

# White Paper

---

## **The Business Value of Reservationless Storage**

*By Brian Garrett*

**November, 2009**

---

## Contents

Introduction .....	3
Background .....	3
Reservationless Storage .....	4
Snapshots .....	4
Thin Provisioning .....	5
Traditional vs. Reservationless Storage .....	5
HP Reservationless Storage .....	7
HP StorageWorks P4000 .....	7
HP StorageWorks SAN Virtualization Services Platform (SVSP) .....	8
HP StorageWorks Enterprise Virtual Arrays (EVA) .....	9
Quantifying the Business Value of Reservationless Storage .....	10
SMB Virtualization Enables Consolidation.....	10
SME Snapshots Improve Recoverability .....	10
Enterprise Tiered Storage Enhances Efficiency .....	10
The Results.....	11
The Bottom Line .....	12
The Bigger Truth .....	12

All trademark names are property of their respective companies. Information contained in this publication has been obtained by sources The Enterprise Strategy Group (ESG) considers to be reliable but is not warranted by ESG. This publication may contain opinions of ESG, which are subject to change from time to time. This publication is copyrighted by The Enterprise Strategy Group, Inc. Any reproduction or redistribution of this publication, in whole or in part, whether in hard-copy format, electronically, or otherwise to persons not authorized to receive it, without the express consent of the Enterprise Strategy Group, Inc., is in violation of U.S. copyright law and will be subject to an action for civil damages and, if applicable, criminal prosecution. Should you have any questions, please contact ESG Client Relations at (508) 482-0188. This ESG White Paper was developed with the assistance and funding of Hewlett Packard.

## Introduction

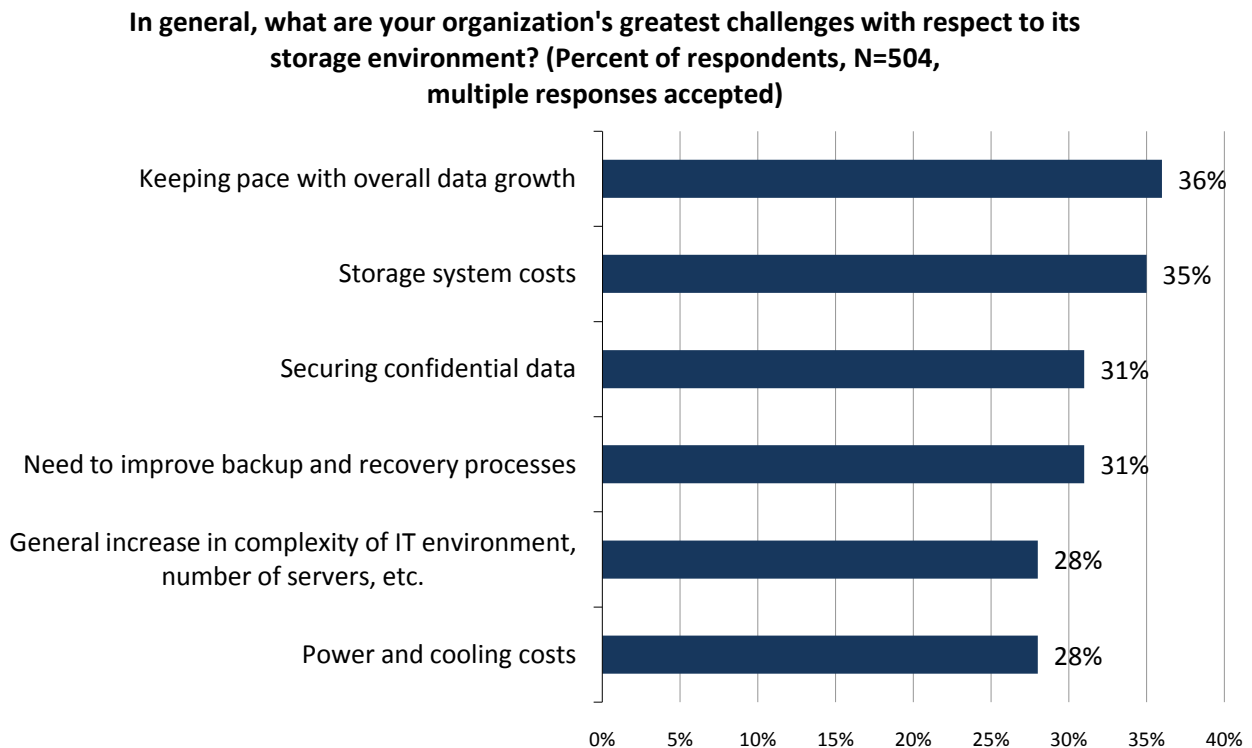
IT managers with increasingly-scarce budgets and resources are looking for products and services that can knock down the key barriers to true data center efficiency—such as unabated data growth, rising storage system costs, infrastructure complexity, and increasing power and cooling requirements. With these goals in mind, this report explores the value of some exciting new storage technologies which are collectively known as “reservationless storage.” ESG Lab hands-on testing of the HP StorageWorks product line and analysis are used to quantify the business value of reservationless storage.

