

WHITEPAPER

Thin Provisioning with the Pillar Axiom

Operational Efficiency in the Data Center

As IT organizations work to maintain application availability while controlling costs, a greater emphasis on operational efficiency is essential. One key area where operational efficiencies can be achieved is in the storage infrastructure. Traditional storage systems are inherently inefficient, with multiple arrays of dedicated storage and various management points. Thin provisioning is now recognized in the industry as a critical approach to simplifying storage management while drastically improving capacity utilization. Additionally, the ability to defer system and capacity purchases results in less frequent and higher utility capital expenditures.

In traditional systems, when storage is allocated to a particular application, the volume is “claimed” for sole use by that application. This prevents other applications or users from accessing this capacity – even if the amount allocated is never actually used. As a result, the array may only have half its capacity physically written to, but because of the allocation, the capacity is “stranded” and cannot be leveraged in support of additional requirements. When this occurs, a new storage system may need to be purchased. This is far more costly than simply adding physical capacity to an existing system.

Storage forecasting is another victim of inefficient traditional storage infrastructures. Storage administrators must attempt to accurately forecast the future utilization associated with each given application or customer requirement. This difficult, time consuming task often results in over-provisioning of capacity when a new application is brought online, or even worse, too little capacity is allocated and an application must be taken down to correct the condition.

The costs associated with these traditional practices are significant. Many organizations will purchase more storage than necessary at initial deployment, the storage allocated is grossly underutilized, and valuable administration cycles are spent managing the environment. Also, the power and floor space expense resulting from the operation of larger or additional arrays is not insignificant.

Thin provisioning mitigates these issues by allowing administrators to allocate storage based on future need and drawing upon a common pool of storage as capacity is physically consumed. With thin provisioning, an administrator creates a LUN or file system of any size without committing the physical capacity at the time of creation. This reduces the amount of physical disk necessary to support a given workload. Each user or application has what appears to be all the storage necessary for ongoing operations, but without the physical capacity locked to a particular volume. As actual used capacity grows toward the limit of physical capacity, more can be added without leaving a portion “stranded.”

Thin Provisioning Benefits:

- Higher utilization rates in that several applications can draw upon a single pool of physical capacity
- Ease of provisioning and management since new volumes no longer require large amounts of physical space at inception
- Lower capital expenditures, as incremental system capacity is added to the general storage pool as needed, but without being tied to a single host.

Pillar's Approach to Thin Provisioning

Pillar recognizes the value of thin provisioning and has taken these inherent benefits one step further by introducing a smarter approach with the Application-Aware Pillar Axiom®. No other thin provisioning vendor provides the ability to consolidate multiple applications in a single, multi-tenancy array while allowing administrators to assign a dynamic quality of service to each volume.

In other systems with thin provisioning in place, a common pool of generic, physical storage backs each volume. This creates a situation where each supported application draws upon a pool of storage with one performance profile, drive type, or connectivity method. All data and associated applications are treated equally at the physical storage layer and the characteristics of the storage are not matched to the unique needs of each application. In this case, mission-critical databases receive the same priority as archive files.

The Pillar Axiom allows you to provide thinly provisioned file systems and LUNs with characteristics appropriate to support each unique application – all on a single consolidated storage system. Each application-aware volume is automatically tuned for drive type (SATA and fibre channel) and connectivity method (NAS, SAN, or iSCSI), along with specific performance and capacity attributes. Pillar's thin provisioning works identically for LUNs and file systems.

One of the major advantages of Axiom's thin provisioning relates to management efficiency. In the past, storage administrators and DBAs spent hours forecasting how much storage was required for an application initially and over multiple years of growth. Experience has taught us that this is virtually impossible to estimate accurately. As a result, administrators were forced to make a "best guess" estimate and then would double or triple it to allow for a cushion, result in capital expenditures of far more capacity than was initially required. Initially, storage vendors responded to this issue by providing the ability to increase the size of a LUN when needed. Unfortunately many operating systems (OS) could not recognize the larger LUN, or the applications would have to be taken offline to see the new capacity. Once the capacity was recognized by the OS, the file systems would then need to be expanded, causing more downtime. An OS that could not recognize the larger LUN would require much longer downtime to add capacity.

