

# White Paper

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## **Efficient Data Center Virtualization Requires All-flash Storage**

*By Scott Sinclair, Storage Analyst*

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## Introduction

There will likely be a day in the not too distant future when historians will look at the use of spinning drive media just as those today view the use of vacuum tubes: a necessary but transitory step. The storage industry and the IT industry as a whole are amidst a large-scale transition to solid-state (or flash) storage technology. Prior to the emergence of solid-state storage, IT organizations often went to great lengths to eke out the necessary performance from mechanical-based drives. As such, drive-based storage solutions often served as the bottleneck for the entire data center design.

The advent of solid-state storage and all-flash arrays has presented IT organizations with an opportunity to eliminate this bottleneck. As organizations are already starting to understand, when a serious performance bottleneck is removed, the positive impacts can be data-center-wide. With performance arguably the most pronounced benefit of all those associated with solid-state storage, it is easy to understand how the earliest adoption of solid-state was seen in those performance-starved applications where a performance increase translated into a tangible business benefit. As the price of solid-state storage declines and the value increases, many IT organizations have expanded their solid-state storage footprints to other transactional workloads, such as database applications and server virtualization environments.

Server virtualization environments in particular possess a number of characteristics that align well with the potential of solid-state storage. Effective virtualization infrastructure design is about efficiency—the more efficient the design, the more virtual machines and workloads can be housed on the infrastructure, which can help to control costs. The more capable the overall infrastructure becomes, the more powerful virtualization technologies can become. By consolidating multiple workloads, server virtualization allows additional workloads to leverage the previously unused capabilities of existing hardware components to provide a more efficient IT ecosystem. These benefits can be even further extended enabling the rest of the hardware infrastructure to be better utilized. As IT organizations seek to further expand their use of virtualization technology and introduce an ever-increasing number of virtual machines, the underlying infrastructure can be pressed to its limits. As virtual machine adoption grows, once the load exceeds the existing infrastructure, the cost to add that next virtual machine increases significantly as new hardware infrastructure is required. The presence of deduplication technology (often available with solid-state storage) provides increased benefits in virtualized environments where duplicates may be more prevalent.

Pure Storage, one of the leaders in the all-flash storage array industry, understands the potential of solid-state storage for a wide variety of enterprise workloads, including virtualized server environments. With the modular design Pure Storage recently introduced in its FlashArray//m array, the storage provider seeks to further extend the benefits of solid-state storage by making the storage more cost-effective in IT environments. When combined with Pure Storage's Evergreen Storage program, the modular design of Pure Storage FlashArray//m offers the ability to extend the life of existing solid-state storage deployments, helping to reduce costs and ease the integration of new technology.

## The Challenges of Server Virtualization

As part of ESG's annual IT spending intentions research, IT leaders identified increasing the use of server virtualization as one of their top overall IT priorities for 2015, making it one of the top five most-cited responses.<sup>1</sup> Server virtualization is a critical component of the modern IT data center. The efficiency and cost savings gains often realized from virtualization environments have provided significant infrastructure savings, but many environments can still struggle with challenges in architectural design. Indeed, research conducted previously by ESG revealed that three of the top five impediments preventing organizations from extending server virtualization deployments were lack of budget, performance issues, and the need to purchase additional infrastructure, which can all be seen to stem from inefficient infrastructure design (see Figure 1).<sup>2</sup>