## Background

For years, the cost and complexity of ever-growing stores of digital assets have been challenges for IT administrators. These concerns have been heightened more recently amid the sobering realities of the global economic downturn. As a matter of fact, a recent ESG survey of IT managers indicates that the top business initiative impacting storage spending over the next 24 months is an internal pressure to reduce the overall cost of doing business.<sup>1</sup> Enterprises that cite cost reduction as a major factor impacting storage spending report that findings ways to better manage storage capacity growth is their top storage-related initiative. IT managers are looking for clarity in how they are using existing capacity and methods which can be used to increase efficiency going forward.

Another recent ESG survey that explored the challenges facing enterprise-class organizations yielded similar results. As shown in Figure 1, keeping pace with overall data growth and the cost of storage systems are the biggest challenges in the storage environment.<sup>2</sup> Clearly, IT managers are looking for ways to reduce cost and complexity as they deal with ever-increasing storage capacity demands.

Figure 1. Storage Environment Challenges



Source: Enterprise Strategy Group, 2009.

<sup>1</sup>Source: ESG Research Report, *ESG 2008 Enterprise Storage Systems Survey*, November 2008.

<sup>2</sup>Source: ESG Research Brief, *Enterprise Storage Priorities Emphasize Information and Infrastructure Efficiency*, January 2009.

Reservationless storage was explicitly designed to help IT managers meet those challenges. Moreover, it was designed to address a number of additional challenges in the data center including:

- Budget constraints
- Manpower constraints
- Never-ending capacity growth
- Space, power, and cooling constraints
- Rising energy and facility costs

## **Reservationless Storage**

Most of us are familiar with the value of reservationless services in our daily lives. Consider, for example, how cell phone contracts have evolved in recent years. We used to have to sign up for a plan which reserved a certain number of minutes of cell phone usage each month. This was a frustrating and often costly exercise, especially for those of us with teenagers. If you reserved too many minutes, you ended up wasting money each month. If you underestimated and used more minutes than you paid for, you faced a penalty. Standing in line at the cell phone store and digging through your past history as you tried to better match your plan with your consumption was a hassle and often didn't work. Fortunately, most cell phone carriers now offer unlimited, reservationless services. You sign up for a collection of services and pay a flat fee. No more worrying about reservations. Service is available when you need it. The cost and complexity associated with consuming mobile services has been reduced.

Much like the evolution of cell phone services, forward looking IT vendors are developing reservationless storage capabilities. At a high level, the concept is simple: instead of having to reserve and purchase storage capacity up front, capacity is provided on demand to meet the needs of the business. As a result, upfront capital equipment costs are reduced due to an increase in storage utilization. Ongoing operational costs are reduced as increased storage utilization leads to less power, cooling, and space required in the data center. Operational costs are further reduced as automation and simplified management reduce the time and complexity associated with allocating storage capacity.

Reservationless storage is implemented within block-based storage solutions supporting core business applications including e-mail and databases. Specifically, these services are provided by disk arrays and storage virtualization solutions which connect to servers through a storage area network using block-based protocols including Fibre Channel and iSCSI. Reservationless storage streamlines the delivery of block-based storage capacity that is used for storage volumes (thin provisioning) and point in time images (snapshots).

## **Snapshots**

Snapshots are used to provide a space-efficient, point in time image of an application for quick and reliable recovery. One of the primary advantages of snapshots is the efficient use of storage capacity they enable. A snapshot consumes only the capacity required to store updates that have occurred since the previous snapshot. While this saves a lot of time and capacity compared to making full volume copies, an administrator needs to reserve capacity for snapshots when using a traditional snapshot solution. A default capacity reservation of 20% is typical. And for some legacy storage solutions, reservations must be managed on a volume by volume basis. Reservations of up to 100% are sometimes configured to retain weeks of history for applications that have a high level of update activity. But capacity that is reserved for snapshots can't be allocated to another application. While the size of a pool of reserved snapshot capacity can be tuned to match the change rate and retention needs of the application, expertise and management intervention are required.

