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Optimize Thin Provisioning with Veritas Storage Foundation

On Unix, Linux and Windows

Thomas Cornely – Sr. Manager, PM

Agenda



- What is Thin Provisioning
- Why the Host Stacks Matter
- Get Thin with Veritas Storage Foundation SmartMove
- Storage Foundation Thin Reclamation



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What is Thin Provisioning

What is Thin Provisioning?



*Andrew Reichman,
Forrester*

“ Thin Provisioning will become industry standard

...

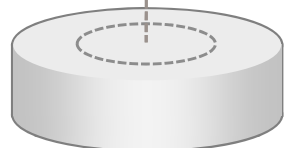
A technology that every storage organization should consider as part of next purchase

”

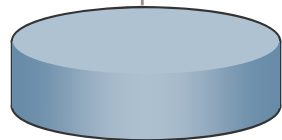
What is Thin Provisioning?

Legacy Storage

Data in file system



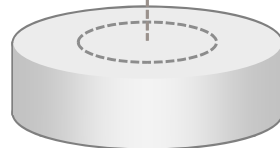
Host Volume



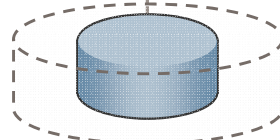
Dedicated in array

Thin Storage

Data in file system



Host Volume



Dedicated in array

- Advantages
 - High utilization
 - Lower costs
 - Efficient operations
- Challenges
 - Getting thin
 - Staying thin
- Requirement
 - Thin-friendly host stack

Potential Benefits of Thin-Provisioning

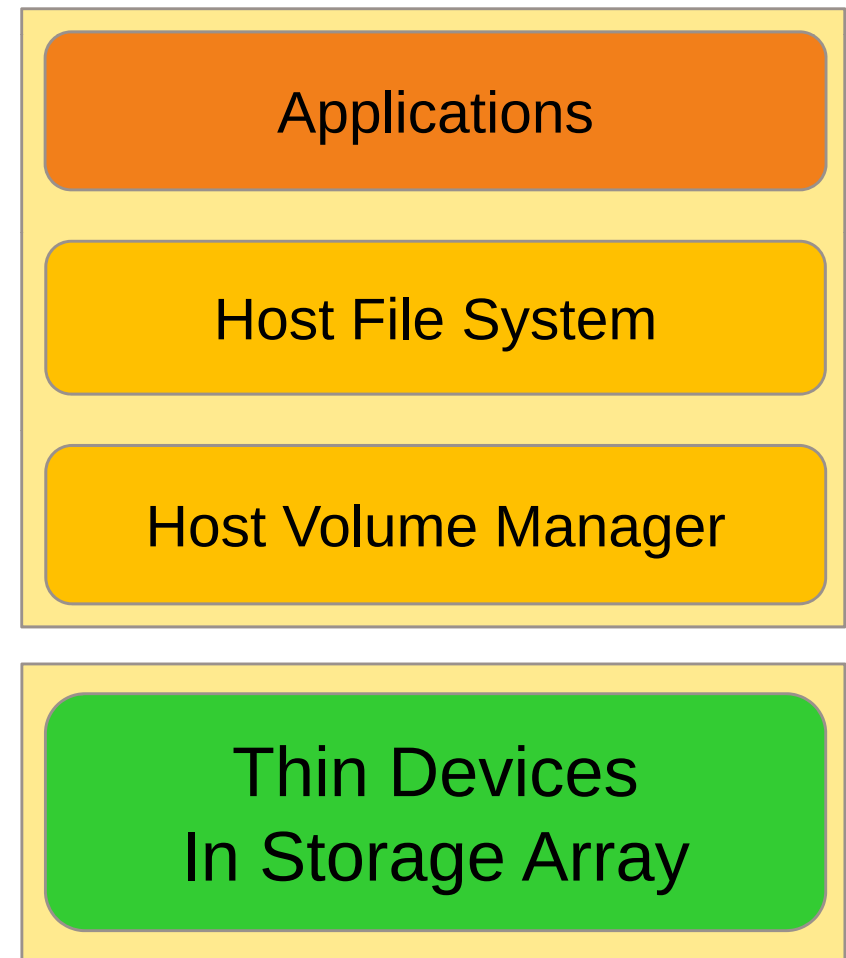


- Potential to reduce storage CAPEX
 - Only pay for “truly used” storage
 - Reduce stranded storage sitting idle “just in case” at the host level
- Potential to reduce storage OPEX
 - Thin Provisioning takes the cost out of over-provisioning
 - Provision large 2 TB Thin LUNs once, never need to grow them
 - No penalty for missing the mark on capacity planning
 - Manage capacity buffer at the *Array Pool Level* instead of *per LUN*
- Potential to significantly change HOW storage is managed
- All industry analysts predict wide adoption
 - Adoption curve expected to mirror that of HW Snapshots
 - **“If all storage HW provide the feature and it works...”**

