



By Kevin Wittmer

HOW THIN PROVISIONING WITH DELL EQUALLOGIC iSCSI STORAGE ARRAYS SIMPLIFIES MANAGEMENT

Thin provisioning is designed to address the storage management and capacity planning challenges posed by fast-growing enterprise applications. This article explores how a thin provisioning strategy using Dell EqualLogic™ PS Series Internet SCSI (iSCSI) storage arrays can help increase storage utilization rates, improve staff productivity, and reduce costs.

Storage area networks (SANs) have greatly simplified the management of storage resources. By creating a centralized pool of storage resources that can be allocated as needed, organizations have often been able to reduce both management and capital costs. However, as the critical applications that organizations depend on for success continue to grow more quickly and less predictably than ever before, even the most capable IT teams may struggle to efficiently allocate storage resources and plan for future capacity needs.

To help meet these challenges, many organizations are turning to thin provisioning, a storage virtualization technology designed to simplify both storage management and capacity planning. Thin provisioning can help organizations increase utilization rates and improve staff productivity, which in turn can help reduce power consumption and overall storage provisioning costs. This article examines the concepts behind thin provisioning and how this approach directly addresses the storage management challenges that many organizations face. In addition, it explores how the advanced thin provisioning tools of Dell EqualLogic PS Series Internet SCSI (iSCSI) storage arrays can help IT managers execute

a thin provisioning strategy and increase the performance and efficiency of their storage resources.¹

CHALLENGES AND COSTS OF TRADITIONAL PROVISIONING

Today, organizations have more options and tools for storage management than ever before. SANs in particular help reduce maintenance and administration costs by enabling administrators to centralize and virtualize their storage resources. And yet for many enterprises, overall storage expenditures are still rising, even as the cost per gigabyte of hard disks continues to drop.

The skyrocketing capacity requirements of today's information-intensive organizations are driving increased demand for storage. However, it can be painful for IT decision makers to sign a purchase order for additional arrays when gigabytes or even terabytes of storage capacity may be going unused.

Underutilization of storage capacity is a significant problem that cuts across all industries. Figure 1 shows a common business situation, in which a significant portion of purchased storage is not in active use. Low storage utilization rates drive up both capital and maintenance costs. Underutilization is also an ongoing drag

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¹ For more information about Dell EqualLogic PS Series arrays, see "Inside the EqualLogic PS Series iSCSI Storage Arrays," by John Joseph, Eric Schott, and Kevin Wittmer, in *Dell Power Solutions*, February 2008, DELL.COM/Downloads/Global/Power/ps1q08-20080249-EqualLogic.pdf.

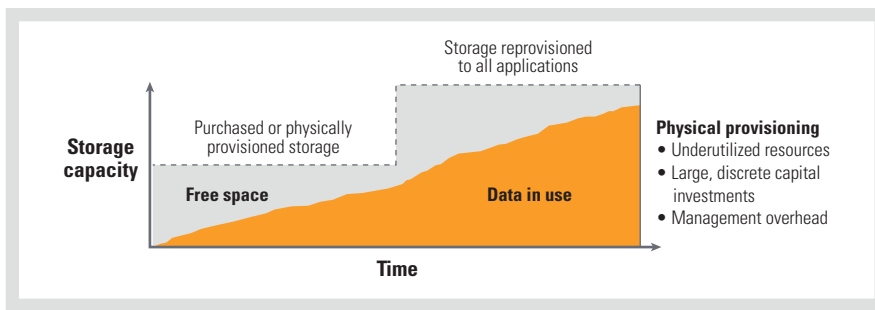


Figure 1. Comparing available capacity to actual use under traditional physical provisioning

on the bottom line when unused storage is kept constantly available—taking up real estate in the data center, consuming power, and increasing the load on data center cooling equipment. Finally, underutilization drives enterprises to purchase storage in large chunks before the business expands to fill the capacity. Assuming current price trends continue, 1 GB of storage will cost less in a year than it does today. As a result, acquiring storage capacity before it is actually needed may raise the total cost of ownership (TCO) of an organization’s storage infrastructure considerably.

How does so much unused storage space accumulate? The answer lies in a combination of technical and business pressures that lead organizations to overprovision, creating storage volumes larger than are immediately necessary.

On the business side, end users consistently ask for more space than they actually need. Excess space serves as a hedge against unexpected growth. Also, in many organizations it can be a successful strategy to ask for a single large chunk of capacity instead of filing a series of smaller requests, any one of which could be denied because of changing business priorities.

Overprovisioning is also an attractive strategy for IT administrators, notwithstanding the long-term costs it incurs. Despite advances in storage management tools, increasing the size of a volume that has already been allocated can be time-consuming and labor-intensive—and often results in downtime for the applications that depend on that volume. Providing

small slices of capacity on an as-needed basis also requires a labor-intensive administrative feedback loop through which business stakeholders can request and receive additional space in a timely manner. Instead, IT teams often allocate the entire amount of storage that will be needed over the lifetime of a given project, even if all of the storage is not needed at first.