There are a number of methods that are used for up front snapshot capacity reservations in legacy storage systems. In some systems, snapshot capacity is drawn from a global pool shared by all of the volumes within a storage system. In others, a snapshot reserve is defined at the volume level. Variations between these two extremes can be found as well. Some systems support the ability to define two or more pools with different levels of

price/performance using a subset of the total available capacity. Others define pools at the volume level that are used for snapshots and other purposes (e.g. avoiding overwrites).

Reservationless storage solution allocates snapshot capacity automatically when it is needed. Capacity does not have to be managed on a volume by volume basis, nor does it have to be reserved up front. The complexity associated with managing snapshot reservation levels is avoided and overall capacity utilization is increased.

### **Thin Provisioning**

When provisioning block-based storage capacity using traditional methods, system administrators typically dedicate a fixed amount of storage to each particular application. For example, if a 500 GB volume is allocated to an application that requires only 100 GB of actual data, that leaves 400 GB with no data stored on it. That unused capacity is still dedicated to that application and no other application can use it. This means that the unused portion of that 500 GB is wasted storage, which means that it also represents wasted money. And even though all of that storage capacity may eventually be used, it might take years to do so. This is a major problem when managing storage capacity and is often referred to as stranded or allocated-but-unused storage. The problem is exacerbated by local and remote copy facilities that consume additional storage by duplicating allocated-but-unused capacity (effectively, making copies of nothing).

With thin provisioning, the storage provisioning process starts out as it does with traditional provisioning. Going back to our example, where a storage administrator provisions 500 GB to an application with only 100 GB of actual data, with thin provisioning, the unused 400 GB can still be made available for other applications or need not be purchased at all. This approach allows the application to grow transparently and at the same time ensures that capacity is not wasted. In other words, thin provisioning provides just-in-time storage capacity. The application thinks that 500 GB of storage is available, but the storage system only provides the capacity when needed. The rest stays in the pool.

As a thin provisioned volume grows to require more capacity, there are two methods for handling how capacity is managed. A reservationless approach automatically pulls capacity from a global pool that is defined over all of the available capacity in the entire system. Thresholds are used to notify the administrator when physical capacity needs to be added to a global pool of shared capacity. Another approach requires the definition and management of one or more pools of capacity for thin provisioned volumes. This approach sets aside a pool of reserved capacity that is used when thin provisioned volumes require more capacity. While this approach creates more efficient pools of reserved capacity compared to traditional provisioning methods which reserve capacity for each volume, it adds complexity and overhead as administrators work to minimize the reserved capacity that sits idle in a thin provisioned pool. In contrast, a reservationless storage solution manages thin provisioned capacity automatically as it increases the ratio of used vs. idle capacity.

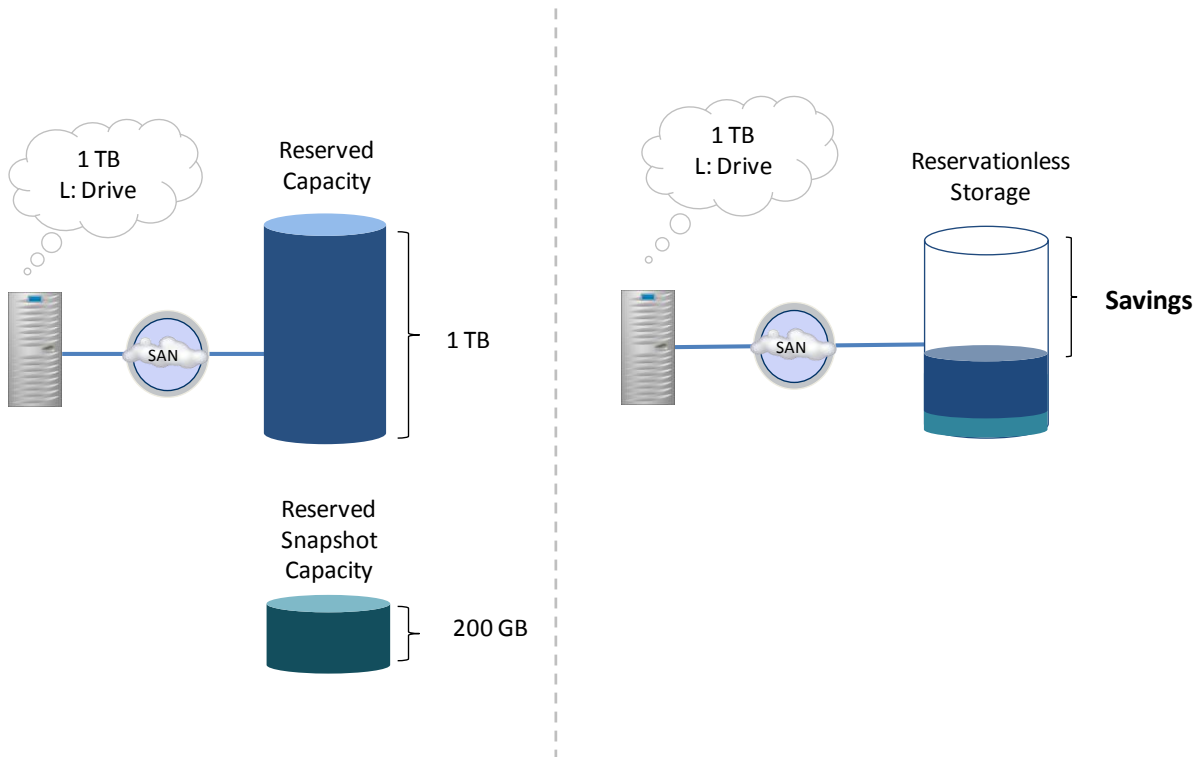
### **Traditional vs. Reservationless Storage**