Considerations to Maximize the Efficiency of Thin Provisioning



- Thin Provisioning begins in the array
- But, the ability to keep thin storage thin depends on the host stack
 - Applications
 - File System
 - Volume Manager
- *Thin Friendliness* is important
- To date, migrating online to Thin Storage has been a challenge





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The Host Stacks Matter To Keep Thin Storage Thin

Optimize Thin Storage with Veritas Storage Foundation



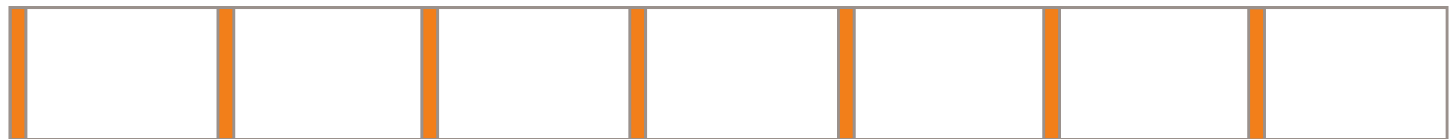
- Thin Provisioning will change how storage is managed
- Optimize Thin Storage on all OS with Storage Foundation
 - Connect any host to any thin provisioning capable hardware
 - VxFS is the only cross-platform thin friendly file system on Unix/Linux
 - SFW Auto-Grow makes NTFS thin-friendly on Windows
 - Automatically reclaim space as you migrate online to thin storage
 - Be ready for online thin storage reclamation
- Standardize on SF 5.0 MP3 and SFW 5.1

Thin Friendliness at File System Creation Time



- Thin Storage is allocated in 'chunks'
 - The chunk size is typically fixed and hardware specific
 - Chunk size goes from a few KBs to a few MBs depending on the hardware
- Where host file system writes affects Thin Storage Utilization
 - Assume a chunk size of 10MB. A single 8KB write can trigger allocation of 10 MB
 - 10 8KB writes issued every 11 MB on a volume trigger 100 MB allocation
 - Some file systems (e.g. UFS) allocate inodes this way...

