SOLUTION SHOWCASE

Next-generation Price/Performance from DataCore

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Abstract: To compete in the modern information age, data is a core competitive asset driving business advantage and impacting every industry. As innovations, such as solid-state, software-defined storage, and multi-core processing, arise to better serve that data, archaic storage architectures often hold back its potential. Simply storing and protecting data is not enough. DataCore's Parallel I/O technology enables software-defined storage to cost-effectively deliver the extreme and adaptable performance required to power the most demanding business-critical databases, virtualization projects, and web-scale environments by harnessing the full power of multi-core servers.

Overview

For decades, the information technology (IT) industry has seemed to be in a state of perpetual innovation. In the enterprise storage industry, however, innovation has come not only in the form of new features and functions, but also in disruptive shifts in architecture design. Technologies such as solid-state and software-defined storage are not only offering new benefits for IT organizations, but also fundamentally changing the way that organizations deploy and manage data.

The disruptive nature of these innovations has been so extreme that many traditional storage systems are simply unable to take advantage. The advent of solid-state storage, for example, took a data center weakness—the latency of the spinning disk—and transformed it into a strength. Storage solutions designed for spinning media could be less efficient, as hard drive latencies often masked inefficiencies in how storage software responded to applications, the outside world, other computers, and back-end data storage…in effect, the end-to-end I/O processing cycle. In some cases, the software processes had to be purposely slowed since the devices were the limiting bottlenecks. With solid-state devices and more "in-memory" architectures, any design inefficiency is immediately exposed, limiting the potential of traditional storage systems and creating substantial opportunities for efficiently designed storage solutions to exploit.

In similar fashion, software-defined storage (SDS) disrupts the storage status quo by allowing storage intelligence to be abstracted from the hardware infrastructure—enabling IT organizations to not only take advantage of a wider and potentially lower cost range of hardware options, but also better adapt their hardware infrastructure to the evolving needs of their workloads. IT organizations continuously deal with "change management" whether in the form of updates, refreshes, migrations, or deploying technologies. SDS provides the needed agility to keep up and manage change in a dynamic world. Also, SDS can allow data management to extend outside of the storage enclosure and into the server. Data can now reside closer to the application (e.g., hyperconverged) and better leverage locality and the potential power of

multi-core processing resources. These abilities are simply not available to the vast majority of traditional storage solutions.

For most industries, the ability to maximize the value of data directly correlates to the competitiveness of the business. Leveraging technologies such as solid-state, SDS, and multi-core processing are critical to keeping pace. Additionally, enterprise workload demands are anything but stagnant; they evolve, change, and grow over time. SDS architectures offer much needed adaptability. DataCore's SDS and Parallel I/O technologies, for example, combine to offer an adaptable architecture design to efficiently maximize the potential of the underlying data infrastructure. The result delivers a next-generation level of price/performance optimized for business-critical workloads, such as server virtualization and databases.

Software-defined Storage and Parallel I/O: Drives Application Performance and Cost Savings

ESG recently surveyed 373 IT decision makers responsible for their organizations' data storage infrastructures as part of a research study investigating general storage trends. This research study investigated multiple aspects of the current state of the storage industry, including SDS. When asked for their organization's perspective on SDS, the respondents indicated a significant interest in the technology's potential, as 68% of storage decision makers responded by saying their organizations were committed to SDS.[1] When polled further on the factors responsible for their consideration of SDS, the most common responses selected were the potential for simplified storage management (55%); the potential for cost reduction with benefits to TCO, operational expenditures, and capital expenditures (all of which were selected by 50% of the respondents); and the potential for greater agility to align with the evolving and fluid demands of business (47%). DataCore's Parallel I/O SDS technology is designed to address each of these expected benefits, while resolving the most commonly identified challenge of scaling database workloads.
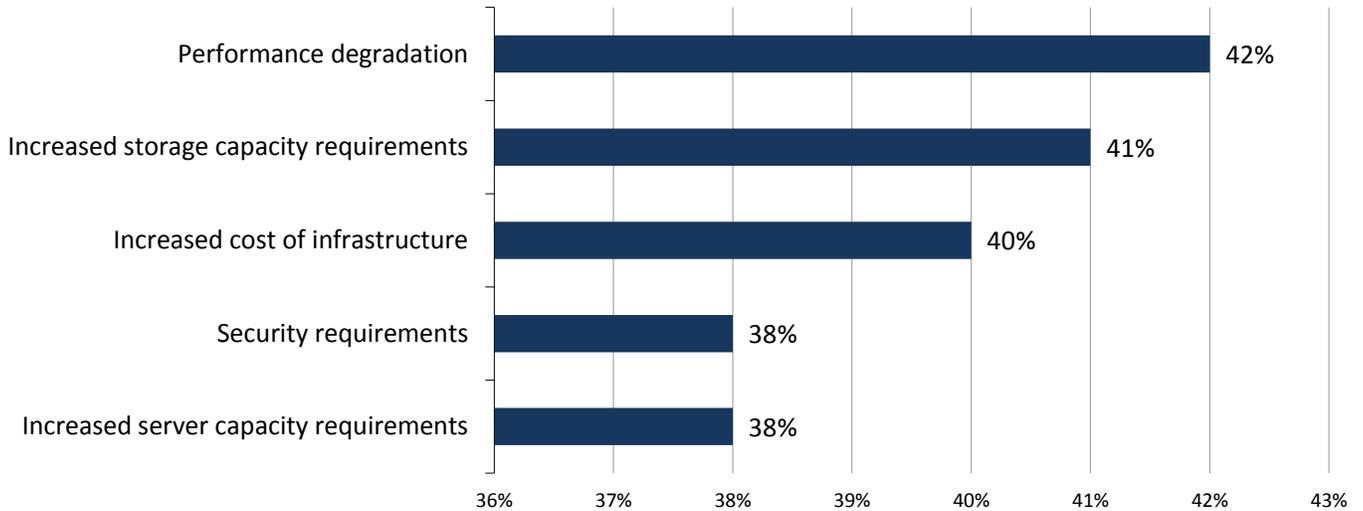
In a separate research study, ESG investigated enterprise database trends in response to the rise of big data workloads. This study surveyed 375 IT and business professionals concerning their organizations' current database technology environment and their forward-looking strategies. When polled on the specific challenges organizations faced with respect to database size and/or growth (see Figure 1), the most common response was performance degradation.[2]