Let's take a quick look at an example which illustrates the differences between traditional and reservationless storage. A storage manager is deploying a new disk array for Microsoft Exchange messaging and collaboration services. The existing Exchange environments supports 1,800 users with a mailbox limit of 200 MB per user. The upgrade has been designed to increase mailbox quotas (500 MB) and allow for growth over the next three years (2,000 mailboxes). To meet these requirements, e-mail capacity is projected to grow from 360 GB to one terabyte (1,000 GB) over the next three years.

The difference between traditional and reservationless storage is shown in Figure 2. In both cases, the e-mail server is presented with a 1 TB L: drive for the e-mail database. Traditional provisioning reserves 1 TB of storage capacity for e-mail and 200 GB (20%) for snapshots. In contrast, the reservationless method uses a third of the capacity when the new disk array is deployed in production. It allocates capacity on demand as e-mail users grow into their new 500 MB mailbox quota. It also allocated capacity on demand for snapshots. The capacity savings are shown as the difference between the capacity required for a traditional and a reservationless storage solution. As capacity is

allocated on demand to meet the needs of the business over the next three years, reservationless storage reduces ongoing management requirements as well.

Figure 2. Traditional vs. Reservationless Storage



Source: Enterprise Strategy Group, 2009.

Reservationless storage was also designed to address a subtle, but insidious challenge: the rising costs associated with the all-too-common practice of over-allocating storage capacity. Database and storage administrators are painfully aware of the risks associated with running out of storage capacity. In the worst case, a database application that grows beyond its allocated storage capacity will crash. Before that limit is hit, applications start to slow down as the database struggles to find free space for updates, end-users complain about performance, and productivity is impacted. Given the potentially dire consequences of running out of capacity, administrators too often will err on the side of caution and overestimate future capacity requirements. Over-optimistic growth assumptions are often applied unilaterally to all database applications. A storage administrator ESG spoke with recently explained how this applied to his organization:

*When I ask my database administrator how much storage a new application is going to consume, he always gives me the same answer: "I need 500 GB." He and I both know that most of our new applications will never grow to use 500 GB. But we've had applications that grew beyond 500 GB and adding capacity was a pain. Estimating capacity usage upfront is a pain as well. Figuring out which applications are going to take off is even harder.*

## HP Reservationless Storage

ESG Lab provides independent hands-on validation of emerging IT products. Over the past six years, ESG Lab has tested more than 100 storage products, including multiple reservationless storage solutions from HP. In addition, ESG Lab has tested traditional storage systems from emerging and leading IT vendors that compete with HP and can confirm that many lack the capabilities of a reservationless storage solution. In this section we'll take a look at the reservationless storage capabilities of the HP StorageWorks product line.

### HP StorageWorks P4000

ESG Lab tested a scalable iSCSI SAN solution from LeftHand Networks in 2006 when storage systems with thin provisioning were just beginning to get traction in the market. The LeftHand product line, which has since been acquired by HP and is now known as the HP StorageWorks P4000, was one of the first storage products in the market with thin provisioning technology. Well before the term had been invented, ESG Lab was beginning to realize the benefits of reservationless storage.