THIN PROVISIONING MODEL

Thin provisioning is a model for automatically allocating physical storage resources as needed to address the root technical pressures behind overprovisioning—nearly eliminating the time IT administrators spend manually provisioning and allocating storage capacity to applications. Thin provisioning works with all applications—but is used optimally when an agreement can be made about storage consumption needs between the application administrator and the storage administrator—to ensure physical

storage is always available as needed. Thin provisioning can take storage virtualization to the next logical step.²

Currently, to allocate space on a SAN, an IT administrator creates a volume and makes it available to the server for which the storage is intended, along with its location and size. When an administrator defines a classic logical volume, the SAN controller responds by reserving physical space on the array of disk drives that it manages. Every byte of storage determined by the volume size is backed up with a physical location, whether it is used or not. Unused space is effectively wasted because it cannot be reclaimed for other volumes and applications.

Using thin provisioning, an administrator creates virtual logical volumes and assigns them to servers and applications. However, physical storage resources are only committed to the volumes when data is actually written to the storage space (see Figure 2 example). The storage that is not being used remains available for use by other volumes. Using this technique, the administrator can provision as many volumes as necessary in any size desired—each volume claims physical resources only when needed.

For example, imagine that an administrator must support three major applications. Each application is expected to eventually need 1 TB of storage, but is only likely to need 300 GB for the first year of

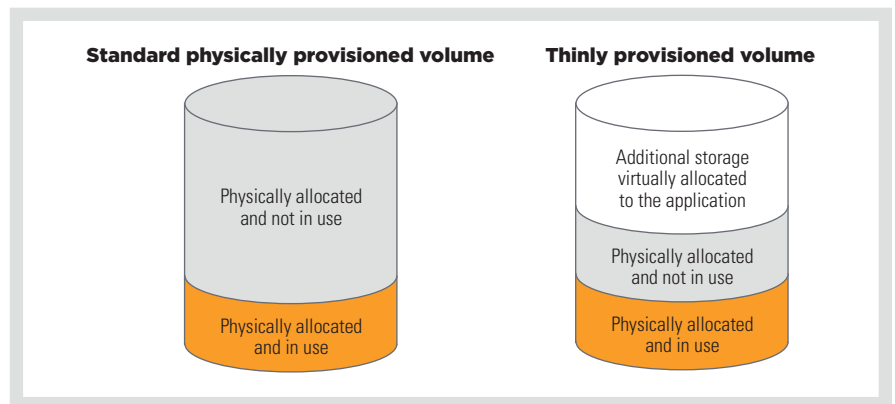


Figure 2. Committing storage resources with standard physical provisioning versus thin provisioning

² For more information about server and storage virtualization, see “Flexible Virtualization with EqualLogic PS Series iSCSI Storage Arrays,” by Timothy Sherbak, in *Dell Power Solutions*, February 2008, DELL.COM/Downloads/Global/Power/ps1q08-20080250-EqualLogic.pdf.

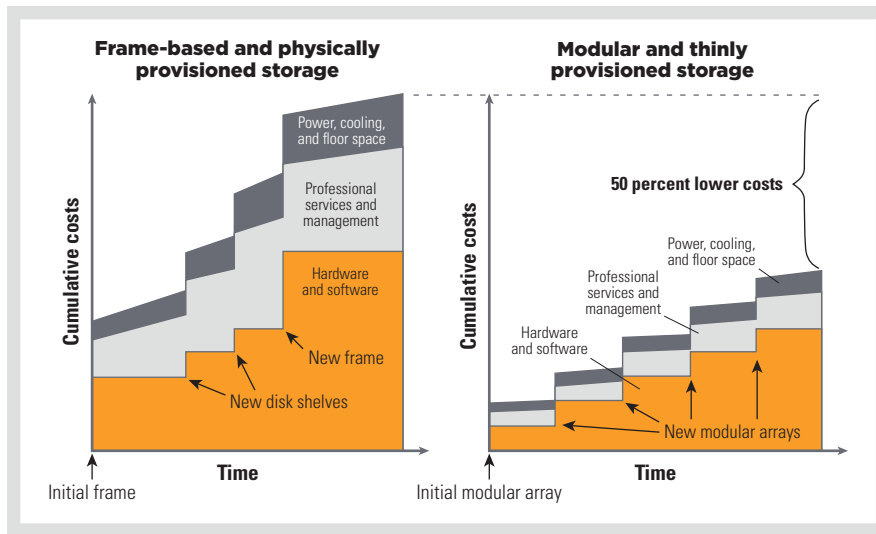


Figure 3. Avoiding cumulative costs with incremental resource allocations through thin provisioning

operation. Using physical provisioning, it is likely that the administrator would allocate a total of 3 TB of storage, even if it were not immediately needed. However, with thin provisioning, the administrator creates three 1 TB logical volumes, but needs to provide only enough physical storage to cover the space that the applications actually use between storage purchase cycles—whether those last three months, six months, or a year.