**Non Thin Friendly
File System**



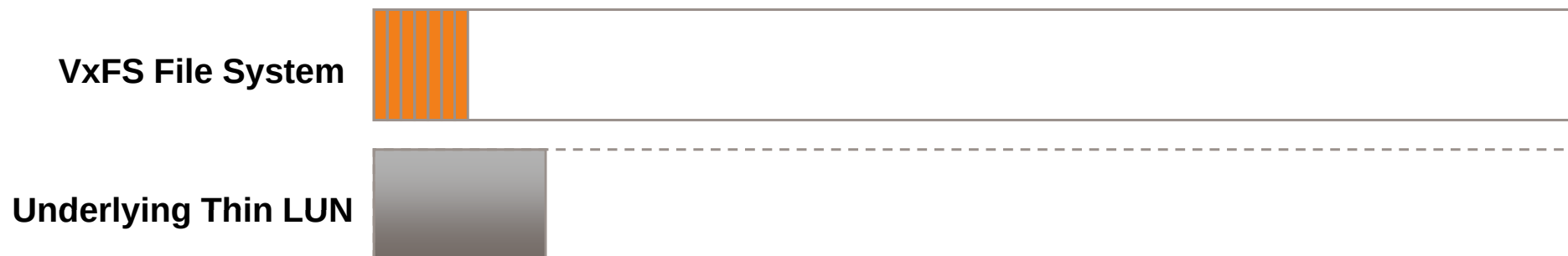
Underlying Thin LUN



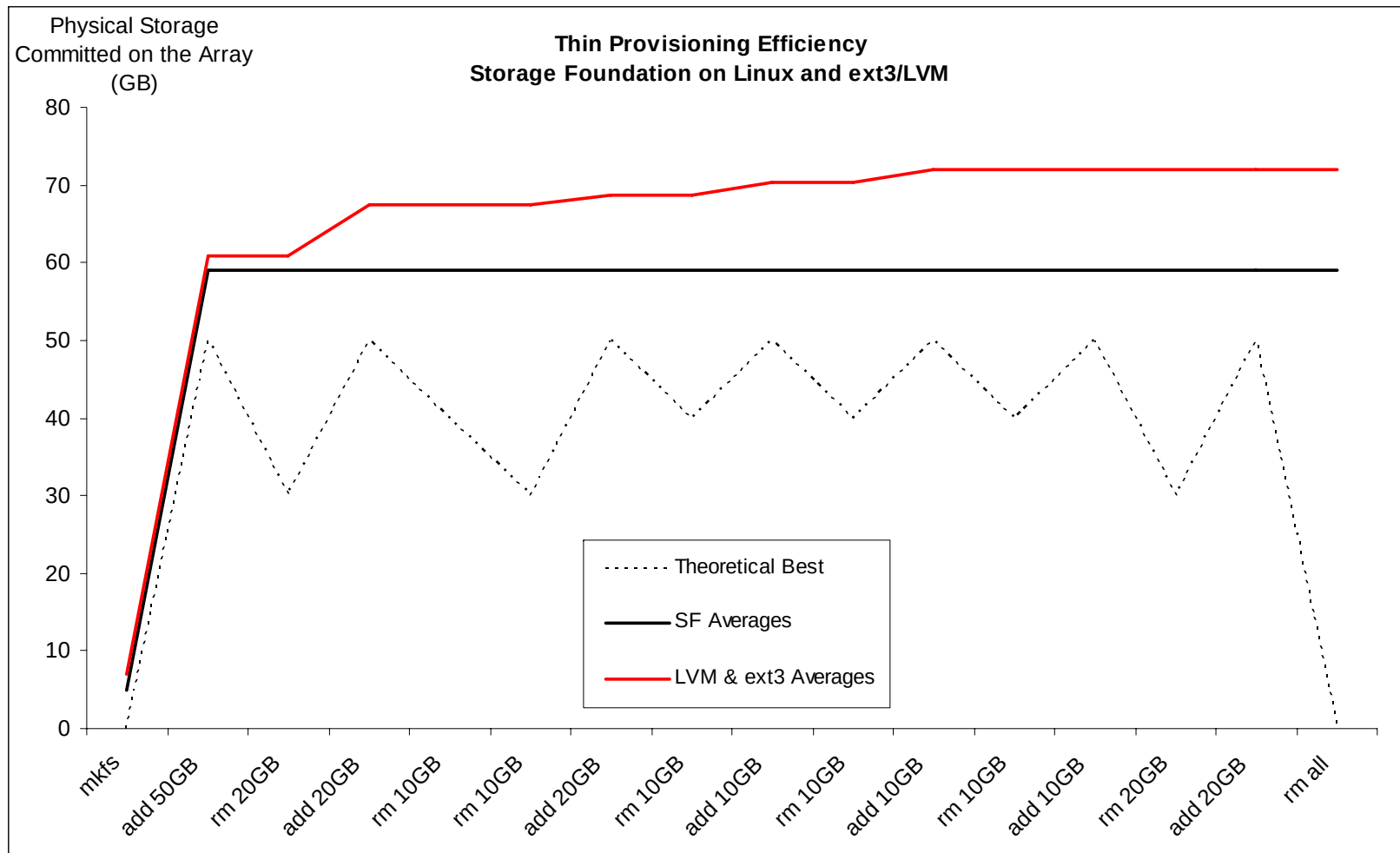
VxFS is Thin Friendly at Creation Time



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 - 10 8KB writes issued every 11 MB on a volume trigger 100 MB allocation
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- **VxFS maximizes Thin Storage Utilization**
 - Few inodes at the beginning of volume at creation (mkfs) time
 - Addition of inodes as needed over time



File System Core Algorithms Affect Thin Storage Utilization



- `dd if=/dev/zero of=$2 bs=1048576k count=$1`
- In this test run, ext3 ends up allocating 21% more than VxFS

Some File System Have a Tendency to Wander Over Underlying Volume



- Thin Storage is 'Write Once, Allocate Forever'
 - A file created triggers allocation. A file deleted does nothing
 - Another file created, if on brand new blocks, triggers allocation
- File systems differ in their ability to reuse 'free' space

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Thin LUN Utilization



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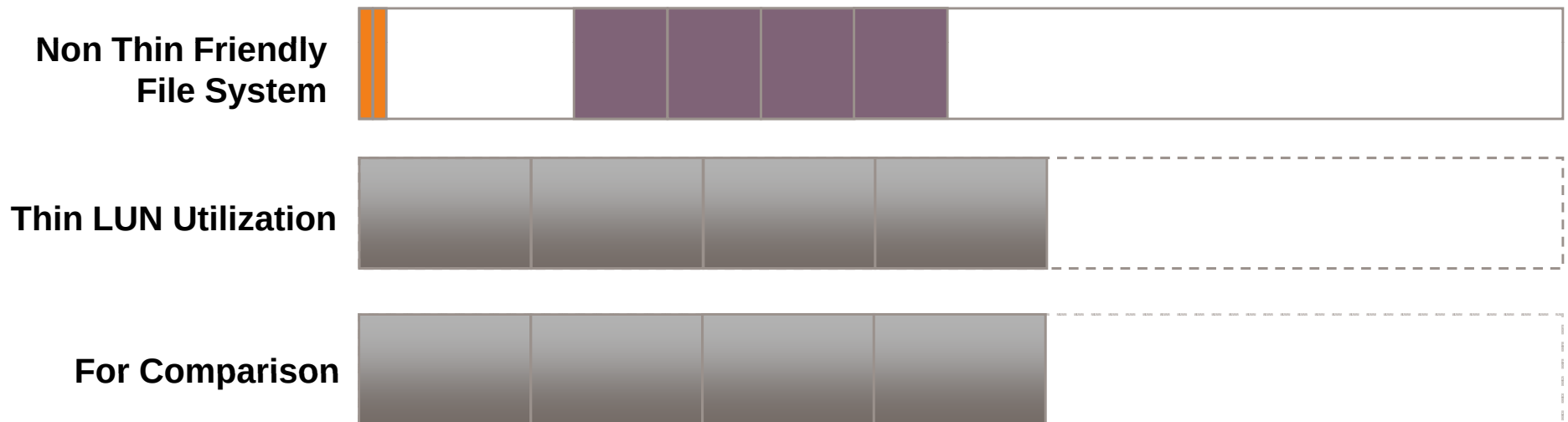
Thin LUN Utilization



