



**Driving Innovation
Through the Information
Infrastructure**

SPRING 2011



Lean Times Call for Thin Provisioning

Michael Haag

Sr. Strategic Alliance Manager

HP Storage



Agenda

- Thin Provisioning Defined
- Why Thin Provisioning is a Key Storage Technology
- Three Must-Have Thin Technologies
 - Starting Thin: Is TP All Equal?
 - Getting Thin: Storage Dieting
 - Staying Thin: Successful Diets Require Support
- Closing Thoughts



Agenda

- **Thin Provisioning Defined**
- Why Thin Provisioning is a Key Storage Technology
- Three Must-Have Thin Technologies
 - Starting Thin: Is TP All Equal?
 - Getting Thin: Storage Dieting
 - Staying Thin: Successful Diets Require Support
- Closing Thoughts

Thin Provisioning Defined

Method of **optimizing the utilization** of storage...

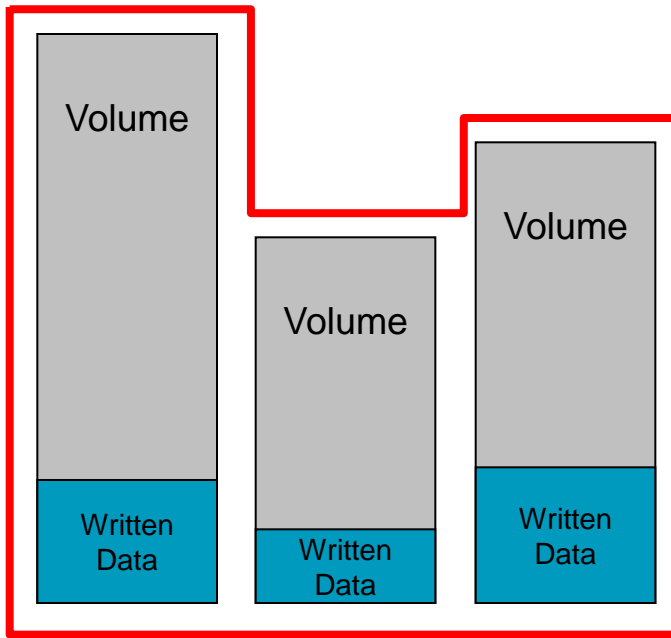
...by provisioning **any size volume** up front...

...and **consuming physical storage on-demand** only when an application actually writes data.