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[1] Source: ESG Research Report, *2015 Data Storage Market Trends*, October 2015.
[2] Source: ESG Research Report, *Enterprise Database Trends in a Big Data World*, July 2014.

Figure 1. Top Five Challenges with Respect to Database Size and/or Growth

You stated that your organization is experiencing difficulties related to database size and growth. What are the specific challenges your organization is facing with respect to its database size and/or growth? (Percent of respondents, N=119, multiple responses accepted)

Source: Enterprise Strategy Group, 2016

Even with the emergence of solid-state storage, performance can continue to be an issue. Fast response times are especially critical for databases and online transactions. Inefficiencies in server, networking, or storage hardware become more apparent in our "instant response" digital world and can quickly become unwieldy elements that drive up costs to a point where the status quo is unsustainable. Within any enterprise storage solution, to optimize performance, a large degree of scheduling and synchronization happens on both the front-end between the applications on hosts or many VMs and the storage subsystem, and the back-end between the storage system and the devices (whether disk or solid-state). Inefficiencies in these processes limit the capabilities of the underlying hardware. Businesses can no longer allow the IT infrastructure design to lock down the potential of applications. The demands being placed upon IT organizations and the businesses they serve are becoming too burdensome and erratic.

Essentially, the necessary performance and capacity for business-critical applications either becomes too costly to supply in a sustainable manner, or overburdens the architecture to the point that applications and, ultimately, the business suffer. To serve the dynamic nature of IT demands, IT resources and performance must be dynamically deployable, manageable, and configurable. Infrastructure must self-tune to the needs of the application to maximize efficiency while simplifying decision making. An adaptable data solution allows organizations to deploy infrastructure quickly and adapt as needs change.

Adaptive Data Infrastructure from DataCore with Parallel I/O

Efficiency is a concept that directly impacts the costs and benefits of every solution. Many technologies exist that claim some form of efficient design, but few can deliver in light of the recent paradigm-shifting innovations in IT hardware over recent years. For example, when coupled with server-based storage systems, more traditional storage software provides under-utilized multi-core processing to drive I/O and run data services. Storage solutions designed for the archaic world of spinning media are likely simply too entrenched in their codebase to be able to efficiently maximize the potential of

Price/Performance of Parallel I/O

- $0.09 per SPC-1 IOPS
- 100 microsecond response time
- 1,510K+ SPC-1 IOPS in 2U

contemporary hardware components. This challenge is only exacerbated with servers advancing at the rate of Moore's law. Maximizing efficiency is at the heart of DataCore's Parallel I/O technology. Enterprise applications, larger virtualization initiatives, and device optimizations like solid-state storage all require storage intelligence that can keep up with the pace of change and fully utilize multi-core processing—I/O can no longer be the bottleneck to application performance. Through its parallel design, Parallel I/O offers a wide variety of benefits for database and server virtualization environments, including:

