Data center resources have traditionally been underutilized while drawing enormous amounts of power and taking up valuable floorspace. Virtualization has been a positive evolutionary step in the data center, driving consolidation of these resources to maximize utilization and power savings, as well as to simplify management and maintenance.

There are many entrants into the server virtualization market, including VMWare, Microsoft, Oracle, Citrix, and others; so there is a good chance that you are either running virtualization in a test or development capacity or have taken the leap toward a production virtualized data center. With all of the benefits of virtualization comes a wholesale change in the way that you must plan for backup, restore, and recovery. It is important that when planning consolidation projects, these important business-continuance applications are considered, as well as the type of storage needed to host them.

**The Zen of Storage Maintenance (in a virtualized datacenter)**

Consolidation projects large and small seem to focus on the server and the application. This makes sense, because these projects are often justified by capital and operational expenditure (CAPEX and OPEX) cost savings and in giving appropriate resources to the most business critical applications. Storage has taken a back seat in these projects because most IT managers think of a LUN as a commodity. A LUN from a SAN-attached array hasn’t changed in decades, and they are all treated equally by the array. Most virtualization software will simply place their files on the LUN or make some kind of raw access meta-data file, so this makes tuning the array for virtualization pointless. According to the best-practices guides from many virtualization vendors, the value of write cache, read-ahead, and all the value add of the high end array go out the window.

But what if there was a way to provision your storage the way you provision your virtualized servers? This way, you could assign array resources (CPU, cache, and disk) based on the applications that will be using them. This would improve the array’s value by greatly increasing its utilization as well as increasing the performance of the applications that run on it. The result would be better server consolidation, resulting in cost savings – and isn’t that what this project is all about?

**Application-Aware Storage**

The Pillar Axiom® is the first storage array that is truly application-aware. It is tuned both automatically and by the administrator for the applications that utilize the array on a file system and LUN level. How does this improve overall system utilization and virtual machine (VM) performance?
With the Pillar Axiom, you gain performance by provisioning your array as you do your VM, assigning resources based on application importance. The Axiom will treat I/O from your provisioned application with a greater priority, giving it more cache and faster spindles than other applications that you have deemed to be less critical to the business. But getting the best value out of the application-aware Pillar Axiom means going against the best practices guides of most virtualization software companies which will suggest that you assign many virtual machines on a single LUN (as individual files, in most cases). Although this seems like a good idea, it actually has an adverse affect both on utilization and on performance due to the issue of capacity vs. spindles.

Let's look at an average scenario: a standard mid-tier array with 300GB of 10K RPM fibre channel drives in a recommended RAID 5 4+1 configuration. This configuration will net about 1.2TB of usable capacity, which seems adequate since most VM software has a 2.0TB limit. But how many VMs will fit on this 1.2TB LUN? Five, ten, twenty – or more? This is what Pillar refers to as a stacked array, where one or multiple physical or virtual LUNs are striped across a RAID group, as shown in the illustration below. You may be working with only five spindles, yet you have up to 20 machines accessing that RAID group. No matter what the individual I/O profile looks like for a single server, the array will see 100% pure random I/O, which is why the write-cache gets overloaded and read-ahead caches become mostly useless.

So what is the solution? Adding more spindles won’t improve matters, because your LUNs will get larger as you add more spindles. Although virtual LUNs will help, they won’t help enough to mitigate the pure random I/O that your array will see. The solution is application-aware storage.

The application-aware Pillar Axiom has a rich feature set that mitigates each of these issues which, in turn, improves VM performance, increases array utilization, and provides for much greater VM consolidation.

Let’s return to the scenario above with the LUN using a RAID 5 4+1 configuration. Although the Pillar Axiom supports RAID 5, each LUN, no matter how large or small will get striped across four RAID-5 disk groups, which increases the spindle count to at least 24 disks. Now that we have more spindles to work with, we need to differentiate the performance of the individual LUNs and tie them to their respective VMs running individual applications.