Fat vs. Thin Provisioning

Traditional (Fat) Provisioning

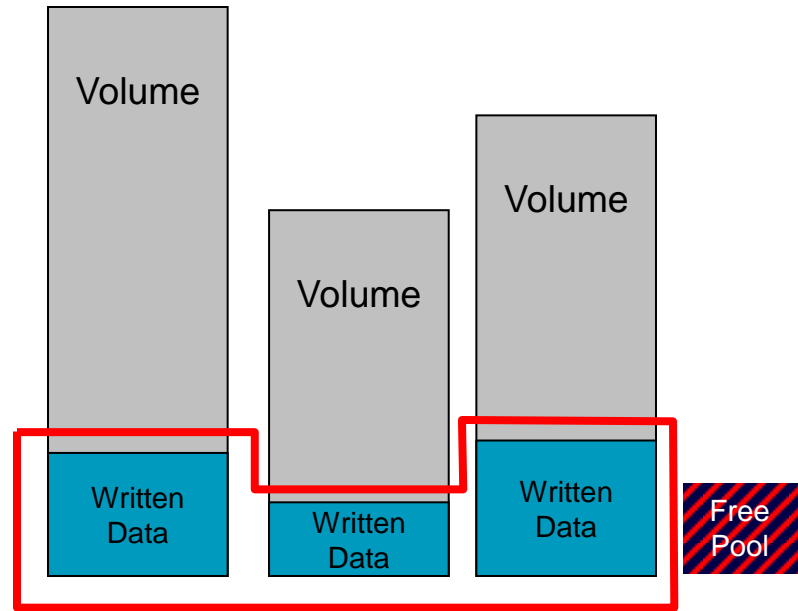
- dedicate on allocation -



Purchased Physical Capacity

Thin Provisioning

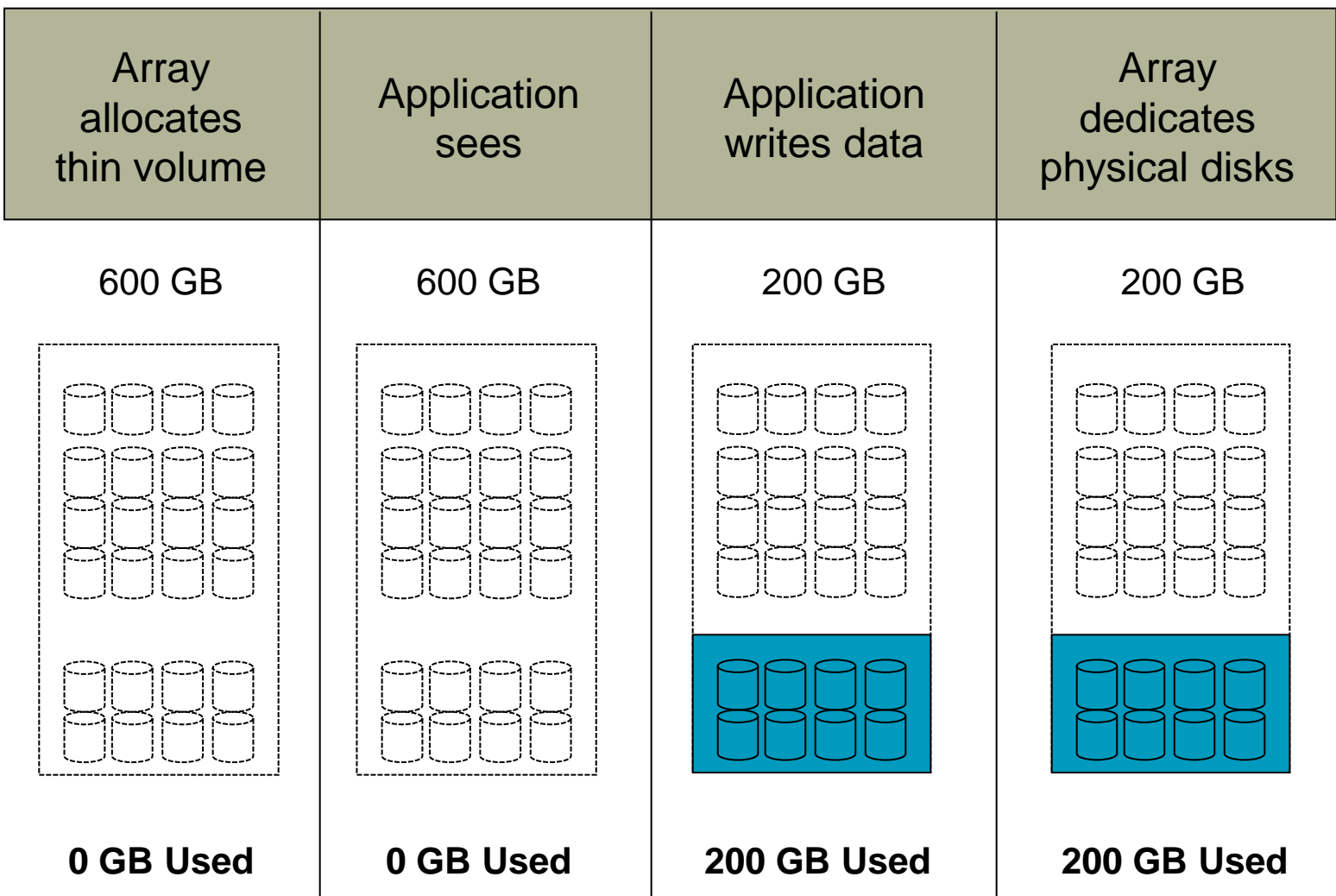
- dedicate on write -



Purchased Physical Capacity

Allocated Capacity Written Capacity Purchased Capacity

Thin Provisioning : How it Works





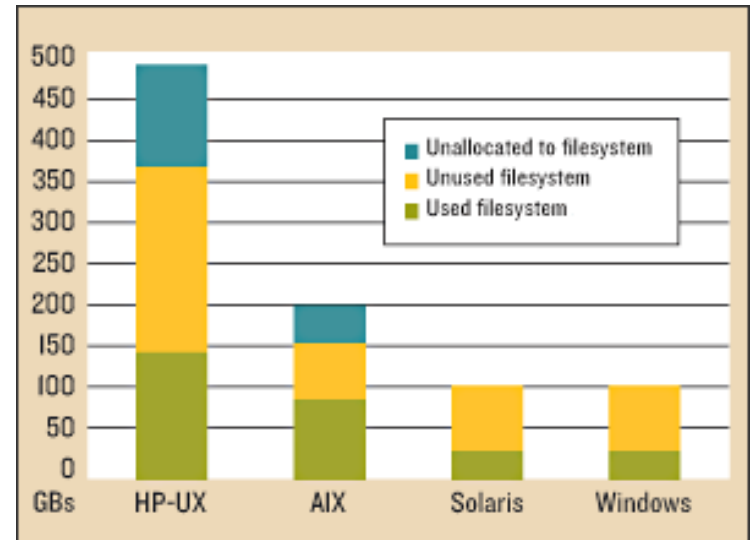
Agenda

- Thin Provisioning Defined
- **Why Thin Provisioning is a Key Storage Technology**
- Three Must-Have Thin Technologies
 - Starting Thin: Is TP All Equal?
 - Getting Thin: Storage Dieting
 - Staying Thin: Successful Diets Require Support
- Closing Thoughts

Standard Utilization: Only 25%

"The average site assigned just 75% of their storage to hosts, left 36% of that unavailable to applications and only used 39% of what was usable. So a typical host might have 500 GB of external storage, 375 GB in volume groups, 240 GB in file systems and just 93 GB used."

$$\frac{93 \text{ GB}}{375 \text{ GB}} = 24.8\%$$



Glasshouse Technologies, in a survey of 750 host systems at over a dozen large and small enterprises. *Storage Magazine*.

Why Is Storage Capacity So Under-utilized?