With Pillar's thin provisioning, administrators can create LUNs up to the maximum size allowed for the OS with little or no physical storage assigned to the LUN. This way, as capacity needs grow, there is no administrative overhead to increase the LUN, no application down time, and the ongoing management interaction is greatly reduced. As data is written to the thinly provisioned LUN and physical capacity is consumed, additional physical capacity will be allocated to the LUN or file system automatically in increments defined by the storage administrator.

Application-aware thin provisioning reinforces the Pillar Axiom's ability to drive storage efficiency in the following ways:

Storage Consolidation

- Each thinly provisioned volume is optimized through data placement and access prioritization. Pillar's unique approach to application-aware storage allows administrators to assign a quality of service to these optimized volumes, allowing for mixed workloads on a single system and directing performance based on application importance. Each application is supported by an appropriate storage service level from within a single virtualized storage pool.
- Axiom's ability to consolidate multiple storage functions into a single array has proven to drastically increase storage utilization, but at a much lower level of capital spending. Pillar customers on average, utilize 62% of their existing capacity and often reach over 80% utilization—compared to an estimated industry average of only 40% of capacity allocated or utilized.

Modular Scalability

- Pillar provides for easy, granular scaling as physical storage is consumed without disruption or reconfiguration. This makes the Axiom a more efficient storage system with lower energy and space costs. Also, when additional storage is needed for thinly provisioned systems, the Axiom automatically adds capacity to the system's single pool of storage while maintaining the quality of service previously assigned to thinly provisioned volumes.
- Pillar combines thin provisioning with application-aware storage to deliver industry leading utilization rates while maintaining consistent performance. Other solutions are hindered by the availability of only two RAID controllers, their inability to control data placement and the inability to easily manage resources. This prevents other systems from delivering consistent performance as capacity is increased. Also, Pillar improves SATA drive performance to rival that of some fibre channel drives, allowing storage administrators to gain high utilization without sacrificing performance and without paying for expensive drives. This is impossible with traditional storage technologies.

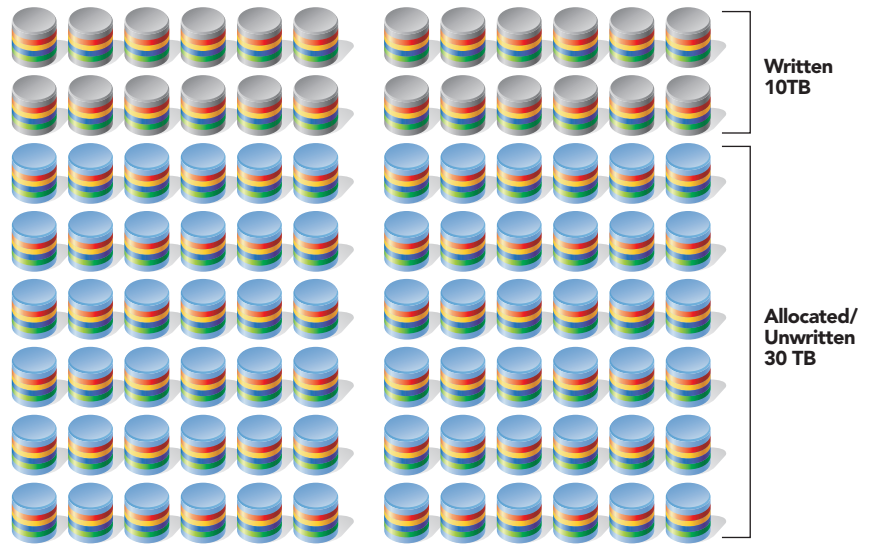
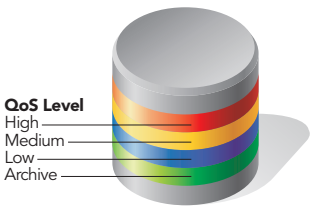
Simplified Management

- Administrators can provision larger LUNs at inception, with reduced management interaction needed to increase the size of the LUN or the usual application downtime.
- Leveraging Axiom's "call home" functionality and system notifications, the risk of unexpectedly running out of physical capacity is virtually eliminated. Also, Pillar Axiom was designed for easy, guided maintenance along with customer-replaceable components.
- An intuitive provisioning tool facilitates the creation of each thin file system or LUN in only six clicks with predictive performance for five levels of service before the volume is created.