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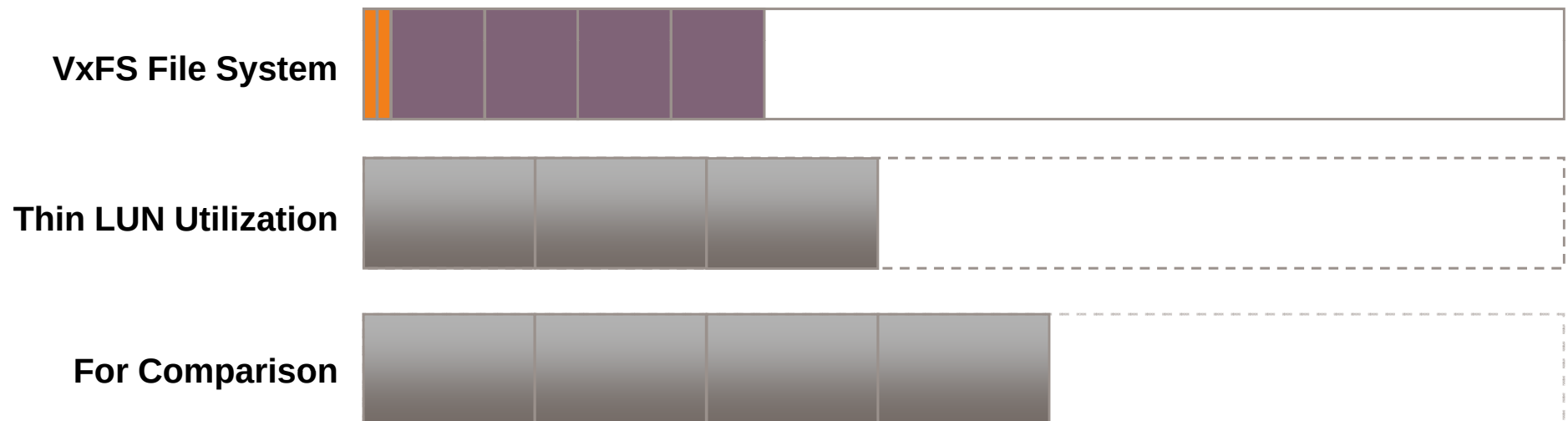
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VxFS on Unix and Linux Minimizes Wasted Space



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- File systems differ in their ability to reuse 'free' space
- **VxFS aggressively recycles freed space**
- **VxFS minimizes unnecessary space allocation in array**



Optimize Thin Provisioning on Windows



- VxFS is very thin friendly on Unix and Linux
- On Windows however, one must contend with NTFS
- NTFS is NOT thin friendly
 - NTFS is OK at creation time
 - NTFS has a strong tendency to wander across entire volume
 - Known problem in the industry documented by storage vendors
- Recommended strategy
 - Running NTFS on a 'small' volume and expand based on utilization
- Storage Foundation Windows can automate all of it
 - Ensure storage teams benefit from high thin storage utilization
 - Without increasing operational burden on server teams

Storage Foundation Windows

Volume Auto-Grow Functionality



- Storage Foundation Windows actively monitors capacity
 - Queries file system for usage
 - Can be configured to notify system administrator
 - Can be configured to automatically take actions
- Automatically grows NTFS file system and underlying volume
 - Online operation. No impact to applications
 - Administrator gets detailed control of when and how things grow
 - Administrator sets size of growth increments
 - Administrator can configure volume max size

Making NTFS Thin Friendly on Windows



- When a volume is formatted in Windows, the file system occupies the entire volume
- When a NTFS is located on a large thin volume, physical storage will be unnecessarily allocated by NTFS
- With SFW, dynamic volumes can be enabled to grow automatically, ensuring high utilization of thin storage

