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Bringing an End to Storage Waste

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New Storage Technologies and Maturing Storage System Software are Creating Unprecedented Storage Efficiencies While Driving Significant Reductions in Ongoing OPEX Storage Costs

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Executive Summary

Organizations are now fully on-board with Green IT. Driven by new corporate social responsibility concerns, existing and looming regulations and the almighty dollar, they now fully recognize the value that Green IT can deliver.

In that vein, many are actively looking for new ways to minimize waste out of their environment and corporate data centers are squarely in their sights. Years of overspending on hardware and software have resulted in crowded data centers, inefficient and underused equipment and electricity bills that consume as much as 90% of the IT budget in some organizations. To try to bring an end to these levels of waste, server virtualization is now viewed as a key initiative as it simultaneously addresses many of these issues.

But an area that organizations are overlooking is the new storage waste that server virtualization is inadvertently creating. High SAN attach rates of virtual servers are resulting in the introduction of purpose-built storage systems that introduce the inefficiencies and waste associated with these systems.

This paper will examine:

- The five ways storage waste is persisting and growing in the midst of Green IT initiatives.
- Why the purpose-built storage systems that many organizations know best are the wrong solution for this new application-centric, distributed, virtual computing model that organizations are creating.
- How the design and features found in modular storage systems deliver the new storage efficiencies, support the application requirements and meet the time and budget constraints that organizations now face.
- Why modular storage systems are ready for production deployments.
- How the Pillar Data Systems Axiom modular storage system delivers on these requirements.

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Green IT is Winning but Storage Waste Persists

The benefits of adopting Green IT technologies are no longer up for debate. As organizations accept more responsibility for preserving and protecting the environment; seek to do business globally; and meet the challenges of one of the tightest economic environments in decades, they are discovering that Green IT is good.

Recent studies and surveys reveal that organizations are being driven to adopt Green IT for the following three main reasons:

- **Corporate social responsibility (CSR).** Companies like Alcatel-Lucent have made CSR an essential and publicized aspect of its overall business strategy. Alcatel-Lucent views CSR as critical to building a stronger business and vital to its long-term success. Alcatel-Lucent's CEO, Ben Verwaayen, states, "They (our stakeholders) are increasingly asking us tough questions, challenging us to reduce the energy used by our products and promote CSR values in everything we do."
- **Federal and international regulation.** The impact that energy efficiency and CSR regulations have on a company will heavily depend on where it conducts business. Organizations operating in Europe already must comply with the Restriction of Hazardous Substance (RoHS) act that took effect in July 1, 2006, with full enforcement to occur in 2010.

Similar changes are afoot in the United States. The US Environmental Protection Agency (EPA) was commissioned under Public Law 109-431 to study the rapid growth and energy consumption of computer data centers by the Federal Government and private enterprise.

This has already resulted in a new Energy Star rating for computer servers.

- **Reduced energy costs.** A May 2009 report conducted by Applied Research found that among the 426 organizations it surveyed in North America, 90% of these organizations spent 6% or more of their data center budget on electricity and 19% of them spent over half of their data center budgets on electricity. These growing energy costs led to over 90% of the organizations surveyed to list reducing energy consumption and cooling costs as their two main reasons for implementing Green IT.

Already we are seeing the results of these Green IT initiatives in the form of the accelerated adoption of server virtualization in these organizations. But as they adopt server virtualization and look to reduce their server hardware footprints, they are failing to adequately analyze the storage infrastructure that they are putting behind their newly virtualized servers. This results in the creation of new levels of waste that organizations are not even aware of, adding both visible and hidden costs.

Five Ways Storage Waste Persists in the Midst of Green IT Initiatives

The heightened focus on server virtualization and the Green IT benefits that it provides are leaving organizations with only a partial picture of the scope to which they can achieve data center efficiencies. While Green IT initiatives such as server virtualization are having very positive effects in creating new data center efficiencies, the attach rates of virtual servers to SANs are extraordinarily high, up to 70% according to some estimates.

Purpose-built Storage Systems Built for an Earlier Era

Purpose-built storage systems were architected during a time when organizations managed computer systems that were also purpose-built. The designs of these storage systems originated in the mainframe computing model, with subsequent generations and derivatives of these being very similar architecturally.