1. Users over-request capacity to avoid future disruption and/or address budget restrictions
2. Allocated capacity is difficult to reallocate
3. Administrators buffer users' requests to avoid future downtime and reconfiguration complexity
4. Most replication SW mirrors the entire base volume, including unwritten data
5. Business model of most storage vendors hinges on selling more capacity, not less

Real Life Example*

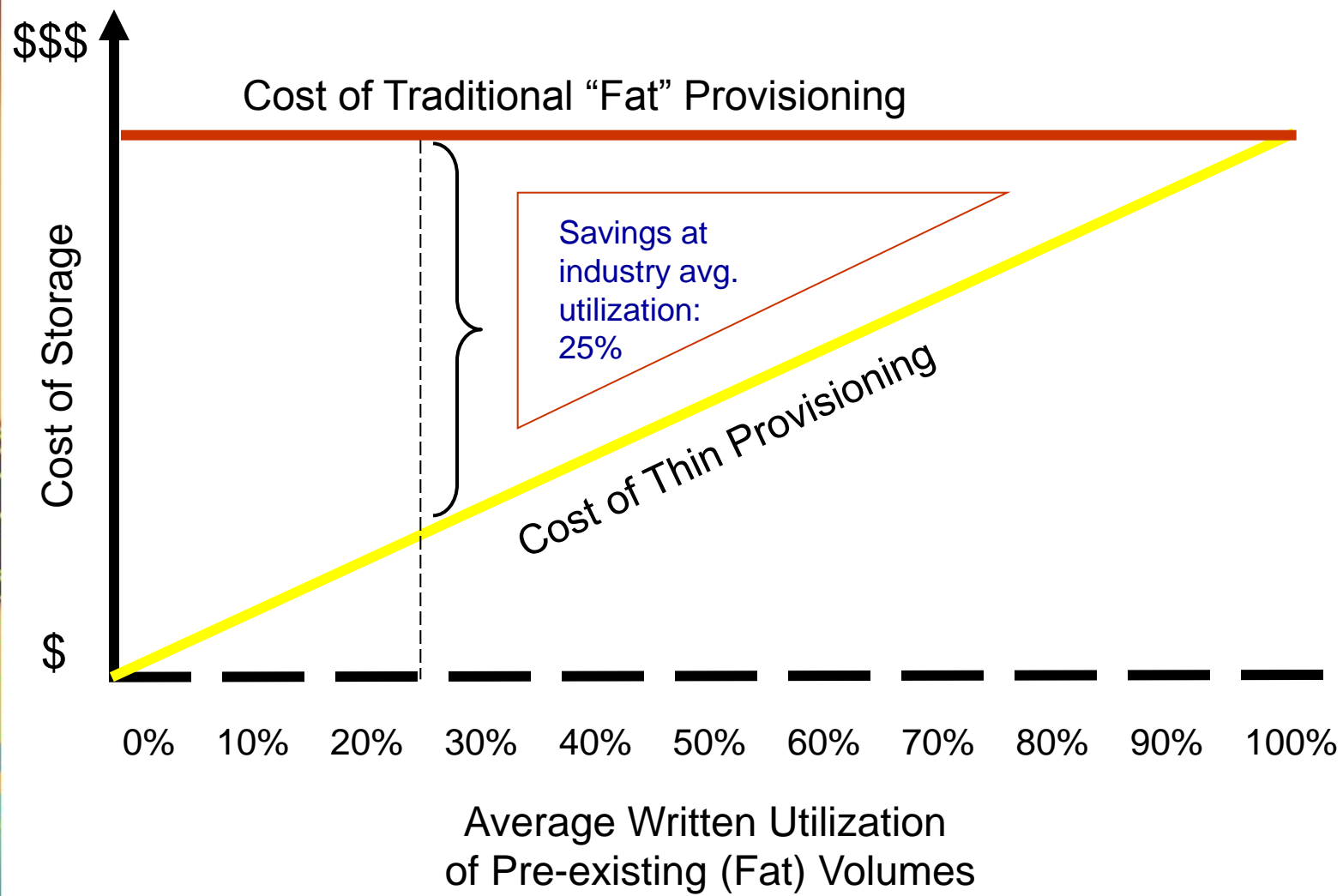
- Application owner *asked* for 10GB
- DBA asked for 15GB
- Unix Admin asked for 22GB
- Storage admin bought 34GB
- **< 30% initial utilization**

* - *Glasshouse Technologies*

Thin Provisioning Business Benefits

- **Thin Provisioning reduces CAPEX by:**
 - Minimizing up-front disk costs with a pay-as-you-go approach
 - Boosting capacity utilization to reduce disk spend
 - Enabling organizations to leverage falling drive prices
 - Reducing SAN ports and storage software fees
- **Thin Provisioning lowers OPEX by:**
 - Reducing power, cooling, and floorspace costs
 - Eliminating application downtime for capacity changes
- **Thin Provisioning improves ROI by:**
 - Permitting more application deployments more affordably
 - Reducing initial costs to accelerate short-term ROI

TP Savings Comparison

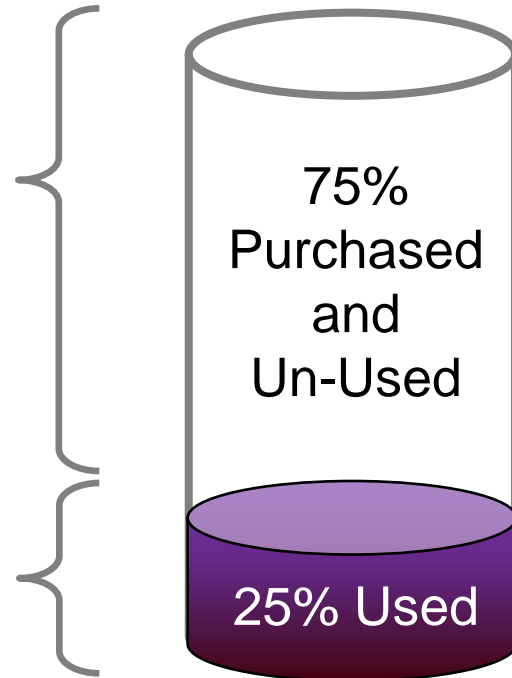


Storage Optimization Techniques

- Thin Provisioning
- Deduplication
- Compression
- Archiving

Thin Provisioning targets the enormous amount of unused capacity

Compression, deduplication, and archiving improves efficiency of written data





Agenda

- Thin Provisioning Defined
- Why Thin Provisioning is a Key Storage Technology
- **Three Must-Have Thin Technologies**
 - Starting Thin: Is TP Always Equal?
 - Getting Thin: Storage Dieting
 - Staying Thin: Successful Diets Require Support
- Closing Thoughts



STARTING THIN

Is TP Always Equal?

