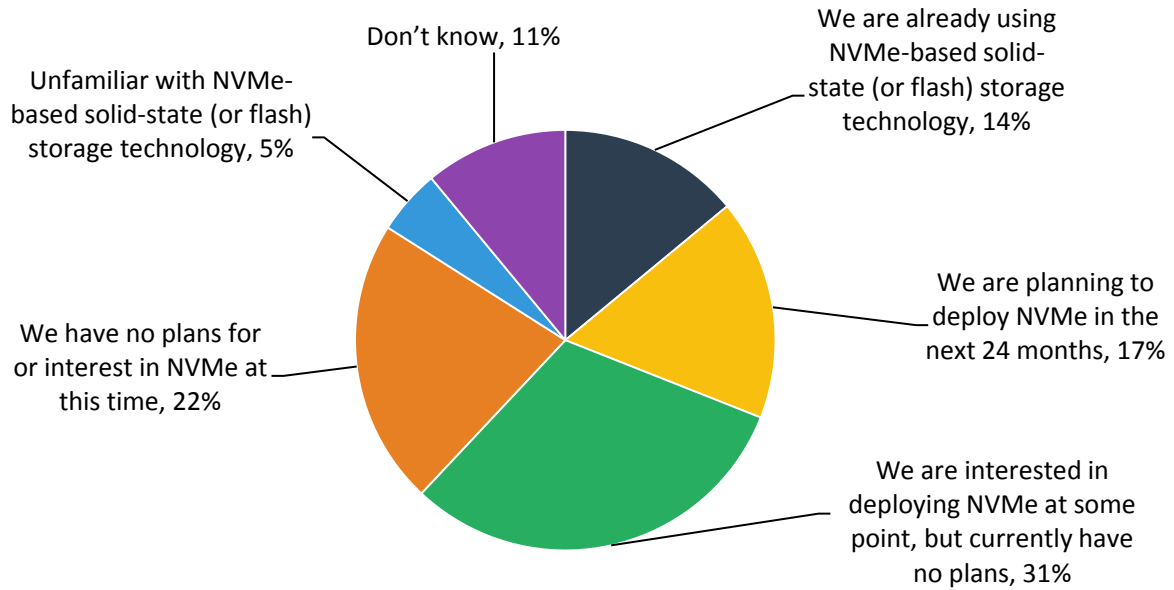| Benefit	Percent
Improved application performance	55%
Reduced power consumption	34%
Improved resource utilization	33%
Improved total cost of ownership	27%
Reduced operational expenses	26%
Improved SLAs	24%
Reduced/deferred hardware capital expenditures	24%

Source: Enterprise Strategy Group, 2017

Rise of NVMe

The most advanced and promising next technological mainstream evolution for solid-state storage is for the flash media to be used in conjunction with the NVMe protocol, which is essentially a method to access the media with much less overhead. Yes, it's still flash, but it is often already referred to as "NVMe flash" or as being made up of "NVMe drives," neither of which is semantically accurate, but such colloquialisms speak volumes (no pun intended!) for its expected incursion into the flash world over the next few years. Indeed, when asked about their plans for NVMe-based solid-state storage, 14% of respondents indicated their organization already uses the technology, and an additional 17% expect to deploy it within the next two years (see Figure 5). At the other end of the spectrum, more than a quarter of respondents either have no current plans for/interest in NVMe (22%) or are unfamiliar with the technology (5%).

Current and potential users of NVMe-based solid-state storage were then asked to prognosticate on the effect the technology would have upon their storage environment, specifically the impact to existing solid-state storage deployments. While more than three-quarters (79%) of the respondents anticipate that NVMe-based solid-state will eventually replace "traditional" solid-state media, less than one-third (31%) believe that it will also become a dominant storage networking protocol (see Figure 6). This result presents the next large question for the flash storage industry to address. NVMe was developed as and is intended to be an interconnect protocol, but if NVMe is limited to which component it can connect, its value is diminished. Multiple storage system and networking providers are invested in taking the benefits of NVMe outside of the box and delivering them across the greater storage network. These results, however, offer a glimpse into the challenges those solutions may face, as storage decision makers may be hesitant to alter their existing storage networking infrastructure. Ultimately, NVMe adoption within the storage network may be directly related to how seamlessly the technology can be integrated without requiring a full networking infrastructure replacement.