While these storage system architectures made sense when they were developed, the world of computing has fundamentally changed. Organizations now manage infrastructures that contain dozens, hundreds or even thousands of computer systems (physical and virtual) that demand storage systems with different capacity needs, performance characteristics, price points and scaling requirements.

Because purpose-built storage systems are unable to economically adapt to these demands, organizations purchase multiple storage systems, resulting in a proliferation of "specialized" storage systems. Some are intended for high performance. Some provide high capacity. Some provide file system interfaces. The end result is that even as organizations are solving their server hardware problems through virtualization, they are creating equally vexing storage hardware problems.



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This is prompting these same organizations to bring in purpose-built storage systems that are based on decades-old architectures. Unfortunately these systems are not always well suited for today's application-centric, distributed, virtual computing models. These purpose-built storage systems may only create new inefficiencies, wasting and undoing that the rewards of their Green IT initiatives.

Five ways in which organizations are wasting their resources when purchasing purpose-built storage systems include:

- **Engineering Waste.** Purpose-built storage systems were developed under the assumption that they would be directly attached to one or only a limited number of computer systems that had comparable workloads. Today's enterprise distributed environments bare no resemblance to this model. When organizations deploy purpose-built storage systems into distributed computing environments, it creates a number of unanticipated problems for the architects and engineers that manage them.

Not only do they have to manage multiple endpoints which add no real value to the business, but they are frequently forced to make compromises and choices that create new risks and costs for the business. For instance, if an application immediately needs more storage capacity and may need performance, on what purpose-built storage system do they assign the application? All they can do is make educated guesses that are usually heavily influenced by the organization's budget, culture and tolerance for risks and wrong guesses.

Key Takeaway: Organizations waste their engineering staff resources as they attempt to manage the placement and optimization of application data on purpose-built storage systems.

- **Financial Waste.** Organizations tend to pay a premium for name brand purpose-built storage systems because of the security they theoretically provide. Organizations assume they will get better equipment, better support and ultimately better solutions. However, organizations are realizing all they get in return for these assumptions is a larger invoice; they can end up paying two to four times more than they would for a storage system from a lesser known provider.

Over the last decade, most storage system providers have begun building their systems using third party components. This has resulted in purpose-built storage systems that only differ from one another in negligible

ways and has created what is largely a level playing field with the only difference being price.

Key Takeaway: Organizations only buying storage from name-brand providers are wasting money on systems when lower cost storage systems that provide the same or more functionality are available.

- **Scaling Waste.** During periods of normal or accelerated economic growth, storage growth can occur at annual rates of 50, 70 or even 100% or more. But even during economic downturns storage growth still occurs in the range of 20–40%.

Here again, organizations run into problems as they cannot scale purpose-built storage systems and have to buy more systems. This results in them purchasing not just additional storage capacity or performance, but more storage controllers, more cabling and more storage capacity that in turn requires more cooling, more power and more software licenses.

Key Takeaway: Organizations waste money on cabling, cooling, floor space, power and software for incremental increases in storage system capacity or performance.

- **Storage waste.** Organizations require both availability and performance from their storage systems, and are often willing to overlook some storage waste in order to achieve this. Part of this willingness to forgive storage waste is driven by the tremendous improvements in technology that have resulted in huge increases in drive capacity densities but not in I/O speed increases for applications.

This imbalance is prompting organizations to throw hardware (i.e. hard drives) at their I/O problem which adversely impacts storage system utilization thereby wasting capital on the added storage capacity and often times not satisfactorily resolving the I/O problem.

Key Takeaway: Inefficient file systems and antiquated approaches to volume management on purpose built storage systems result in organizations wasting money on unneeded storage that may not even solve their underlying application problems.

- **Support waste.** Replacing parts and components on purpose-built storage systems can be a complicated process requiring trained engineers to perform, even for routine maintenance such as hard drive replacement or firmware upgrades. Since many organizations do not want the risk associated with these types of changes or



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do not have staff trained to perform them, they purchase expensive maintenance contracts from the vendor, who then handles these tasks.