Are All Thin Provisioning
Implementations created equal?

Thin Provisioning Differentiators

- **Reservation-less vs. Reservation-based**
 - Avoids silos of allocated-but-unused capacity
 - No pool management
 - Eliminates administrative work to size, provision and manage
- **Allocation Unit Size: Small or Large**
 - If too large, the smallest write can consume many megabytes of disk capacity
- **Automatic vs. Manual Provisioning**
 - Does not requires an administrator to add capacity so thin volumes can grow automatically
- **Built-in or Bolted-on Design**
 - Truly virtualized infrastructure
 - Integrated with all storage software subsystems
- **Scalable Performance**
 - Does not sacrifice performance for capacity savings
 - Available across product family



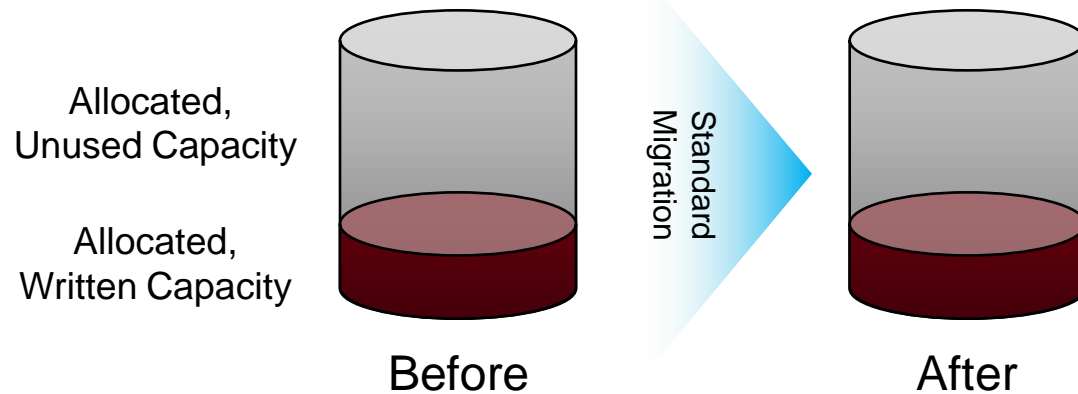
GETTING THIN

Storage Dieting

Improve your utilization today by converting legacy, fat volumes to thin volumes.

Fat-to-Thin Volume Conversion

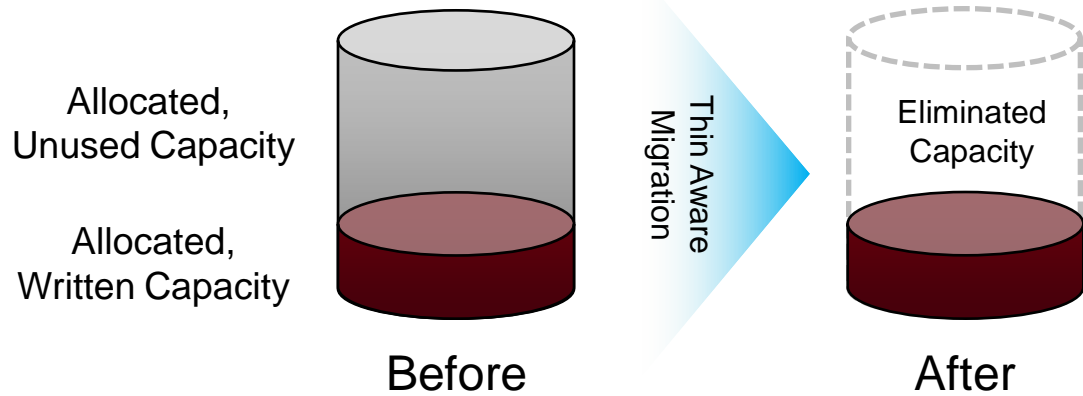
Standard Block-Level Migration



- Migrating online typically involves FULL 'block level' copy to Thin Devices
- No benefit from Thin Provisioning even if the array is Thin-capable