1. A small dynamic volume is created on thin storage



NTFS Data



SFW Volume under NTFS

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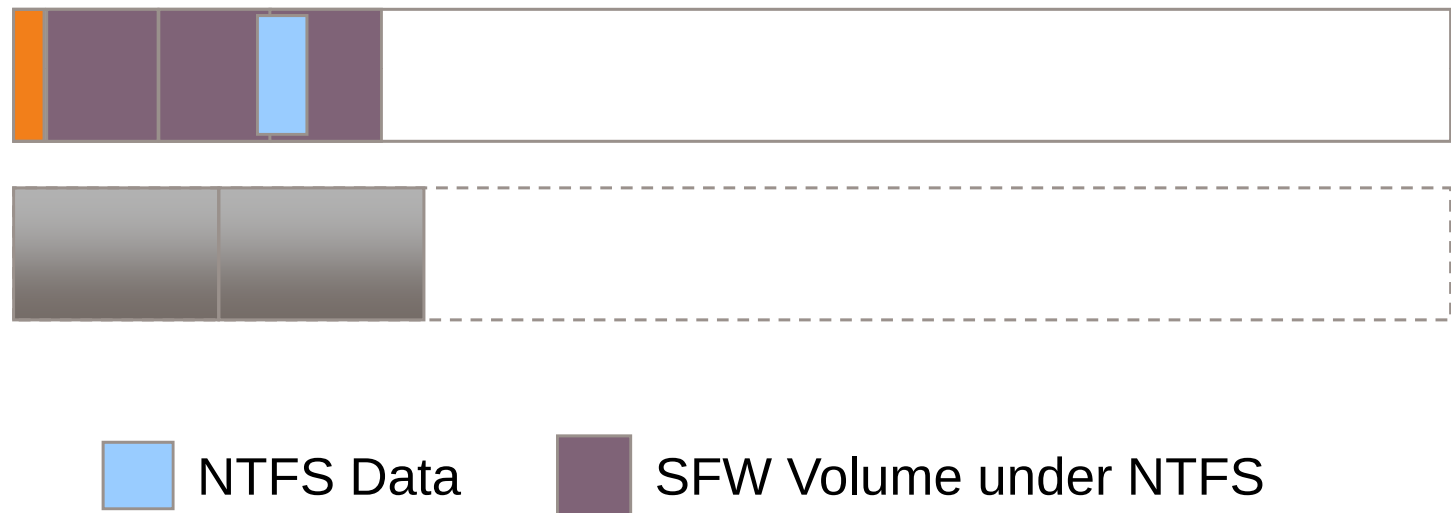
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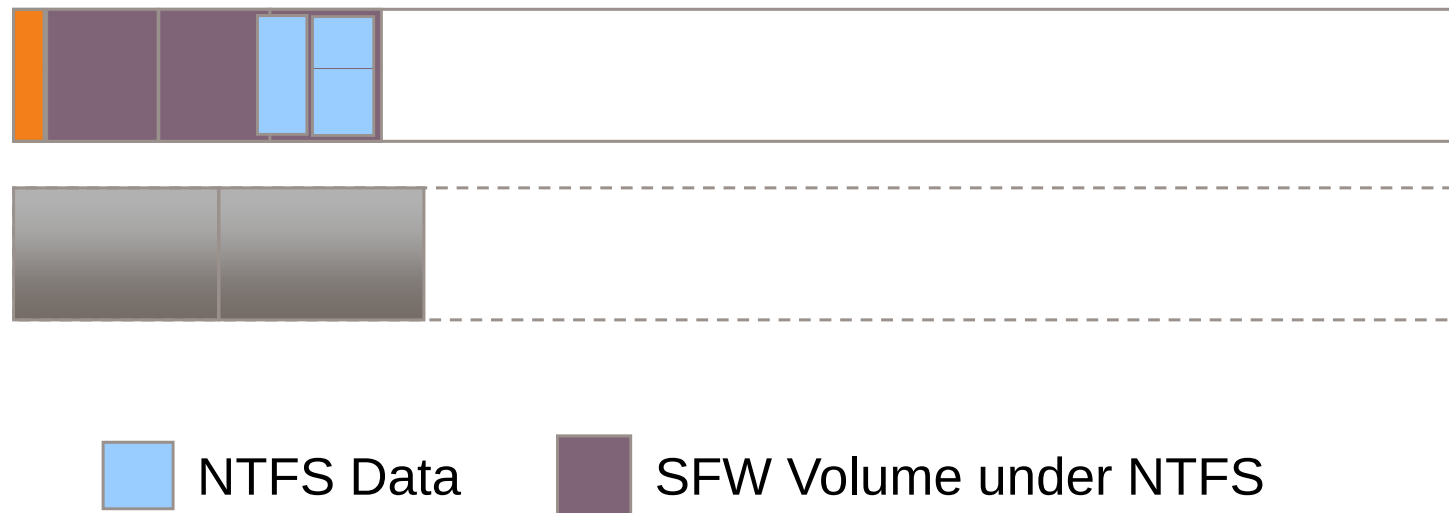