However, even then their problems are not solved. Organizations still require administrators to open trouble tickets, schedule time for engineers to come onsite, oversee the fixes and replacements and then notify affected parties that the change was completed. Depending on how many storage systems an enterprise shop is managing, just this job of managing maintenance on multiple storage systems can become a full-time position.

While maintenance contracts are never going to go away, if storage systems were easier to administer and manage, organizations would have the option to perform these tasks internally. This would prove to be more cost effective and time efficient, avoiding the need to contract routine maintenance services to third parties.

Key Takeaway: Organizations routinely waste dollars and staff time managing support contracts that offer storage system maintenance that they should have the option of doing themselves.

The New Era of Modular Storage

The five ways in which purpose-built storage systems waste corporate resources reinforce why a major change in storage systems is imminent. In fact, if one needs any

further evidence that such a change is in the works, one only needs to look at the most recent Q32009 sales results from the major purpose-built storage system providers. They are seeing sizeable drops in storage sales as their customers start to turn their backs on systems that cost too much and fail to meet their current and anticipated needs.

These results stand in stark contrast to the sales of a new breed of storage system that are generating increased interest from customers who are awakening to the fact that the computing world has permanently changed. These sales trends as much as anything mark the beginning of the end of storage waste and a new era where modular storage systems with the following characteristics begin to prevail.

- **Modular Design.** Modular storage systems are as important to today's virtual, distributed, application-centric computing models as purpose-built storage systems were to yesterday's purpose-built computer systems. Modular storage systems scale capacity and processing more dynamically, easily and economically with more options than purpose-built storage systems.

A major benefit that this provides is the ability to add and even intermix different tiers of storage and processing power in the same modular storage system to accommodate different cost constraints and processing loads that organizations are sure to encounter. This freedom to intermix different components enables more economical redundancy of components, simplified replacements for parts and upgrade paths for existing systems.

The "Safe" Storage Choice is Now Modular

Organizations sometimes feel obligated to stay with name brand, traditional solutions because they are perceived as "safe". However one only has to look at the number of storage system acquisitions that name brand storage vendors have made in the last few years to know that they do not have the right solutions in house for the emerging requirements that organizations now have.

It also serves to illustrate that features on modular storage systems are well beyond the "conceptual", "untested" or "running in beta" stages. Many of these modular storage systems now have up to a decade of experience of running in real world production environments with hundreds if not thousands of customers using these systems. These years of experience has resulted in feature sets and firmware code that can be appropriately classified as mature.

This maturity coupled with the new pressures that organizations face are bringing them face-to-face with the many benefits and features that modular storage systems offer over purpose-built storage systems. Lower upfront storage costs, improved operational efficiencies, environmentally friendly options, enterprise storage system features, appropriate levels of performance, and consolidated, simplified storage management interfaces make it impossible for organizations to ignore these storage systems any longer.

So as organizations weigh the choice between purpose-built and modular storage systems, it should quickly become evident that it is the modular storage system design, not the purpose-built one, that is really the safe choice.



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- **Unified Storage.** Almost every application server in some way uses networked storage. However, cost and performance constraints for application servers vary. Some require high performance, block storage requirements while others only require LAN connections for file sharing. Many servers require both.

New modular storage systems build in support for both block and file networked storage connections in a single storage system. By combining both of these interfaces into a single system alleviates the need for company to purchase separate purpose-built storage systems while accessing and sharing available storage capacity between the two interfaces.

- **Intelligent Storage Systems.** Organizations do not have the time, staff or expertise to consistently configure and manage storage to meet the specific and changing needs of their many applications. New modular storage systems incorporate automated storage tiering so data is placed on the appropriate tier of storage according to the specific needs of the application.

To accomplish this, storage systems need some level of application awareness of which two methods are commonly deployed; data placement based on usage patterns of the past; or, the use of policies to pre-stage data on the appropriate tier of storage to meet future application needs. Of the two options, policy driven storage tiering may turn out to be the preferred method longer term. Using this option, the storage system can position the data in anticipation of application requirements plus it allows for the creation of specialized policies; such as wide striping that optimizes performance for applications like Oracle.