- **Dramatic, paradigm-shifting price/performance:** As touched upon previously, Parallel I/O replaces the serial I/O processing architecture found in many traditional storage systems with a parallel process that is able to fully maximize modern multi-core processing environments. This capability is made possible by Parallel I/O's SDS architecture. DataCore's Parallel I/O technology achieves some staggering results. In March of 2016, using the SPC-1 benchmark in a test performed by the Storage Performance Council, DataCore recorded a price/performance record of $0.09 per SPC-1 IOPS.[3] This result was achieved along with a response time of 100 microseconds running a 100% database transaction load and performance density of over 1,510 thousand SPC-1 IOPS in a 2U compact server. While some may debate how applicable benchmarks are to real-world application performance, they still serve as a solid, "all things being equal" comparison. Even for the most benchmark-skeptical reviewer, this data shows response times multiple times faster than all-flash arrays and multimillion-dollar storage systems, suggesting that DataCore is a solution that needs to be considered when evaluating performance.

- **Adaptable storage for business-critical workloads:** The enhanced performance enabled by the Parallel I/O technology allows DataCore's SDS platform to provide ample performance for business-critical workloads, such as Oracle, MS SQL Server, or SAP HANA, as well as server virtualization environments. The efficient delivery of performance also offers the ability to reduce TCO via consolidation. Faster response times mean far more work can be achieved in the same given time and that database queries can be responded to more rapidly. Each database application license is able to serve more transactions, thus fewer servers are needed to span the workload, which reduces software costs. Likewise, existing hardware infrastructure can serve more virtual machines or VDIs per server. The net result allows businesses to do more with their existing infrastructures and to scale more efficiency, and at a lower cost, in the future. Put simply, one can do "far more with less" and achieve web-scale economics on one or two servers instead of throwing money away and sprawling more servers to meet application service level demands.

- **Tangible simplicity through efficiency:** It seems like every IT product claims to be simple. Often, the claims for simplicity are based on certain manageability aspects, such as fewer clicks or less time required to install or manage. Hyperconverged systems, for example, make this claim but can be underpowered for high-performance workloads requiring scale out to 12- or even 24-node systems in order to compensate. Ultimately, however, these claims can often vary greatly based on the experience of the individual. DataCore delivers simplicity in a more measurable, and potentially more rational, fashion. The price/performance efficiency of Parallel I/O requires fewer systems to deliver

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[3] http://www.storageperformance.org/results/benchmark_results_spc1_top-ten/#spc1_top10_price

the performance needed for business-critical applications. If an organization can reduce the number of systems required to deliver the same performance, protection, and capacity by 80%, it means that they need to pay for, manage, and repair 80% fewer systems. DataCore delivers simplicity and reduces operational costs by enabling efficiency, allowing customers to do more with less. Ultimately, without efficiency, simplicity is a myth.

DataCore's Parallel I/O technology ultimately eliminates the bottlenecks common in traditional storage architectures. In the era of spinning disks, storage system designers were to some degree protected by disk latencies. Inefficiencies in the way the code handled data could be masked by the latencies of the hard drive. Reliance on serial processes, for example, was not an issue, since the disk remained the bottleneck. In an era of low-cost, virtually unlimited compute power fueled by multi-cores and faster solid-state media, those days are over. According to Chairman of DataCore Software, Ziya Aral, "There is no magic in what we are doing. Yes, we use a standard 2U server but it is a server with 36 cores and 72 logical CPUs. At 2.5 GHz clock speed that multiplies out to the equivalent of 180 GHz, provided only that we use those CPUs concurrently. Even if the CPUs don't scale perfectly, we have an 'embarrassment of riches' in compute power. If they scaled at only 60%—and they do much better than that—we effectively have access to over 100 GHz of CPU power. Frankly, we would have been disappointed if we hadn't been able to put up these kinds of I/O numbers with a 100 GHz CPU." Efficiency is king, and DataCore's price/performance is the result.

The Bigger Truth

Until recently, applications, and the businesses they serve, were bound by the limits of the infrastructure deployed. The advent of SDS creates an opportunity for the industry to change this restriction. That being said, some SDS providers simply seek to take the same capabilities found in their traditional SAN or NAS arrays and deliver those capabilities as a software-only package. While these solutions may provide some benefits to flexibility and hardware choice, they are limited in the potential they can achieve. For DataCore, the goal is for the infrastructure to adapt to the applications' demands, instead of the other way around. Ultimately, that is a fundamental goal in the promise of SDS technology.

Adaptability alone, however, is not enough. Efficiency is required to keep costs under control in an era of ever-increasing levels in the amount of data being stored and of the value being placed on that data. By offering parallel I/O software the ability to fully harness the capabilities of previously neglected cores of processing power, DataCore is able to serve the data demands of the business with fewer systems, resulting in lowered cost, less complexity, and greater opportunity.

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