Technical white paper

HP 3PAR StoreServ Storage best practices guide

A reference and best practices guide for HP 3PAR StoreServ Storage

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Typographical conventions

This guide uses the following typographical conventions:

Table 1. Typographical conventions

Typeface	Meaning	Example
ABCDabcd	Used for dialog elements such as titles, button labels, and other screen elements	When prompted, click Finish to complete the installation
ABCDabcd	Used for user input, filenames, commands, paths, and screen output	`Start the \OS\Windows\setup.exe`
<ABCDabcd>	Used for variables in user input, filenames, paths, and screen output	To add a user to a domain issue the setuser –adddomain <domainname>:role <username> command
Best practice	Used to highlight best practices for a particular topic section	**Best practice:** Use RAID 5

Advisories

To avoid injury to people or damage to data and equipment, be sure to observe the cautions and warnings in this guide. *Always be careful when handling any electrical equipment.*

WARNING! Warnings alert you to actions that can cause injury to people or irreversible damage to data or the operating system.

CAUTION! Cautions alert you to actions that can cause damage to equipment, software, or data.

Note: Notes are reminders, tips, or suggestions that supplement the procedures included in this guide.

Note: The InServ Storage Server has been rebranded as the HP 3PAR StoreServ Storage system. There are instances in this document where menu items and command output refer to the HP 3PAR StoreServ Storage system as InServ or InServ Storage Server.

Introduction

Audience

This guide is for system and storage administrators of all levels. Anyone who plans storage policies, configures storage resources, or monitors the storage usage of HP 3PAR StoreServ Storage should read this guide.

User interfaces

Two user interfaces are available for the administration of HP 3PAR StoreServ: the HP 3PAR Operating System (OS) Command Line Interface (CLI) software and the HP 3PAR Management Console software. Unless otherwise stated, all tasks can be performed with both the CLI and the Management Console. Refer to the *HP 3PAR OS CLI Administrator's Manual* and the *HP 3PAR OS Management Console Online Help* for instructions on how to perform the tasks described at a conceptual level in this guide.

Units of measure

All units of storage (capacity) are calculated base 2 (x 1,024). Therefore:

- 1 KiB = 1,024 bytes
- 1 MiB = 2^{20} bytes = 1,048,576 bytes
- 1 GiB = 2^{30} bytes = 1,024 MB = 1,073,741,824 bytes
- 1 TiB = 2^{40} bytes = 1,024 GB = 1,099,511,627,776 bytes

All units of performance (speed) are calculated base 10 (x1000). Therefore:

- 1 KB = 1000 bytes
- 1 MB = 10^{20} bytes = 1,000,000 bytes
- 1 GB = 10^{30} bytes = 1000 MB = 1,000,000,000 bytes
- 1 TB = 10^{40} bytes = 1000 GB = 1,000,000,000,000 bytes

Related documentation

Complete description of CLI commands	HP 3PAR Command Line Reference
Using the Management Console to configure and administer the system	HP 3PAR Management Console Online Help
Using the CLI to configure and administer the system	HP 3PAR CLI Administrator's Manual
Identifying storage system components and detailed alert information	HP 3PAR OS Messages and Operator's Guide
Using HP 3PAR Remote Copy Software	HP 3PAR Remote Copy Software User's Guide
Using the HP 3PAR CIM	HP 3PAR CIM API Programming Reference
Using HP 3PAR Host Explorer Software	HP 3PAR Host Explorer User's Guide

For identifying storage system configuration specifications and compatibility information, go to the Single Point of Connectivity Knowledge (SPOCK) website at http://h20272.www2.hp.com/.