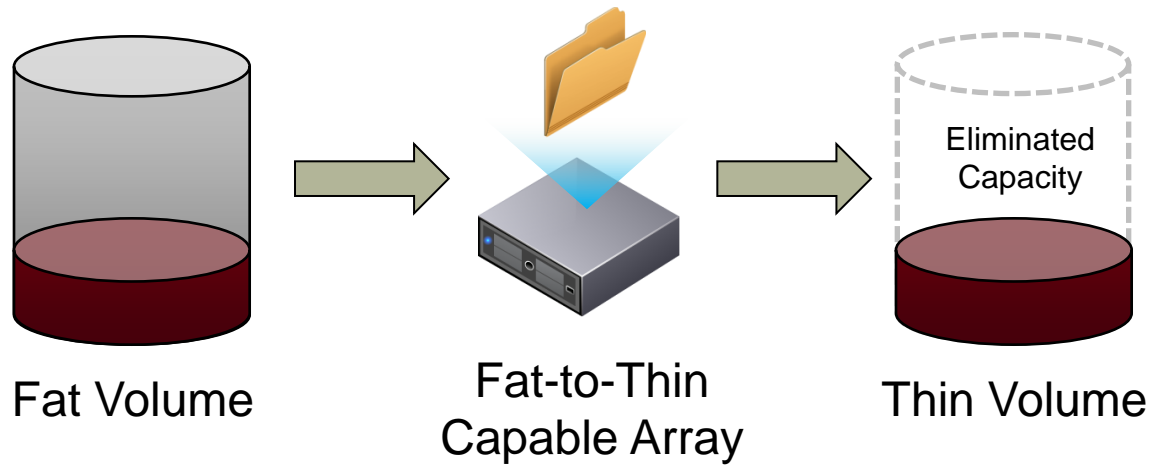
Fat-to-Thin Volume Conversion

Thin-Aware Block-Level Migration



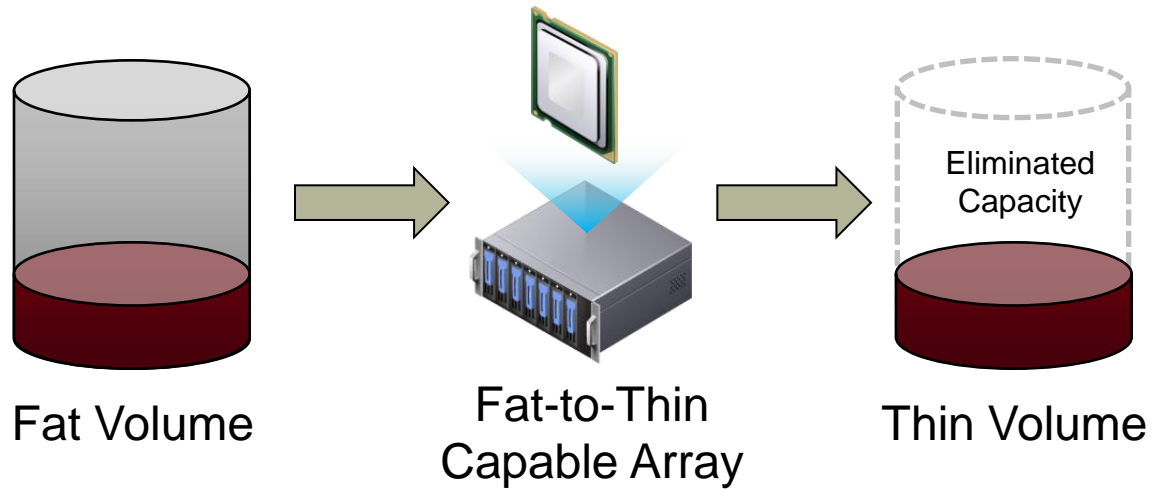
- Enables existing volumes to achieve significant efficiency benefits
- Supports deployment of newer arrays

Software-Based Fat-to-Thin Conversion



- Works with any thin provisioning storage
- Only migrates space actually used by file system for meaningful data
- *Challenge:* Consumes server resources and potentially impacts other activities

Array-Based Fat-to-Thin Conversion



- Hardware-based thinning built-in
- Does not copy zeroes
- Conversion occurs without impacting the performance of other volumes