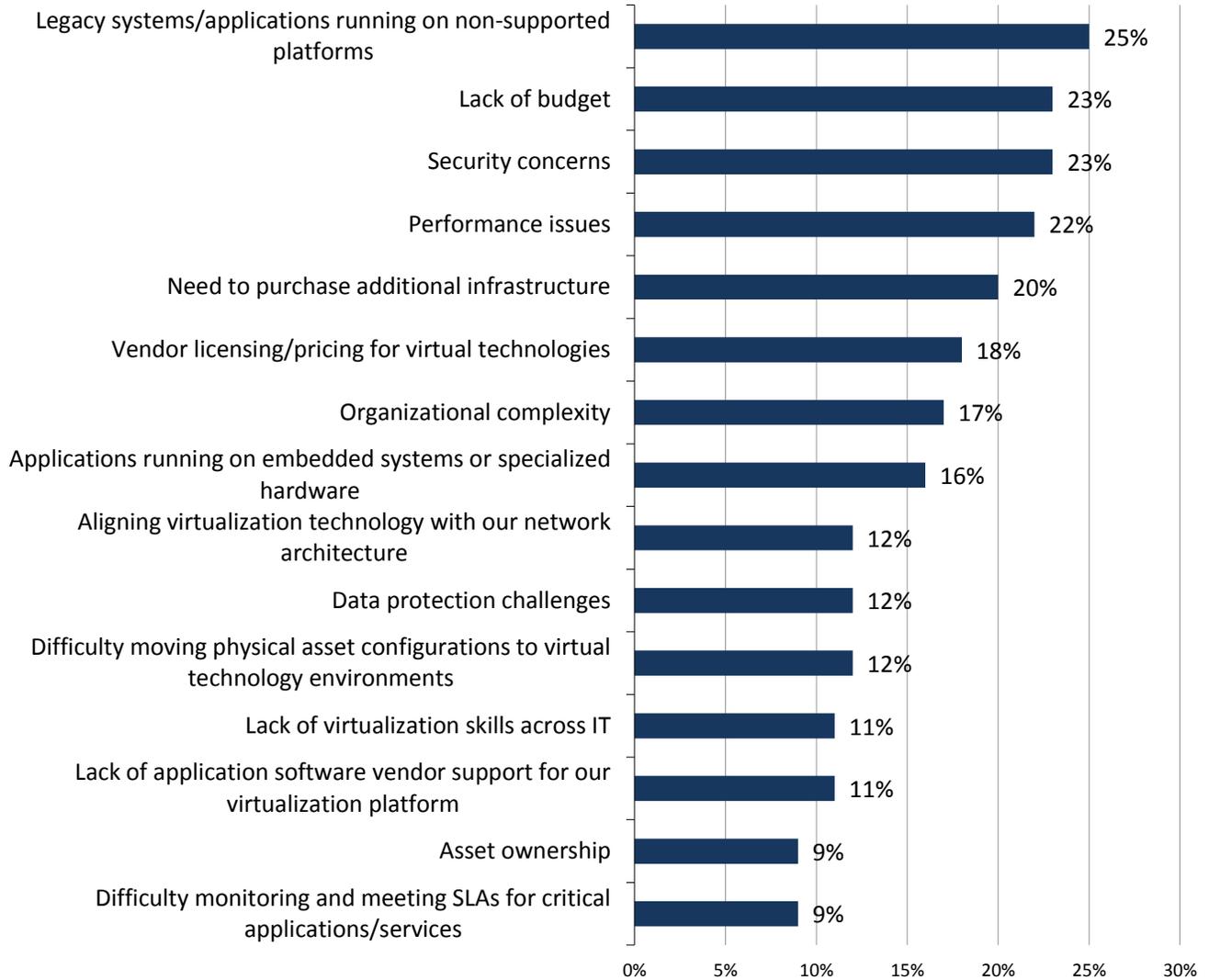
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<sup>1</sup> Source: ESG Research Report, [2015 IT Spending Intentions Survey](#), February 2015.

<sup>2</sup> Source: ESG Research Report, [Trends in Private Cloud Infrastructure](#), April 2014.

Figure 1. Factors Preventing Organizations From Using Server Virtualization More Pervasively

In general, which of the following factors would you say are preventing your organization from using server virtualization technology more pervasively? (Percent of respondents, N=303, five responses accepted, top 15 responses shown)



Source: Enterprise Strategy Group, 2015.