Overview

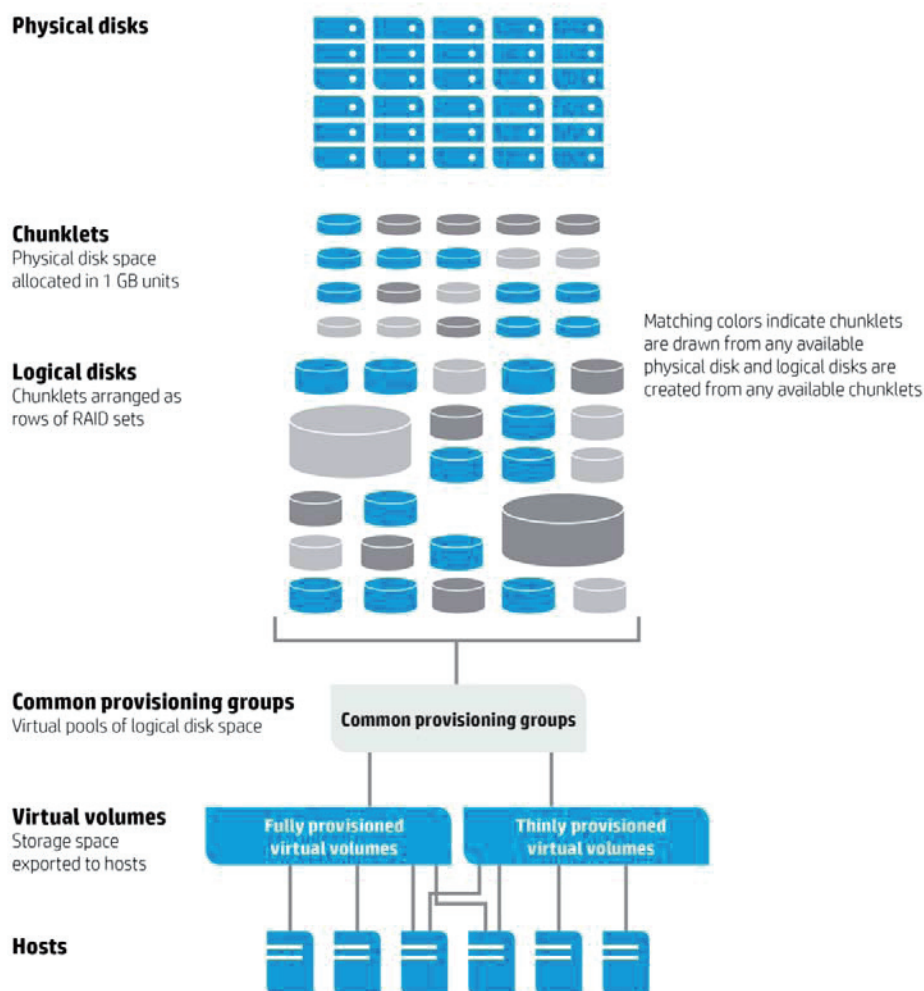## HP 3PAR StoreServ Storage concepts and terminology

HP 3PAR StoreServ includes both hardware components that physically store data and software applications that manage data. For more information about hardware platforms, see the section titled "HP 3PAR StoreServ hardware" in this document. For more information about system software applications and features, see the section titled "HP 3PAR OS software."

HP 3PAR StoreServ comprises the following logical data layers:

- Physical disks
- Chunklets
- Logical disks
- Common provisioning groups
- Virtual volumes

The relationship between system data layers is illustrated in figure 1. Each layer is created from elements of the layer above. Chunklets are drawn from physical disks. Logical disks are created from groups of chunklets. Common provisioning groups (CPGs) are groups of logical disks. And virtual volumes use storage space provided by CPGs. The virtual volumes are exported to hosts and are the only data layer visible to hosts.

Figure 1. HP 3PAR StoreServ system data layers

Physical disks

A *physical disk* is a hard drive mounted on a drive magazine located in an HP 3PAR StoreServ drive enclosure.

Chunklets

Physical disks are divided into *chunklets.* Each chunklet occupies contiguous space on a physical disk. On F-Class and T-Class systems, all chunklets are 256 MB. On HP 3PAR StoreServ 10000 and 7000 Storage, all chunklets are 1 GB. Chunklets are automatically created by the HP 3PAR OS and they are used to create logical disks. A chunklet is assigned to only one logical disk.

Logical disks

A *logical disk* is a collection of chunklets arranged as rows of RAID sets. Each RAID set is made up of chunklets from different physical disks. Logical disks are pooled together in common provisioning groups, which allocate space to virtual volumes. The underlying logical disks are automatically created by the HP 3PAR OS when you create VVs. The RAID type, space allocation, growth increments, and other logical disk parameters are specified when you create a CPG or can be modified later. HP 3PAR StoreServ supports the following RAID types:

- RAID 10 (RAID 1)
- RAID 50 (RAID 5)
- RAID Multi-Parity (MP) or RAID 6

Common provisioning groups (CPGs)

A *CPG* is a virtual pool of logical disks that allocates space to virtual volumes on demand. A CPG allows up to 4,095 virtual volumes to share the CPG's resources. You can create fully provisioned virtual volumes and thinly provisioned virtual volumes (TPVVs) that draw space from a CPG's logical disk pool. It is important to note that if no volumes (thick or thin) have been created in a CPG, it consumes no space.

Virtual volumes (VVs)

Virtual volumes draw their resources from CPGs and are exported as logical unit numbers (LUNs) to hosts. Virtual volumes are the only data layer visible to the hosts. You can create physical copies or virtual copy snapshots of virtual volumes. Full copies remain available if the original base volume becomes unavailable. Before creating virtual volumes, you must first create CPGs to allocate space to the virtual volumes.

Fully provisioned virtual volumes

A *fully provisioned* virtual volume is a volume that uses logical disks that belong to a CPG. Unlike TPVVs, fully provisioned virtual volumes have a set amount of user space that is allocated for user data. The fully provisioned volume size is fixed, and the size limits range from 1 GB to 16 TB.