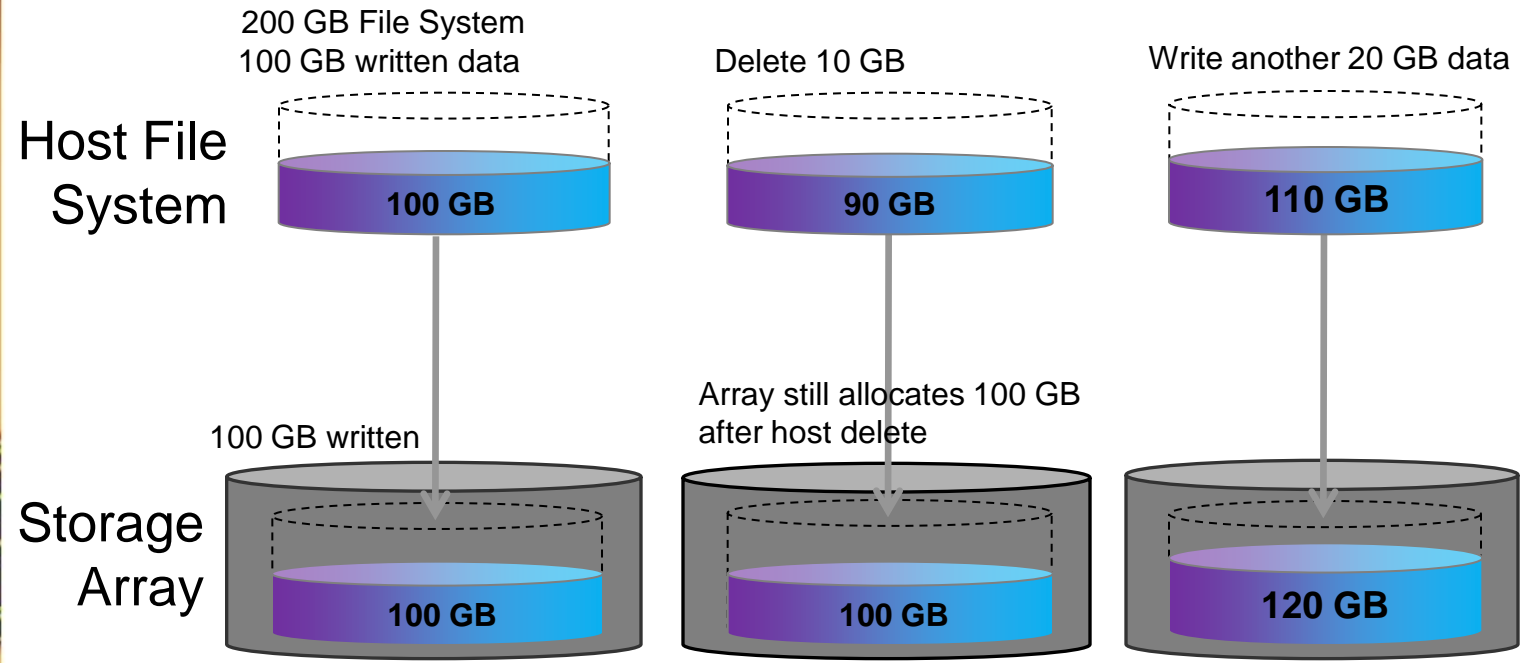


STAYING THIN

Successful Diets Require Support

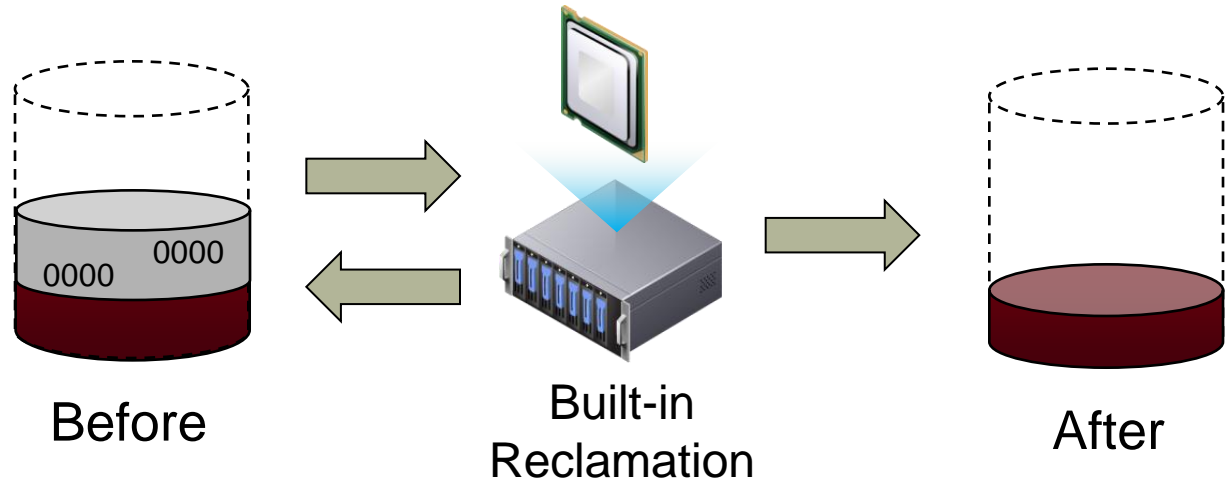
What about deleted data? How can you maintain the benefits of thin provisioning over time?

The Challenge: Deleted Data



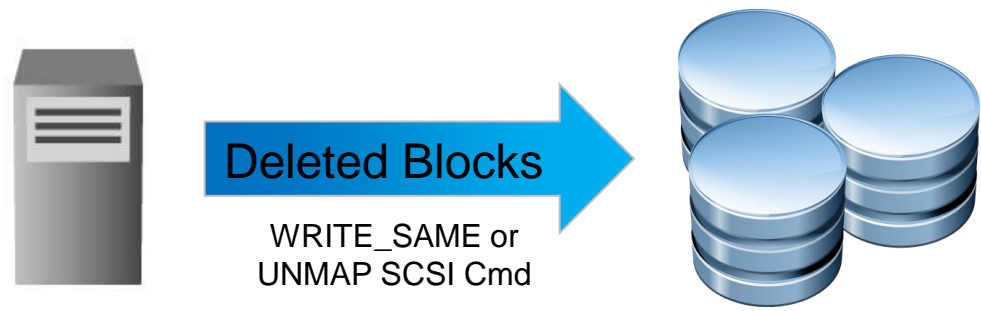
Deleted space on a host file system does not result in deleted space on the storage array