*The LeftHand solution is one of the best SAN-based storage systems we've ever tested (and we've tested some great stuff). It is easy to use and manage, provides advanced features including snapshots and remote replication, and **offers innovative and valuable technology such as thin provisioning**. Additionally, LeftHand has a scalable clustered architecture that **simplifies management and allows customers to grow their environments as needed**.<sup>3</sup>*

During a subsequent validation, ESG Lab realized the true power of reservationless storage.

*The only information required to create a volume is its name and size. The advanced tab allows users to access additional optional features like replication levels and the volume type—full or thin provisioned. **ESG Lab found thin provisioning in LeftHand's world to be extremely simple, with no calculations or decisions to be made for storage allocation**. The size of the volume entered becomes its maximum size and **storage is only allocated as data is actually written by applications**.*

*... When defining a snapshot, the only required information is the snapshot name... Snap provisioning is completely virtual—**snapshots are all thin provisioned and do not require pre-allocated or reserved space**. **This makes management of snapshot copies for backups, file level undelete, and quick restores extremely simple**.<sup>4</sup>*

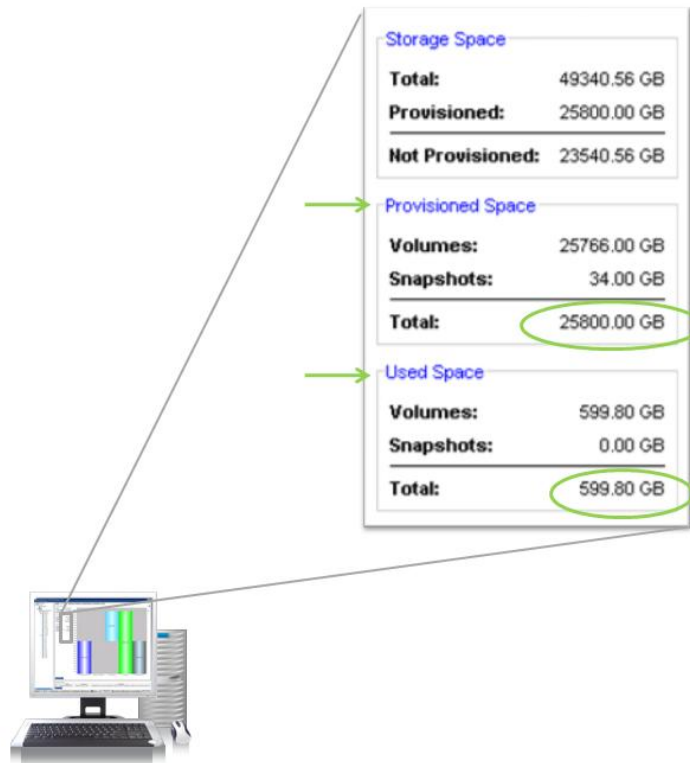
More recently, ESG Lab has tested the StorageWorks P4000 working in concert with server and desktop virtualization solutions from VMware and Citrix. In these evaluations, ESG has shown that virtualization is not simply a server technology. HP creates virtualization solutions using a combination of servers, storage, and applications to fundamentally change IT infrastructure resources are utilized. Reservationless storage amplifies the value of HP virtualization solutions as it reduces cost and complexity and improves your ability to respond to business changes.

<sup>3</sup> Source: ESG Lab Validation Report, *LeftHand Networks Open iSCSI SAN Platform*, June 2006.

<sup>4</sup> Source: ESG Lab Validation Report, *LeftHand Networks 100 TB SAN*, July 2007.

The power of HP reservationless storage is demonstrated in the screen shot shown in Figure 3. This screenshot was taken during an ESG Lab Validation in 2007. A total of 25.8 TB of capacity has been allocated for volumes and snapshots, yet only 599.8 GB has been used.

Figure 3. Reservationless Storage in Action (HP StorageWorks P4000)



Source: Enterprise Strategy Group, 2009.

### HP StorageWorks SAN Virtualization Services Platform (SVSP)

ESG Lab has also tested the reservationless storage capabilities of the HP StorageWorks SVSP. SVSP is a network-based virtualization solution that delivers reservationless storage services in a FC SAN. Thin provisioned reservationless capacity and reservationless snapshots are supported.