THIN PROVISIONING BENEFITS

Administrators can use thin provisioning to help increase the utilization of their organizations' storage resources. Given the modest utilization rates that are typical at many enterprises, even a moderate improvement can produce dramatic results. In the preceding example, the administrator could support the three applications for the first year with 1.5 TB of storage, which leaves considerable room for growth. This simple change could cut the number of hard disks needed by half or more, generating corresponding savings in power consumption and cooling. When the organization does need to acquire additional storage, it is possible that the devices will cost less per gigabyte, contributing to a reduction in TCO of the system in its final state. Adding the storage resources in increments also helps simplify budget allocations by allowing

organizations to make small incremental additions instead of large capital expenditures, enabling a just-in-time purchasing model (see Figure 3 example).

Thin provisioning helps simplify management and improve productivity because IT staff members need to monitor fewer storage devices than with physical provisioning. Also, thin provisioning helps reduce or eliminate time spent re-provisioning volumes to deal with changing storage requirements—which in turn enhances the productivity of end users, because minimized re-provisioning helps reduce server and application downtime.

ADVANTAGES OF DELL EQUALLOGIC PS SERIES ISCSI STORAGE ARRAYS

As organizations explore thin provisioning, Dell EqualLogic PS Series iSCSI storage arrays provide a cost-effective, flexible platform that helps maximize the benefits of the technology. Thin provisioning is a standard feature on PS Series arrays—no per-volume licenses are required. As a result, administrators are free to use the technology to tailor their IT infrastructure to meet the specific needs of their organization without incurring additional costs. PS Series arrays also offer administrators a high level of flexibility by supporting both thinly provisioned and physically provisioned volumes on the

same storage array. This approach allows administrators to cost-effectively test and determine the most appropriate strategy while preserving options to apply either the thin provisioning model or the physical provisioning model to a given volume—and back again. The PS Series also supports flexibility by offering administrators the ability to freely convert the provisioning type from physical to thin, or back, at any time.

Dell EqualLogic PS Series arrays include simple, powerful tools to help administrators manage their storage resources. To set up and manage thinly provisioned volumes, administrators simply define four parameters:


- **Volume size:** The logical size determined by the administrator based on the current and future maximum sizes needed by applications. This volume size can be increased in the same manner as traditional physically provisioned volumes.
- **Minimum volume reserve:** The smallest amount of storage that can be allocated to a thinly provisioned volume—generally 10 percent of the actual volume size.
- **In-use volume reserve warning level:** When the amount of physical storage used on the volume reaches this level, the PS Series group generates an alert.
- **Maximum in-use space:** The maximum amount of physical storage (as a percentage of the volume size) that the PS Series group allows the volume to use.

The PS Series management interface provides a simple graphical display that clearly depicts the parameters of thinly provisioned volumes and how these parameters relate to each other, enabling administrators to quickly and easily adjust the parameters. Once the essential parameters have been established, PS Series arrays automatically maintain the logical volumes, adding resources from the free storage pool as necessary.

Relieved from the labor-intensive work of provisioning and maintaining storage volumes, IT administrators can focus on

strategic management of their organizations' storage resources. PS Series iSCSI storage arrays feature a series of notification options that keep administrators apprised of available space levels, facilitating long-term capacity planning and alerting administrators to unusual usage patterns that might require tactical adjustments. The notifications are customizable, enabling administrators to tailor the level, frequency, and delivery method according to the needs of their organizations. When it does become necessary to add additional storage resources, the peer provisioning features of the PS Series make the process fast and easy.

PS Series storage arrays automatically act as a peer network, working together to balance loads and distribute data to maximize performance and data availability. When a new PS Series device is added to an existing infrastructure, no manual configuration is necessary. Dell EqualLogic peer provisioning management algorithms automatically recognize and configure the new device, adding it to the storage network, where it immediately begins to participate as a full peer.

Thin provisioning enables IT managers to reduce time spent maintaining individual storage volumes and increase time managing their storage environment and improving overall performance. Organizations can cut costs and enhance efficiency by enabling increased storage utilization and incremental storage investments in step with business growth. Dell EqualLogic PS Series iSCSI storage arrays provide IT administrators with simple tools for managing their thin provisioning implementation, while the peer provisioning features provide a deep, powerful foundation for a next-generation storage infrastructure. 

Kevin Wittmer leads product marketing for the Dell EqualLogic product family. He has more than 21 years of experience developing and bringing to market enterprise storage products. He is currently the vice chair for the Storage Networking Industry Association (SNIA) IP Storage Forum board of directors, and previously served on the board of directors for the SATA International Organization (SATA-IO). Kevin has a B.S. in Electrical Engineering from Rensselaer Polytechnic Institute and an M.S.E.E. and M.B.A. from Worcester Polytechnic Institute.



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