Array-Based Thin Reclamation



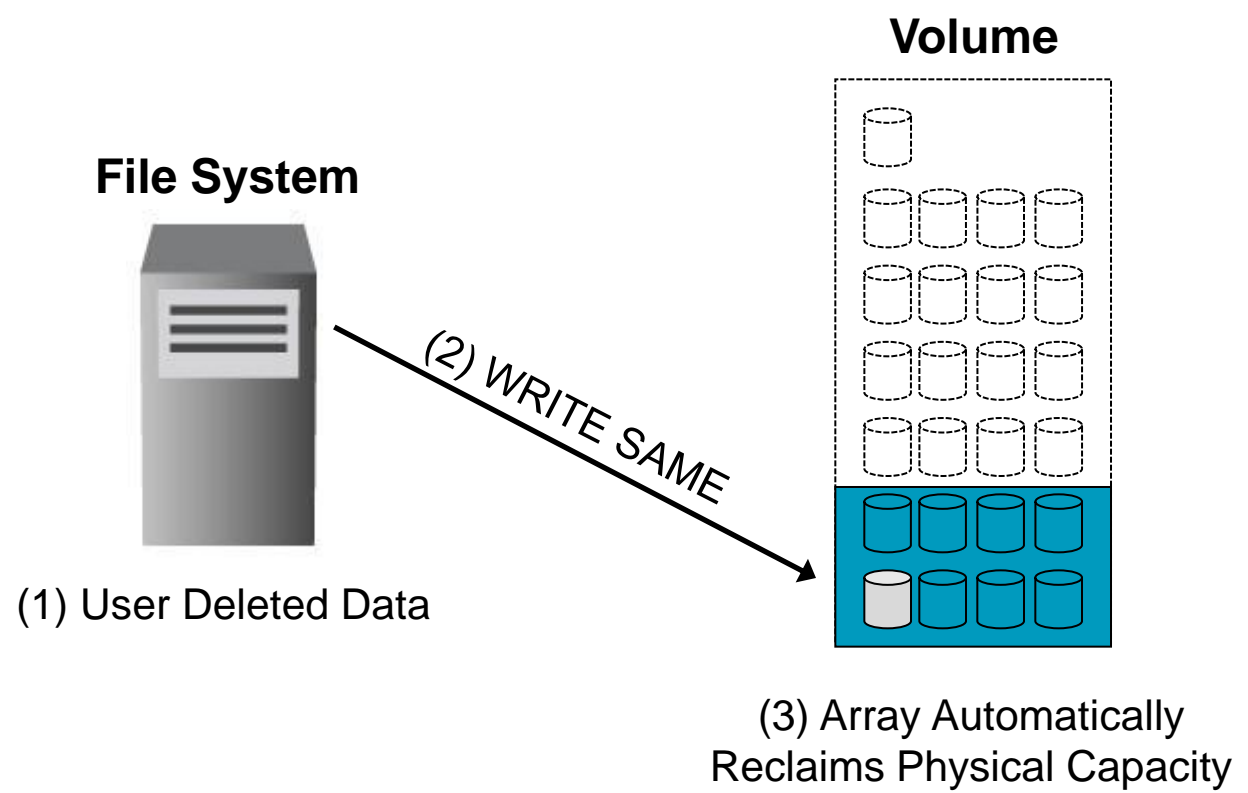
- Non-disruptive and application-transparent “re-thinning” of thin provisioned volumes
- Array performs automatic, hardware-based zero detection
- Zero blocks detected and unmapped (reclaimed)
 - Returns space to thin provisioned volumes and to free pool for reuse

File System Cooperation: Thin Reclamation



- Location of unused space communicated to the array in-band using standards-based commands
- Array reclaims all chunks of physical storage that were wasted support file system unused space

File System Cooperation: Thin Reclamation



Goal: Automatic online, non-disruptive storage reclamation after file system commands received

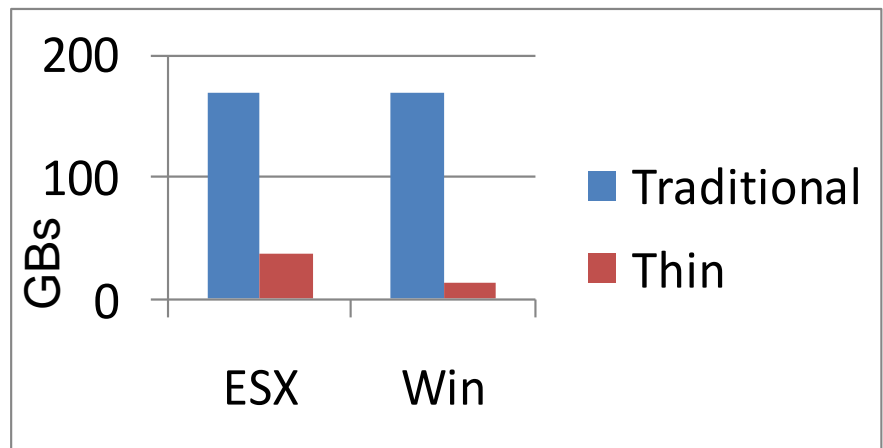
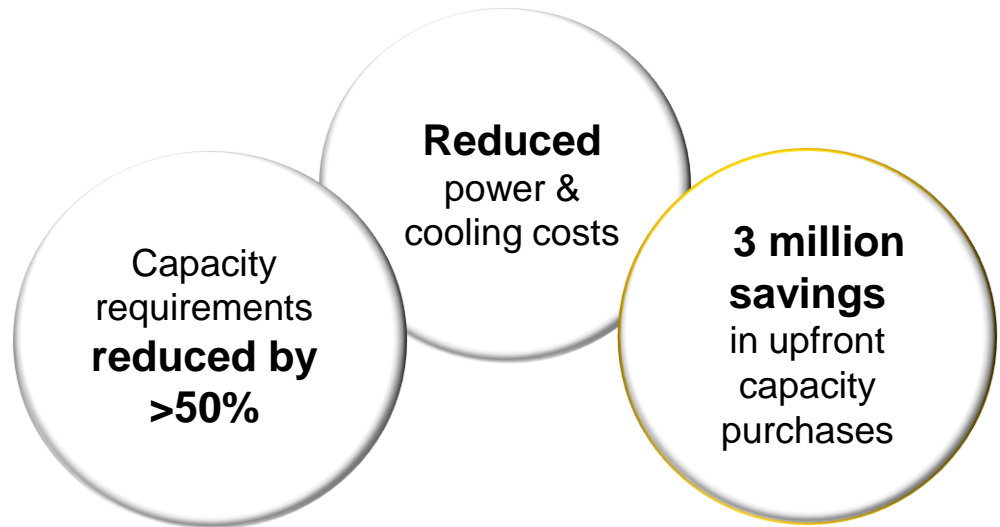