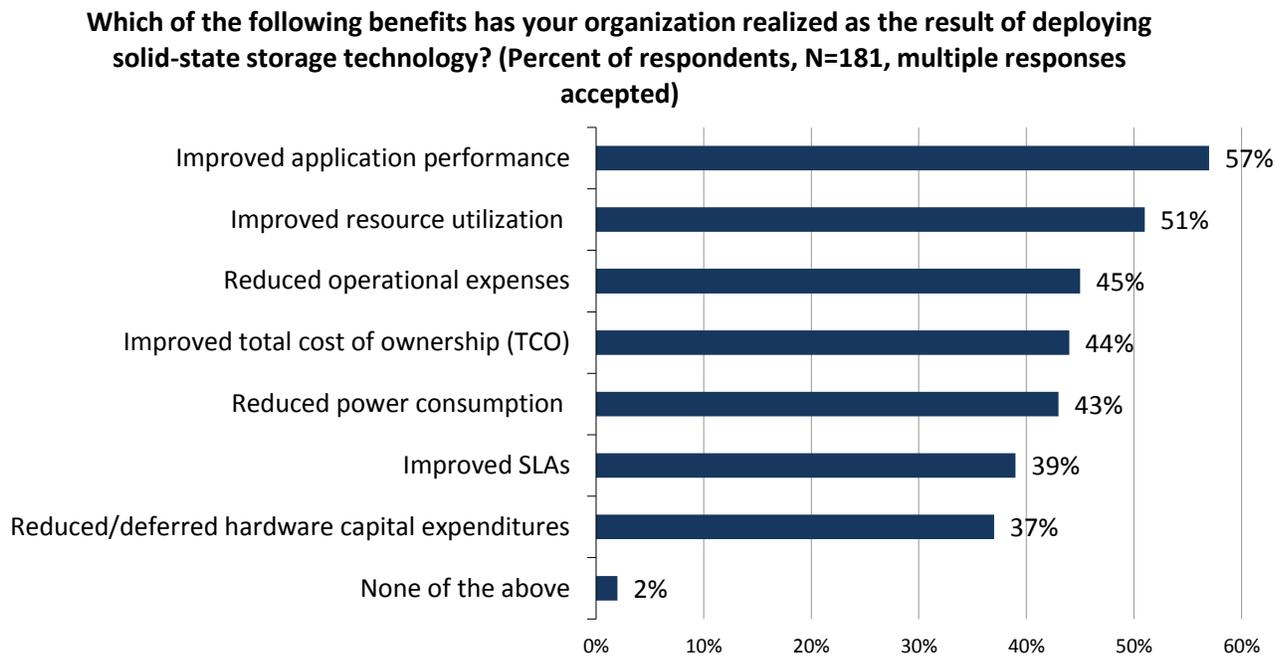
As organizations seek to extend their usage of virtualization, challenges with hardware design can create complexities and increase costs. Within virtualization environments, an efficient infrastructure incorporates a blend of IT hardware elements, including server, networking, storage, and backup. In these environments, not only can a single bottleneck drive inefficiencies across the other components, but inefficiencies can also be difficult to diagnose. As such, integrating the right hardware infrastructure elements, such as solid-state storage, can go a long way to ensuring that virtualization can expand when needed, while making effective use of budget dollars.

### Greater Data Center Efficiency with Solid-state Storage

As part of a recent research study, ESG investigated multiple data storage technologies, including solid-state storage. Current solid-state users were asked to identify the benefits their organizations realized from the technology. While the most commonly identified response to this inquiry, improved application performance (57%),

will not likely surprise anyone, the interesting responses were the ones that followed, including improved resource utilization, reduced operational expenses, and improved total cost of ownership (see Figure 2).<sup>3</sup>

Figure 2. *Benefits Realized as a Result of Deploying Solid-state Storage*



Source: Enterprise Strategy Group, 2015.

The likely storyline that emerges from the data in Figure 2 is that by eliminating the spinning disk storage bottleneck, the remainder of the IT ecosystem (such as the server and networking infrastructure) can become more efficient as well. This increased efficiency improves resource utilization and helps reduce the overall total cost of ownership of the solution.

## Efficient Server Virtual Environments with Pure Storage

With multiple ways in which solid-state storage can potentially empower virtualization environments, it is also important to note that the delivery model of solid-state storage plays a role as well. Pure Storage's Flash//m, for example, offers a number of advantages for server virtualization ecosystems. These benefits not only extend to existing server virtualization environments, but can also provide the headroom necessary to meet future virtual machine demands. The benefits include:

- Increased performance and reduced I/O latencies:** When consolidating multiple application workloads on the same hardware ecosystem, performance is important, but lower latencies can be even more important. When the storage system takes less time to service a data request, the system is better able to respond to the next request. When layering multiple applications on the same hardware, spikes in data requests may offset one another, but often an amplification effect can occur as application demand increases overlap each other. In these cases, the ability of the storage environment to provide ample performance to support the increased demands and to respond quickly can be critical to ensuring performance support. Additionally, infrastructure design decisions often attempt to allow for the maximum or near-maximum performance demand. With a lower performing or higher latency storage technology, that can equate to a significant infrastructure spend and deployment. All-flash array storage ensures that the solution provides enough IOPS to support any application demand spikes and to support future demand growth expectations.
- Individual servers able to house more virtual machines:** With the storage bottleneck alleviated, server hardware can be freed to achieve its full potential. In some cases, this can result in each system housing an

<sup>3</sup> Source: ESG Brief, [Solid-state: Just Part of the Storage "Furniture"](#), September 2015.

additional one, two, or more virtual machines. The net result allows organizations to delay capital purchases for new server infrastructure. This can reduce the number of systems the data center has to manage, power, cool, and protect, which ultimately reduces costs and frees up budget for other activities.