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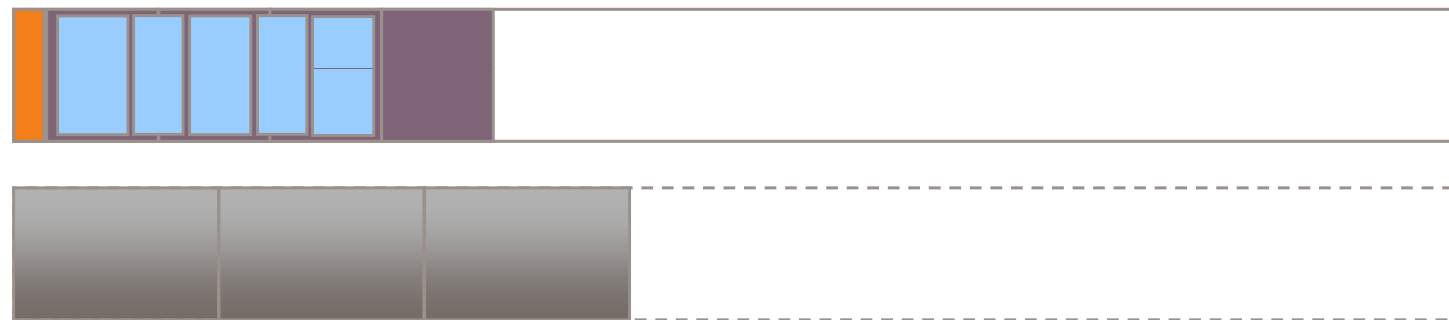
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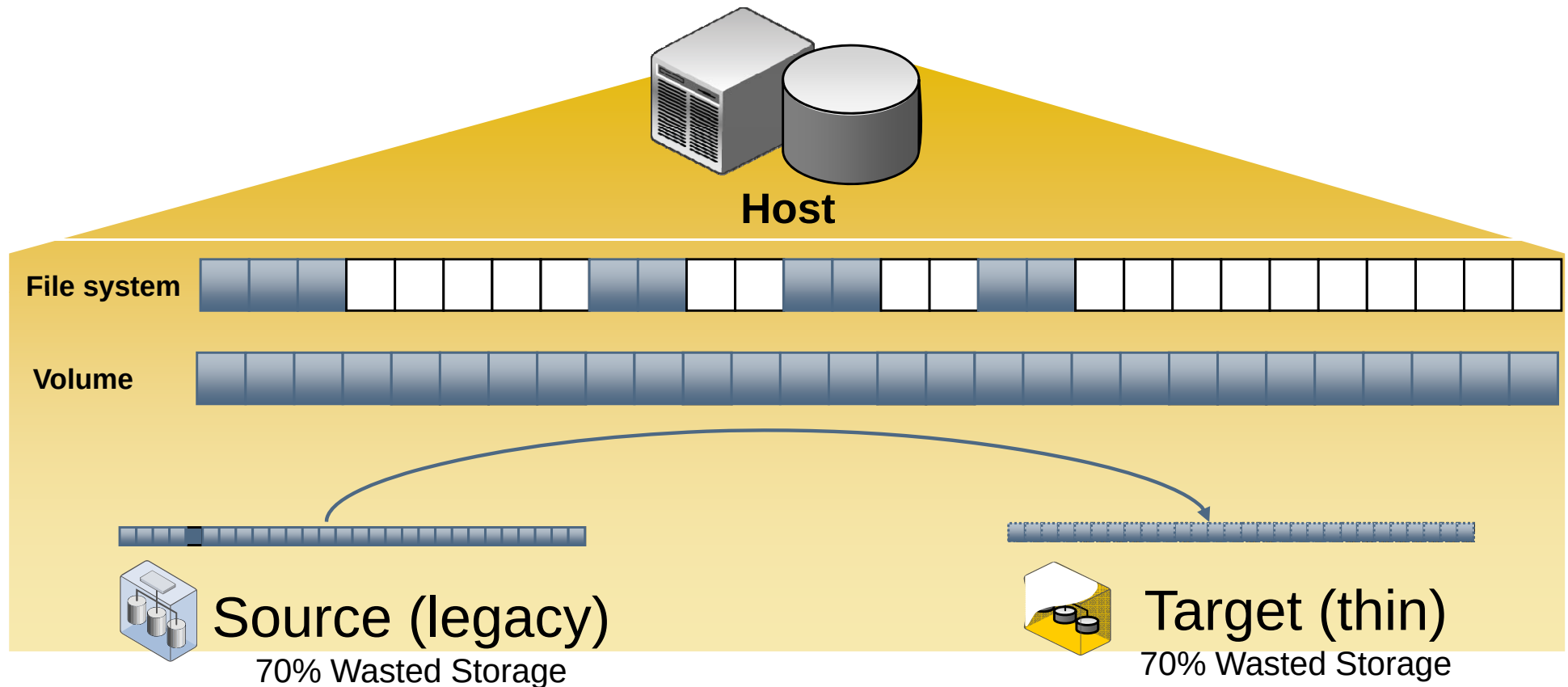
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Get Thin with SmartMove™