- **Advanced Storage Management Features.** Advanced storage management features are now readily available on modular storage systems. Clones, snapshots, thin provisioning and path management software for load balancing and path failover are just some examples of features that should be viewed as expected on these systems.
- **High Availability, Capacity and Performance.** Solid state drives (SSD) that deliver high I/Os per second coupled with the continued growth of SATA hard drives that offer high storage capacity at low price points, give organizations the option to configure modular storage systems however they choose. They can configure them as high performance systems, high capacity systems or use some mix of both with data optimally placed on the appropriate drive tier by the storage system software.

Their modular design also supports the economical introduction of high availability into these systems since their controllers are made of inexpensive components. This makes the deployment of controllers in pairs both economical and feasible to achieve.

This combination of features that modular storage systems now possess makes them well-suited to meet today's new pressures of CSR, the rising tide of regulation and corporate directives to rein in data center energy costs. Their high availability, capacity and performance, operationally efficient designs, scalable architectures and flexible price points are all there for those organizations willing to look beyond the obvious. The remaining trick is for organizations to identify the right modular storage system that can deliver on all of these features while consolidating multiple application workloads onto a single platform.

Pillar Axiom Designed to Bring an End to Storage Waste

The Pillar Data Systems Axiom is a prime example of a modular storage system that has matured tremendously since its introduction in the fall of 2001. Since its initial product launch in New York City (which I had the opportunity to attend and witness), its focus has been and continues to be on bringing an end to storage waste and creating a modular storage system that meets these new organizational storage system requirements.

The Axiom is a storage system with nearly a decade of field experience, investment, and research behind it and during that time has gained the maturity and breadth of hardware and software features that organizations are demanding to meet today's new storage requirements. While other modular storage system providers are also chiming in on this message, the Axiom and its AxiomOne™ storage management software have differentiated themselves with the following features:

- **Distributed RAID.** The Axiom distributes data across drives in its different Axiom Brick Storage Enclosures according to preset policies. This distributed RAID design has the net effect of increasing the availability, performance, recoverability and resiliency of the Axiom without compromising the integrity of the data it contains.
- **Application-Aware Storage Profiles.** This feature is truly one that sets Pillar apart from the crowd. Applications often have their own capacity and performance



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characteristics. Using Pillar, organizations can assign application-specific profiles to these applications so each application is assigned the appropriate tier of performance and capacity. Pillar already has Application-aware storage profiles available for disk-to-disk backup, deduplication, Microsoft Server Exchange, Oracle and VMware.

- **Modular Architecture.** The Pillar Axiom provides the freedom to build the type of storage system that an organization wants or needs. Its Axiom Brick Storage Enclosures support SSD, Serial ATA and Fibre Channel drives that can be mixed and matched within a single Pillar Axiom system. Policies can then be applied using the Pillar Pilot Policy Controller that controls what data resides on each storage tier. The Pillar Slammer Storage Controller completes the picture by providing dual active/active data movement and management with both NAS and SAN interfaces that access and share the same backend pool of storage. This gives organizations the flexibility to build a higher performing but most costly storage system, a lower cost, higher capacity system or a storage system that delivers a mix of each.
- **Storage Utilization Guarantee.** Pillar's Distributed RAID creates new efficiencies not possible with traditional RAID architectures. This design enables them to use up

to 80% of the available storage capacity on its systems and make storage utilization guarantees that come without many of the qualifiers and conditions that its competitors impose on their customers.

- **Automated Tiering using Pillar's Quality of Service (QoS).** In addition to tiering storage capacity, Pillar also tiers cache and CPU using its QoS feature that is included with its AxiomOne Storage Management software. It provides five services that throttle service up or down for applications as they need it and as system resources become available or are consumed.

Wasting time, money, power and resources on storage and storage management are luxuries that organizations can ill-afford when they are placing a premium on efficiencies across the board. Current Green IT initiatives such as server virtualization are laser focused on eliminating these types of waste but in the process may be introducing new waste into their storage environment.

The Pillar Axiom offers a means for organizations to avoid this scenario. Its combination of storage hardware and software features provide a comprehensive solution for those organizations ready to bury their wasteful ways of the past and create a new future where server and storage efficiencies are inextricably intertwined.

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