Agenda

- Thin Provisioning Defined
- Why Thin Provisioning is a Key Storage Technology
- Three Must-Have Thin Technologies
 - Starting Thin: Is TP Always Equal?
 - Getting Thin: Storage Dieting
 - Staying Thin: Successful Diets Require Support
- **Closing Thoughts**

Thin Customer: Global Bank

- No budget for additional storage
- Moved 271 TBs to a Thin Array
 - Online/non-disruptive
 - No professional services
 - Large capacity savings

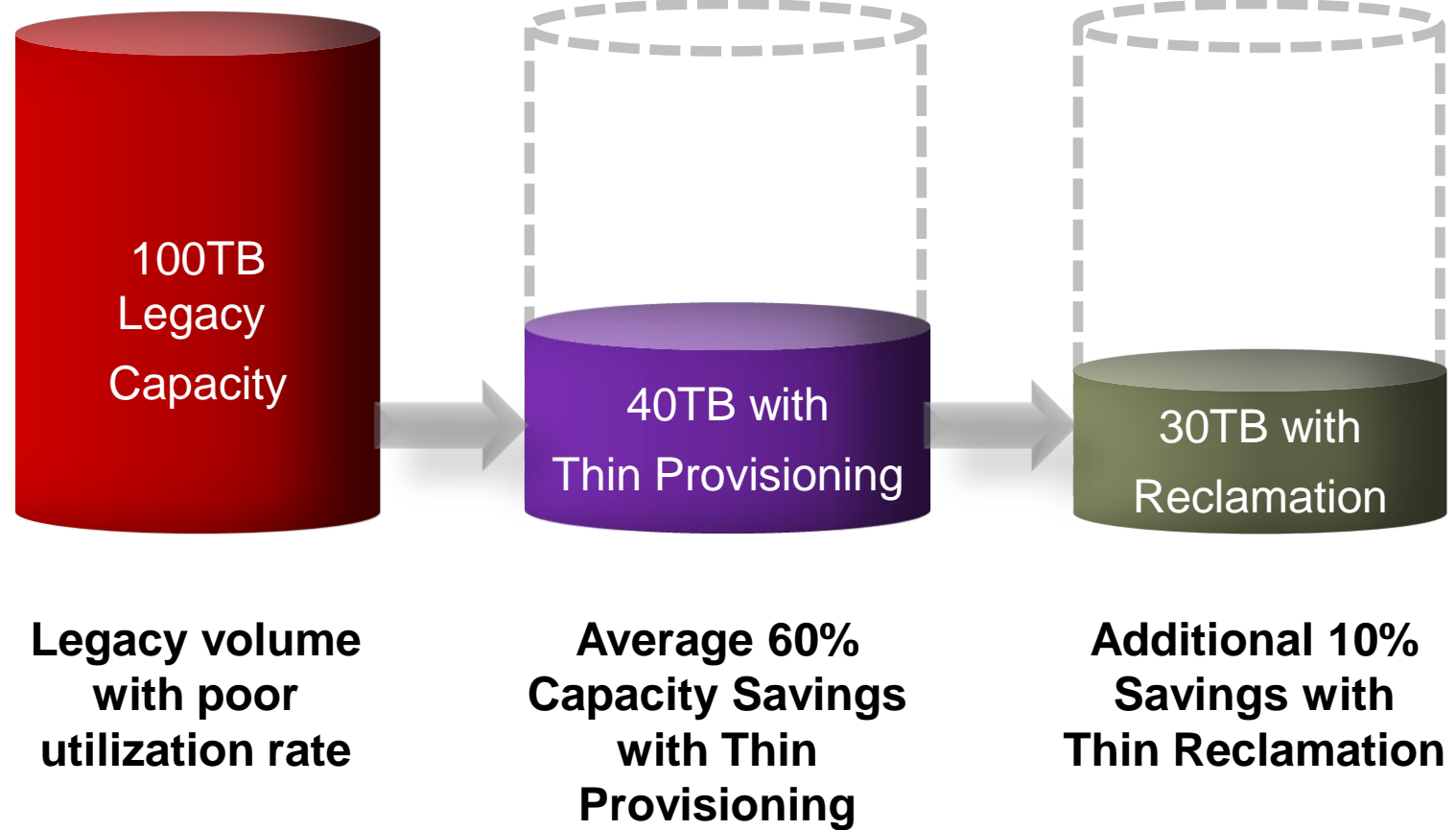




Summary: Three Essential Thin Technologies

- Start Thin
 - Consume capacity only as you need it
 - Remember: Not all TP created equal!
- Get Thin
 - Convert fat, legacy capacity to thin volumes
 - Software and hardware options available
- Stay Thin
 - Maintain maximum storage utilization over time, regardless of data changes

Choose the Right Thin Provisioning Technologies





Questions?

Michael Haag

Michael.Haag@hp.com