Challenge of Migrating to Thin Storage



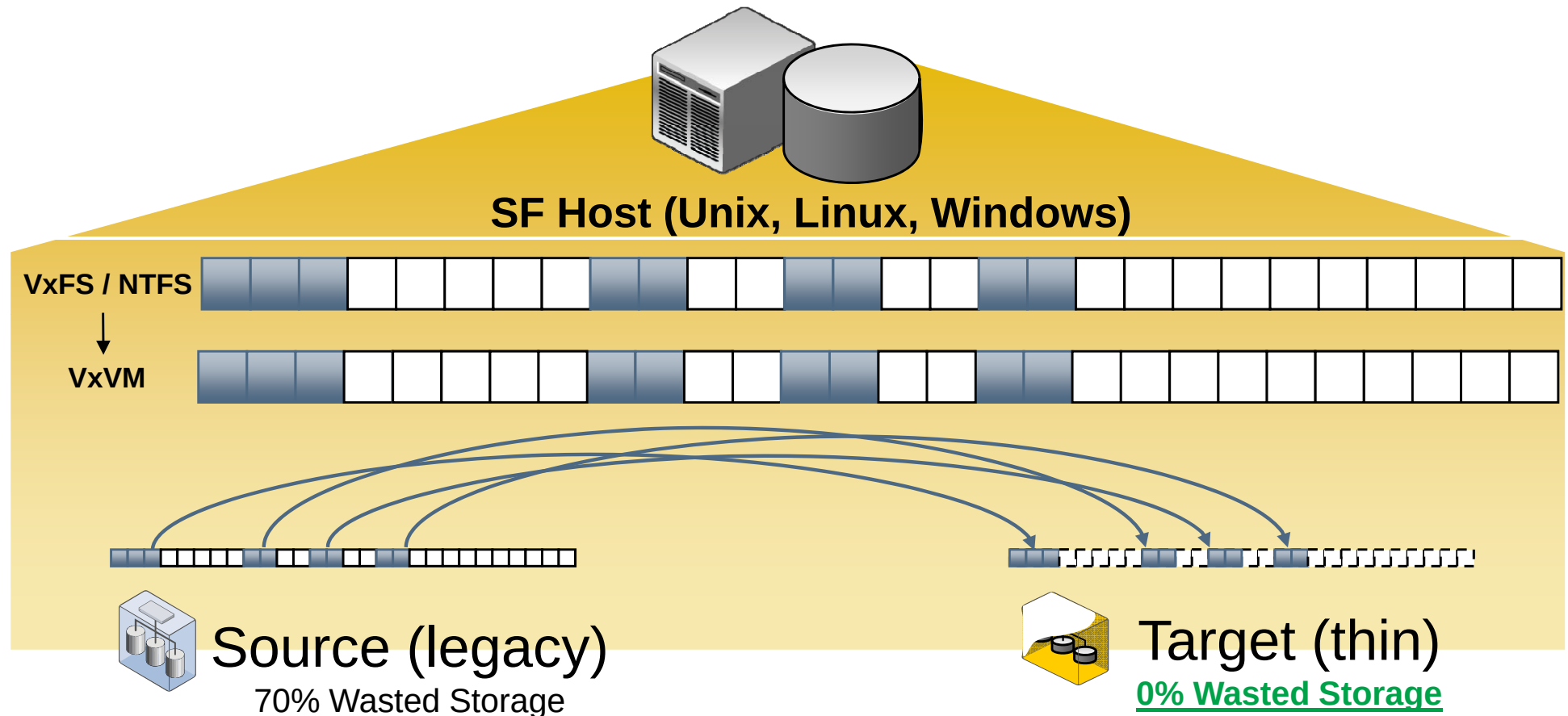
- Migrating online typically involves FULL 'block level' copy to Thin Devices
 - Effectively writes across entire TP mirror, causing full allocation
 - If plex 1 is 100 GB with 50 GB used, 100 GB will be allocated to TP plex 2
- This applies to ALL block level copy methods (Host, Network, Appliance, Array)