*ESG Lab testing has confirmed that HP's SVSP Thin Provisioning can be used to **reduce the cost and complexity of storage provisioning while providing significant capacity savings**. ESG believes that thin provisioning is one of the most useful storage functions today and yet few storage systems currently support this capability. HP's SVSP Thin Provisioning provides the benefits of thin provisioning for all SVSP-managed disk arrays even if they do not support thin provisioning themselves.*

*...ESG Lab has confirmed that HP SVSP Business Copy can be used as a unified platform for creating and maintaining multiple read/write point-in-time copies of volumes, and can **retain the space-efficient copies independently and separately from the original volume**. In addition, ESG Lab was impressed with SVSP's redirect-on-write snapshot technology. In contrast to the more commonly used copy-on-write technology, redirect-on-write offers both flexibility and performance efficiency while **enabling administrators to create, access, and manage a virtually unlimited number of independent point-in-time copies**.<sup>5</sup>*

<sup>5</sup> Source: ESG Lab Report, *HP StorageWorks SAN Virtualization Services Platform*, December 2008.

## HP StorageWorks Enterprise Virtual Arrays (EVA)

ESG has been tracking the success of the HP StorageWorks EVA product line for years. The EVA delivers reservationless storage services using a variety of technologies:

**Virtualization-enabled storage pooling** delivers reservationless capacity from a centralized pool. Instead of carving host volumes from a RAID group, the EVA stripes data over a pool of capacity defined over one or more RAID groups. All of the capacity within an EVA can be striped within a single group if desired. This layer of virtualization within the EVA controller reduces the complexity of storage deployment as it improves storage utilization.

**Virtually Capacity-Free Snapshots** does not reserve capacity for the snapshot volumes in advance. Instead, space in the snapshot volume is used only as the data of the original virtual disk is changed. This simplifies management as it reduces the cost associated with reserved snapshot capacity.

**Distributed Sparing** spreads hot spare capacity across multiple disk spindles. In traditional architectures, storage administrators must set aside one or more physical drives as a dedicated hot spare in case of a drive failure. With distributed sparing, EVA administrators can get better utilization as they reduce the wasted capacity associated with spare drives. Striping spare drive capacity within a virtualized pool also reduces the time it takes to complete a RAID rebuild after a drive failure.

**Dynamic Expansion** is used to grow or shrink virtual disk capacity dynamically. This enables administrators using the EVA to monitor the capacity usage of a volume and dynamically allocate or remove capacity as needed. This minimizes the stranded capacity associated with traditional storage arrays where capacity for each volume is pre-allocated to account for the growth over time.

The reservationless storage capabilities within the HP StorageWorks EVA, P4000 and SVSP product lines are well aligned with HP's broader mission of enabling a converged infrastructure. Mark Peters, a Senior Analyst at ESG, summed it up well when he said:

*In large, complex, and demanding data centers, the traditional static silos of IT equipment and applications must give way to 'liquid IT;' 'just-in-case' provisioning must give way to 'just-in-time' and 'just enough' while optimized efficiency must be just as important as operational effectiveness. Few vendors have this figured out and even fewer have a viable design concept. HP actually has a credible approach and pedigree. Converging, virtualizing, and automating everything is clearly the way to a much better future.*<sup>6</sup>

---

<sup>6</sup> <http://h20195.www2.hp.com/V2/GetDocument.aspx?docname=4AA0-2061ENW&cc=us&lc=en>

## Quantifying the Business Value of Reservationless Storage

In this section, we'll present the results of ESG analysis with a goal of quantifying the savings that can be achieved with reservationless storage. The following assumptions were used for this analysis:

- *A primary storage utilization rate of 50%.* This value is an estimate of the ratio of used vs. allocated primary storage within organizations that have not yet deployed reservationless storage. While ESG has spoken with IT managers with primary capacity utilization rates as low as 20% and as high as 80%, more than half of the respondents to an ESG survey of early storage administrators managing large enterprise infrastructures report that between 31% and 50% of purchased storage capacity was stranded and unused.<sup>7</sup> ESG believes that 50%, which is towards the optimistic end of this range, represents a conservative assumption for this analysis.
- *A snapshot reservation pool of 20% per logical drive.* Based on a review of the publicly available documentation for market leading modular storage solutions, 20% is a commonly used value for the default starting point when planning the amount of capacity that is set aside for snapshots.
- *Provisioning reservationless storage is 80% more efficient than traditional methods.* This is an estimate based on ESG Lab testing of dozens of storage solutions. Reservationless storage reduces the manpower required for routine provisioning tasks as it eliminates the need for up front reservations of primary and snapshot capacity. Manpower savings can also be realized as the need for monitoring, tuning, and communicating with stakeholders is reduced.
- *A total cost of \$15 per GB for storage capacity.* This is an estimate based on a recent ESG analysis of the total cost of ownership for a 75 TB modular storage solution from leading IT vendors. The midpoint of the total cost of hardware, software, and maintenance for an organization using snapshots and remote mirroring was used for this analysis.