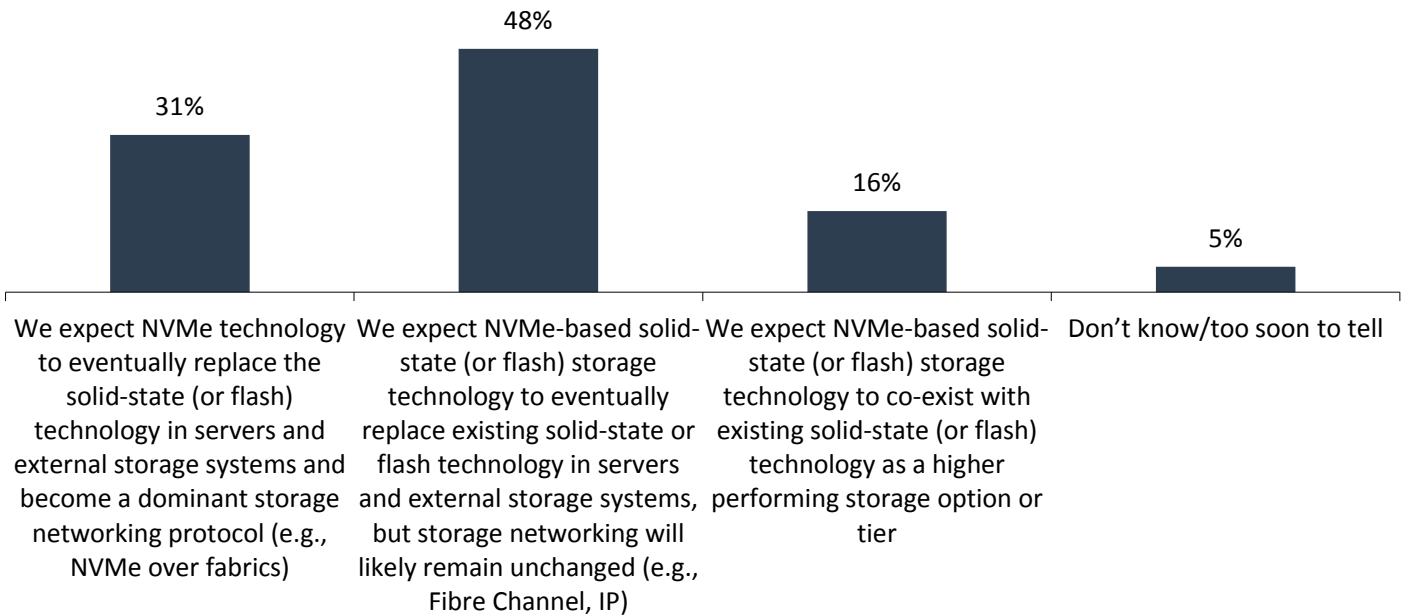**Figure 5. NVMe-based Solid-state Storage Usage**

To the best of your knowledge, has your organization deployed or is it considering deploying NVMe-based solid-state (or flash) storage technology? (Percent of respondents, N=356)

Don't know, 11%

Unfamiliar with NVMe-based solid-state (or flash) storage technology, 5%

We are already using NVMe-based solid-state (or flash) storage technology, 14%

We are planning to deploy NVMe in the next 24 months, 17%

We have no plans for or interest in NVMe at this time, 22%

We are interested in deploying NVMe at some point, but currently have no plans, 31%

Source: Enterprise Strategy Group, 2017

Figure 6. Expected Impact of NVMe-based Solid-state Storage Usage

Which of the following best describes your organization's perspective on the future of NVMe-based solid-state (or flash) storage technology? (Percent of respondents, N=220)

48%

31%

16%

5%

We expect NVMe technology to eventually replace the solid-state (or flash) technology in servers and external storage systems and become a dominant storage networking protocol (e.g., NVMe over fabrics)

We expect NVMe-based solid-state (or flash) storage technology to eventually replace existing solid-state or flash technology in servers and external storage systems, but storage networking will likely remain unchanged (e.g., Fibre Channel, IP)

We expect NVMe-based solid-state (or flash) storage technology to co-exist with existing solid-state (or flash) technology as a higher performing storage option or tier

Don't know/too soon to tell

Source: Enterprise Strategy Group, 2017

The Bigger Truth

At a high level, solid-state storage (which mostly means flash these days, but packaged in different ways: as drives, on cards, etc.) continues to experience high levels of adoption while delivering a myriad of technical, operational, and financial benefits. In addition, organizations that leverage solid-state were found to be more optimistic about the technology's applicability to a wider range of workloads. In other words, if you use flash storage, you are likely to want to use more of it, and for more things, which is a good sign for any technology. Moving forward, however, the benefits of flash will be limited for as long as traditional storage network technologies hold back performance. This helps explain the attraction of technologies, such as NVMe, that accelerate the data path, which are therefore necessary to extend the level of flash benefits that can actually be enjoyed by its users. Access to those benefits may be stifled if the transition to NVMe is seen by potential users as a complex "rip and replace" exercise, instead of a seamless transition. Looking ahead, therefore, the manner in which vendors enable NVMe deployments will likely play a key role in determining the extent to which—certainly the rate at which—solid-state storage can truly transform the data center.

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