The administrator assigns resources on the server by virtue of CPU, memory, and network, however on the Axiom the administrator will either use a pre-existing profile for their application or create a custom profile based on CPU, cache, and disk layout (fibre channel or SATA). This will map them to the individual VM as either a single VMDK (virtual machine disk format) or RDM (raw device mapping) (using VMware terminology as an example). No stacking VMDKs on a single LUN using this approach, Pillar will take care of this aspect so as to keep the random I/O random, and the sequential I/O sequential to take advantage of the write-cache and read-ahead array functions.
The result is an array that shows the same resource preferences as your servers. This improves performance for the applications to which you assigned greater server resources, while not punishing the workload from other applications. This inherently drives greater array utilization and Pillar has found that it also increases the amount of VMs that can be placed on a physical server by reducing or eliminating the fibre channel I/O bottleneck in high-end consolidation projects.

### Backup (Restore sold separately)

For the past twenty years in open systems IT backup strategy, reducing the backup window has been a primary focus of backup administrators. As the cost of disk space decreased and the need for speed became greater, some technologies such as virtual tape entered the scene from the mainframe world. The need for a reduced backup window played a large role in the proliferation of SANs as the concept of LAN-free backup using 1, 2, or 4Gbps fibre channel sped up the backup process without impacting the front end, user facing, Ethernet interfaces of the servers.

With virtualization, the concept of backup windows has mostly disappeared. LAN-free backup is still a good idea, and most virtualization software vendors prefer to use network-based storage to support their inherently clustered file systems. But because most virtualization software supports file-system quiesced snapshot capabilities, the need for a backup window becomes moot. And with LAN-free SAN-attached backups you can easily access SAN-attached tape libraries.
But what about your company’s investment in existing backup technologies such as virtual tape or disk-based backup systems? Technologies such as deduplicated archives are becoming prevalent in the new virtualized data center. As shown in the figure below, deduplicated archive overlaps directly with virtual tape libraries (VTL) and tape, allowing you to store deduplicated data on disk in perpetuity without the need to migrate from one tape format to another as technology evolves. For further explanation of the illustration below, schedule a briefing with your Pillar Data Systems sales team.

### Restore

Restoring data to a server tends to be one of the scariest tasks for an IT manager. When disaster strikes and a restoration is needed, he must locate the data and then hope that it will restore reliably, quickly, and without interrupting data availability on the system. The chart above goes over a plethora of backup options, each with their own recovery point and time objective (RPO and RTO) benefits. Add to this the new dimension that a newly-virtualized datacenter brings with it to recovering a file, a directory, a record, a transaction, an email, and a whole server.

When making investment decisions for your backup and restoration infrastructure, it all comes down to how much data you are willing to lose, how quickly you want to restore, and how much money you are willing to spend. But notice that you don’t have to spend a lot to get quick recovery from a mixture of continuous data protection (CDP) recycled every 4 hours, array-based snapshots using Remote Deployment Manager, and DeDup. These three technologies will enable your environment to have 100% restore capability very quickly – on the order of seconds – with absolutely no tape. And for Sarbanes-Oxley compliance, you can replicate the DeDup archive to a secondary site.
Application-Aware Consolidated Archive

Due to Pillar Axiom’s application-aware nature, it also makes for an exceptional consolidated archive target. By provisioning Axiom’s capabilities toward storing CDP transactions, deduplicated backups, email archive, and retention; the Axiom can differentiate services to these various backup applications and provide them with the performance they need to operate efficiently. By supporting both Secure WORMfs and SAN in the same system, the Axiom can serve as a target for email retention for regulatory and discovery compliance along with handling all of the aforementioned recovery options.

The illustration below shows the Axiom as the enterprise consolidated archive target in this type of environment.

Summary: Keeping the Data in the Data Center

Particularly in a virtualized data center, consolidating DAS, NAS, SAN, and other disparate storage resources onto a networked storage pool can go a long way toward improving efficiencies. Consolidating storage on the heterogeneous, application-aware Pillar Axiom not only holds the pooled storage on an east-to-access platform, but it allows for all management and maintenance to be performed through a single interface, greatly reducing management effort and cost.

With the highest utilization rate in the industry – up to 80% higher than average, and with the lowest power and space consumption per GB of storage, the Pillar Axiom is fast becoming the storage system of choice for the virtualized data center.

Pillar Data Systems takes a sensible, customer-centric approach to networked storage. We started with a simple, yet powerful idea: Build a successful storage company by creating value that others had promised, but never produced. At Pillar, we’re on a mission to deliver the most cost-effective, highly available networked storage solutions on the market. We build reliable, flexible solutions that, for the first time, seamlessly unite SAN with NAS and enable multiple tiers of storage on a single platform. In the end, we created an entirely new class of storage.

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