With these assumptions in mind, three customer scenarios were analyzed with a goal of quantifying the savings that can be realized with reservationless storage.

### SMB Virtualization Enables Consolidation

A municipal government organization with 150 employees currently has 5 terabytes of direct attached storage supporting a number of business productivity applications including Microsoft Exchange and SQL Server. VMware server virtualization and SAN attached storage virtualization will be used to consolidate and optimize IT infrastructure. The current storage utilization is 30 percent and utilization is growing at a rate of 20 percent annually. Snapshots taken four times daily will be used for quick recovery of Microsoft Exchange and SQL Server. The ratio of snapshot vs. utilized primary capacity is 10 percent.

### SME Snapshots Improve Recoverability

A manufacturing organization with 1,000 employees is upgrading its ERP IT infrastructure. Oracle and SAP data currently resides on modular FC attached storage arrays with lease contracts that are due to expire. The existing 12 TB SAN is 40% utilized. Storage capacity is growing at an annual rate of 30%. Snapshots will be used for improved recoverability. Snapshots taken eight times per business day will be retained for a week. The ratio of snapshot vs. utilized primary capacity is 8 percent.

### Enterprise Tiered Storage Enhances Efficiency

A major healthcare organization with 4,000 employees is upgrading their core storage infrastructure. A multi-tiered application workload is being migrated to a multi-tiered IT infrastructure. Key applications to be upgraded include patient care, ERP and medical imaging. The current storage infrastructure consists of 60 TB of SAN attached

---

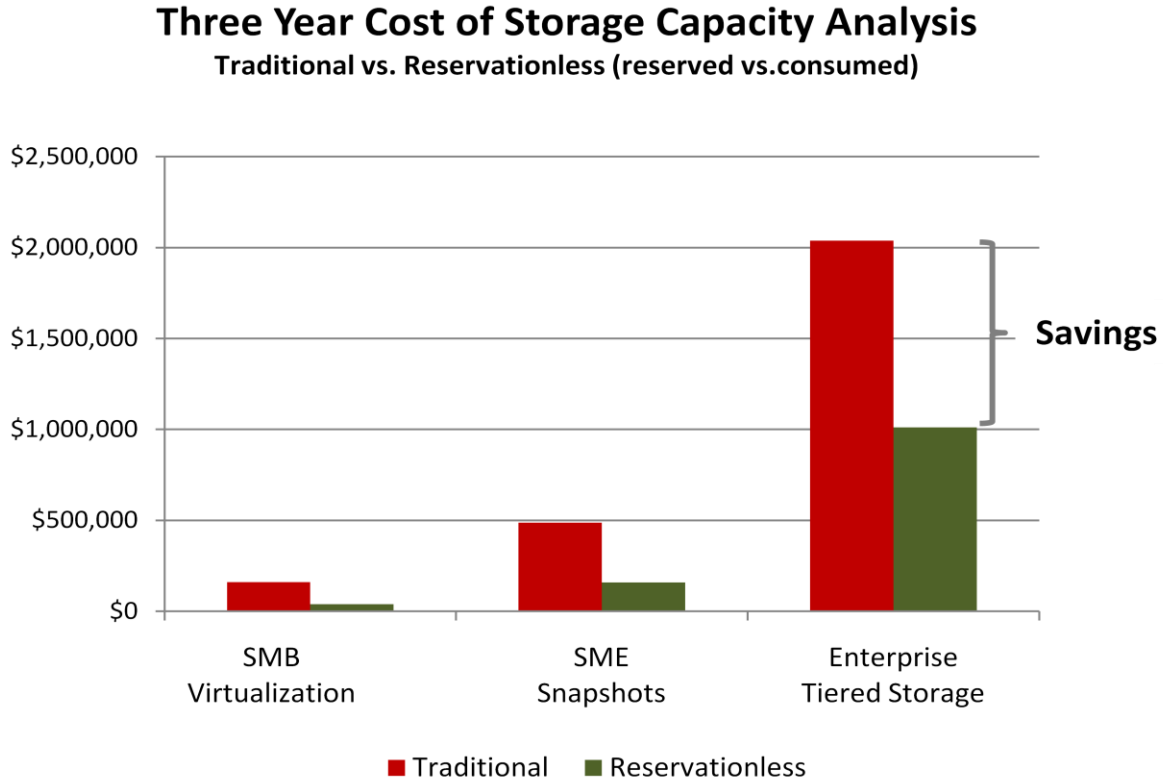
<sup>7</sup> Source: ESG Report, *Thin Provisioning*, April 2006.

storage. As a result of a recent acquisition, six disk arrays from multiple vendors are currently deployed in production. The existing SAN infrastructure is 50% utilized. Due to recent growth in the amount of digital medical image data that is retained on disk, SAN attached storage capacity is growing at an annual rate of 65%. Twice daily snapshots of the patient care and ERP applications account for 4% of utilized disk capacity.