Example

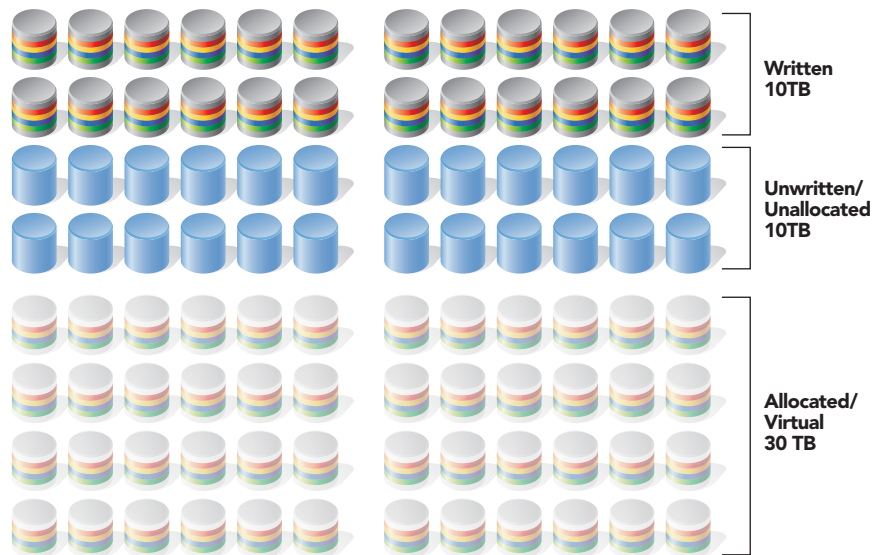
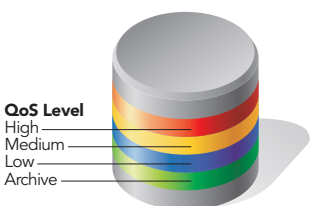
Consider an example where a customer needs twenty 2TB LUNs in support of several applications. In normal provisioning with the Pillar Axiom, LUNs are spread across a disk group that consists of six drives. In this example, the customer has four different LUNs, each with a unique quality of service (Figure 1). Pillar drives higher utilization levels by leveraging all sectors of a drive, delivering the appropriate level of performance for each LUN. In the illustration in Figure 1, each LUN has been allocated at three times the current required capacity to account for growth. This is illustrated with the blue disk group. Given operational requirements, this capacity may not be ever used and becomes “stranded.”

Figure 1.
Traditional Provisioning
 Physical Capacity: 40TB
 Written Capacity: 10TB
 Allocated Capacity: 30TB
 Utilization Rate: 20%



With Pillar’s smarter approach to thin provisioning, only 20TB is needed to support the same utilized capacity, with an additional 30TB of virtual capacity available as written – all while maintaining the same quality of service for each LUN as it grows (Figure 2).

Figure 2.
Thin Provisioning
 Physical Capacity: 20TB
 Written Capacity: 10TB
 Allocated Capacity: 30TB
 Utilization Rate: 50%



Thin provisioning in this example results in several benefits:

- Only a small amount of physical capacity is required to support the host applications and utilization has increased significantly.
- Costs are greatly reduced, as incremental capacity purchases are delayed and only executed as needed
- Capacity allocation per LUN is significantly higher, eliminating the need to accurately forecast the growth of each LUN
- The system draws from a common pool of un-allocated storage as needed, sharing the storage assets and growing in granular increments

Summary

Pillar is the only vendor that delivers an Application-Aware storage solution with thin provisioning and true quality of service that is configured at LUN or file system creation – not as a separate process. This delivers capacity utilization as much as two times the industry average, all while driving down solution complexity, simplifying management, and reducing acquisition and operation costs. With our complete quality of service functionality and our distributed RAID technology, The Pillar solution is the most complete and effective thin provisioning solution on the market.

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. www.pillardata.com