Migrate Online and Reclaim Storage



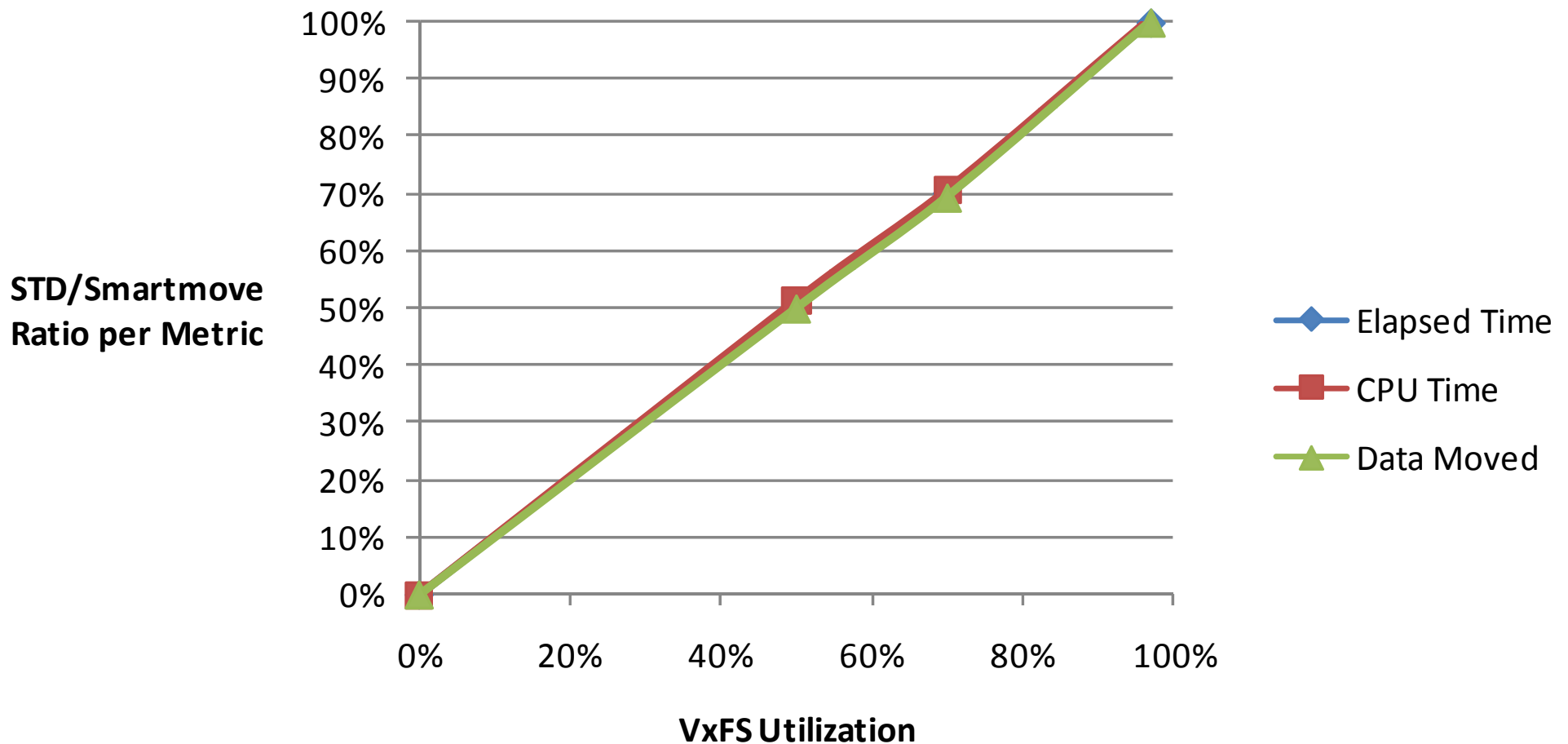
- SmartMove™ allows online reclamation as you migrate to Thin Storage
 - When mirroring, SmartMove only copies useful blocks
- SmartMove™ is hardware independent and works with ALL thin storage
- Industry's only solution for online thick to thin conversions



SmartMove™ Performance Benefits



- Performance benefits are linear with VxFS utilization





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Storage Foundation Thin Reclamation

Need to Optimize Thin Storage Over Time

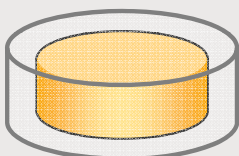


- Ability to reclaim 'no longer used' thin storage is needed
- SmartMove provides a great starting point
- VxFS and SFW minimize unnecessary allocations...
- ... BUT unnecessary allocations are caused by applications
 - Think of the multiple temp files Word creates on Windows
 - Think of an application running-away on a Thin Volume...
- Only the host can differentiate between free and used blocks

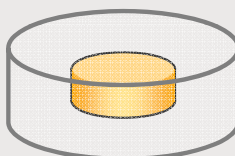
Storage Foundation Thin Reclamation



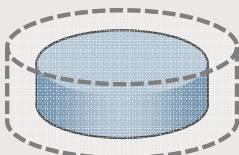
Used space in large
VxFS file system



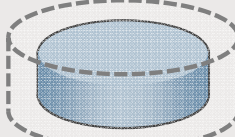
File deletions
reduce VxFS
used space



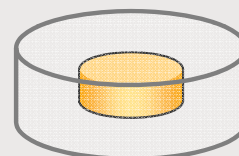
Physical storage
behind Thin LUN



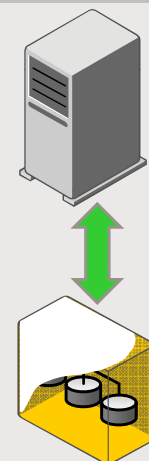
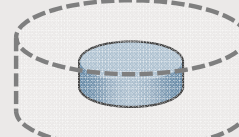
Physical storage
does NOT change



SF Thin Reclamation
No change on host



Physical storage
is “right-sized”



- Leverage host intelligence to “right-size” physically allocated space
- Make storage reclamation easy, online, and transparent to the host
 - No change to VxFS file system and VxVM volume size or configuration
- SF 5.0 MP3 is Online Thin Reclamation ready
 - Thin Reclamation requires hardware specific integration

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 - Simplify storage management and increase utilization
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HDS Whitepaper on HDP and Storage Foundation
<http://www.hds.com/products/storage-software/hitachi-dynamic-provisioning.html>

QUESTIONS & ANSWERS

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