### The Results

The savings that can be realized with reservationless storage are summarized in Figure 4 and Table 1.

Figure 4. Reservationless Capacity Savings



Source: Enterprise Strategy Group, 2009.

Table 1: Three Year Reservationless Capacity Savings

Scenario	Capacity (GB)		Cost		Savings	
	Traditional	Reservationless	Traditional	Reservationless	Dollars	Percent
SMB	10,726	2,592	\$160,883	\$38,880	\$122,003	76%
SME	32,462	10,546	\$486,937	\$158,184	\$328,753	68%
Enterprise	135,850	67,382	\$2,037,744	\$1,010,728	\$1,027,016	50%

## The Bottom Line

Reservationless storage automates the delivery of storage capacity to meet the needs of the business. For the scenarios examined by ESG, capacity savings of 50%, 68% and 76% were realized. The resulting bottom line value for an IT organization can be summarized simply:

- Storage utilization increases
- Less storage capacity is purchased and deployed
- Capital equipment costs are reduced
- Less power, cooling and space is required
- The ongoing management of storage capacity is simplified
- Operational costs are reduced

## The Bigger Truth

Traditional block-based storage solutions can lead to utilization rates of 50% or less. As a matter of fact, more than half of IT managers within large enterprises surveyed by ESG report that between 31% and 50% of their purchased capacity is stranded and unused. Fully 80% felt that storage provisioning had a significant negative impact on IT time and resources.

Purchasing a storage solution that is only 50% efficient is a waste of time and money. For every dollar you spend on useful storage capacity, another dollar is wasted on reserved capacity. While careful monitoring and tuning of traditional provisioning methods can be used to increase storage utilization, the manpower costs often outweigh the benefits. Besides the time required for managing storage capacity, meeting with stakeholders to review historical consumption and future requirements takes time as well. With time being a precious commodity, IT managers are often forced towards a philosophy of *just buy more*. With reservationless storage, IT managers can move away from *just buy more* to a best practice of *just-in-time* to dynamically meet the needs of the business.

HP StorageWorks delivers just-in-time storage capacity using a collection of technologies known as reservationless storage. Hands-on testing by ESG Lab has confirmed that HP StorageWorks P4000 and SVSP use a reservationless approach when managing snapshot and thin provisioned storage capacity. The HP StorageWorks EVA, with virtualization-enabled storage pooling, virtually capacity-free snapshots, distributed sparing and dynamic expansion rounds out HP's line of reservationless SAN attached storage products.

With reservationless storage, less capacity is required over the life of the storage system since the amount of stranded storage can be reduced or even eliminated. Purchases of new storage systems can be delayed or deferred based on reclaiming stranded storage. The savings are multiplied as the raw capacity for RAID protection, full volume copies, and remote mirroring is reduced.

There's a key concept that needs to be considered as you plan for the adoption of reservationless storage. *Eliminating reservations simplifies management, but it does not eliminate the need for planning.* You still need to keep track of storage capacity growth and you still need to monitor utilization to know when it's time to buy more capacity. While you don't need to reserve capacity upfront, you still need to set thresholds and keep an eye out for runaway consumers.

Reservationless storage delivers on the promises of HP's Converged Infrastructure strategy, portfolio and proven architectural framework. Resources are delivered on demand. The productivity of administrators and systems is increased. Continuity of services is ensured. And last, but not least, the time that it takes to realize business value from IT investments is accelerated.

ESG has confirmed that HP reservationless storage not only works as advertised, it also delivers tremendous value. HP reservationless storage can be used to reduce the cost of storage capacity by 50% or more as it reduces the manpower required to manage storage capacity up to 80%. So when you're considering your next SAN attached storage capacity purchase, ESG recommends that you consider the bottom line savings that can be realized with HP reservationless storage.



Enterprise Strategy Group | **Getting to the bigger truth.**

20 Asylum Street | Milford, MA 01757 | Tel:508.482.0188 Fax: 508.482.0218 | [www.enterprisestrategygroup.com](http://www.enterprisestrategygroup.com)  
4AA3-0411ENW, November 2009