- **Deduplication:** Virtualization environments offer the potential for improved hardware utilization, but in the process, these architectures often create a high likelihood of duplicates. Pure Storage's deduplication technology helps to reduce the cost of storage by eliminating duplicate data and increasing effective storage capacity. For virtualization environments, the impact can be significant.
- **Integration with hypervisor storage management:** As more storage management functionality becomes available as part of hypervisor management interface solutions, managing storage infrastructure is becoming simpler for hypervisor environments. In some cases, IT organizations have shifted storage provisioning duties to the virtualization team. Pure Storage offers integration into hypervisor management tools that can help ease storage management activities and free up resources for other projects within the data center. Additionally, integration into hypervisor management tools makes it easier to adapt to changing performance demands of new workloads.
- **Future proof and performance scaling:** Innovation in storage—especially flash storage—technology, continues to evolve and mature. Storage architectures that can more easily integrate new technologies allow for organizations to gain access to the benefits of advances in processing, memory, and solid-state storage. In turn, the reduced disruption can translate into a significant reduction in management and operating costs. This is the idea behind Pure Storage's modular FlashArray//m architecture and Evergreen Storage program. With Evergreen Storage, Pure Storage intends for IT organizations to deploy a Pure Storage FlashArray//m once and then upgrade the features and the hardware capabilities as needed without requiring a data migration. Pure Storage claims this modular capability allows the expected life span of each deployment to exceed ten years. If a solution requires more performance, more memory, or more capacity, the solution can simply be upgraded, adding only what is needed. With Evergreen Storage, Pure Storage is able to provide a single pool of storage that spans hardware generations, helping to reduce the total cost of ownership of the solution.

Multiple solid-state storage delivery models have the potential to positively impact server virtualization environments. Hybrid arrays, for example, leverage a mix of solid-state and spinning media storage to provide some of the benefits of solid-state storage at a reduced price per capacity. In those arrays, however, a large percentage of data still resides on spinning media, which can result in slowed data access and reduced efficiency. Additionally, the deduplication capabilities of Pure Storage's all-flash technology, as mentioned previously, align well with virtualization environments, significantly reducing the price per capacity and allowing all data, instead of just a small percentage, to reside on solid-state storage.

## The Bigger Truth

The introduction of server virtualization unleashed a disruptive increase in data center efficiency. Workloads were able to take advantage of previously unused hardware resources, allowing IT organizations to deliver the same number of applications utilizing significantly less hardware infrastructure. Now, with the advent of solid-state storage, organizations are able to further extend the level of hardware efficiency, helping to make the most of their data center infrastructure.

While some may shy away from all-flash storage due to concerns of raw storage prices, Pure Storage is driving to reduce the cost of solid-state and make it easier to adopt. With its Evergreen Storage program and its modular all-flash array design, Pure Storage understands that not only will the needs of the data center change, but so too will the flash technology that these storage solutions are built upon. As organizations seek to become more efficient and leverage new innovations in processing, memory, and solid-state storage, Pure Storage allows these new innovations to be deployed while data remains in place and available. The net result helps offer increased hardware efficiency as the solution can augment only the capability that is needed, only when it is needed. In the end, IT decisions are business decisions. IT organizations are in a constant battle to deliver more applications, performance, and capacity with less. As users of solid-state storage are beginning to understand, the cost of storage is not simply a price-per-capacity conversation. If the storage solution can extend efficiency benefits to other elements of the hardware ecosystem, as Pure Storage is capable of delivering, then the business benefits of server virtualization can be extended even further. As more IT organizations continue to increase their utilization of virtualization technology, efficient hardware infrastructure design will become only more critical to meet not only the needs of today, but also the foreseeable future.



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