Thinly provisioned virtual volumes

A *thinly provisioned* virtual volume (TPVV) is a volume that uses logical disks that belong to a CPG. TPVVs associated with the same CPG draw space from that pool as needed, allocating space on demand in small increments for each TPVV. As the volumes that draw space from the CPG require additional storage, the HP 3PAR OS automatically creates additional logical disks and adds them to the pool until the CPG reaches the user-defined growth limit, which restricts the CPG's maximum size.

Physical copies

A *physical copy* duplicates all the data from a base volume to a destination volume. The base volume is the original volume that is copied to the destination volume. The physical copy on the destination volume remains available if the original base volume becomes unavailable. Unlike a virtual copy or snapshot, a physical copy can maintain the performance of the base virtual volume provided the physical copy has the same disk characteristics (type, speed, RAID level, etc.).

In addition, the destination volume must have a user space size at least as large as the user space of the base volume being copied. In addition, the HP 3PAR OS now allows the export of the physical copy immediately after the creation of the copy, while the data copy continues to completion in the background.

Note: With an HP 3PAR Remote Copy software license, physical copies can be copied from one HP 3PAR StoreServ system to another using Remote Copy. For additional information, see the *HP 3PAR Remote Copy User's Guide.*

Virtual copy snapshots

A *snapshot* is a virtual copy of a base volume. The base volume is the original volume that is copied. Unlike a physical copy, which is a duplicate of an entire volume, a virtual copy only records changes to the base volume. This allows an earlier state of the original virtual volume to be re-created by starting with its current state and rolling back all the changes that have been made since the creation of the virtual copy.

You can make snapshots of fully provisioned virtual volumes, TPVVs, physical copies, or another virtual copy snapshot. Snapshots are created using copy-on-write techniques available only with the HP 3PAR Virtual Copy software license. Thousands of snapshots of each virtual volume can be created, assuming that there is sufficient storage space available. It is worth noting that snapshots do not consume any space unless data on the base volume has been updated and the original data copied to the Snapshot Data Space. Changed data is copied only once regardless of the number of snapshots taken.

Note: Creating virtual copies requires an HP 3PAR Virtual Copy software license.

Exporting virtual volumes

For a host to see a virtual volume, the volume must be exported as a logical unit number (LUN). Volumes are exported by creating virtual volume-LUN pairings (VLUNs) on the system. When you create VLUNs, the system produces both *VLUN templates* that establish export rules, and *active VLUNs* that the host sees as LUNs or attached disk devices.

HP 3PAR software products

HP 3PAR software offerings include both the operating system and additional software products that run on the HP 3PAR Storage System and on Microsoft® Windows®, Linux, or UNIX® hosts.

- **HP 3PAR Operating System software:** The HP 3PAR Operating System software comes installed on the HP 3PAR Storage System. The HP 3PAR OS includes a collection of advanced internal virtualization capabilities to increase storage efficiency and reduce administration time.

- **Additional HP 3PAR software:** Additional software products available for HP 3PAR Storage Systems offer enhanced capabilities, including thin storage technologies, secure partitioning for virtual private arrays, and virtual and remote copy capabilities.

- **Host software:** Host-based software products from HP 3PAR enable the next-generation HP 3PAR platform to address the needs of specific application environments, multipathing, and historical performance and capacity management.

- **HP 3PAR StoreServ 7000 software suites:** HP 3PAR StoreServ 7000 Storage supports the same operating system and software offerings as the other members of the HP 3PAR StoreServ family, but with these specific StoreServ models you have the opportunity to purchase software bundled into a series of suites designed to be affordable and simple to purchase. Selected software titles can also be purchased separately, as indicated below.

What's new

HP 3PAR Operating System software additions

- HP 3PAR Persistence Ports
- HP 3PAR Autonomic Rebalance
- HP 3PAR Web Services API

HP 3PAR StoreServ 7000 software suites

- HP 3PAR Operating System Software Suite
- HP 3PAR Data Optimization Software Suite
- HP 3PAR Replication Software Suite
- HP 3PAR Security Software Suite
- HP 3PAR Reporting Software Suite

- HP 3PAR Application Software Suite for VMware
- HP 3PAR Application Software Suite for Exchange
- HP 3PAR Application Software Suite for SQL
- HP 3PAR Application Software Suite for Oracle

HP 3PAR Operating System software

The software foundation of HP 3PAR Utility Storage is the HP 3PAR Operating System, which utilizes advanced internal virtualization capabilities to increase administrative efficiency, system utilization, and storage performance.

The HP 3PAR OS includes the following functionality and features:

- HP 3PAR Administration Tools
- Rapid Provisioning
- Autonomic Groups
- Scheduler
- Persistent Cache
- RAID MP (Multi-Parity)
- Full Copy
- Access Guard
- Thin Copy Reclamation
- LDAP Support

Product highlights:

- **Access Guard:** Access Guard is an HP 3PAR OS feature that delivers user-configurable volume security at logical and physical levels by enabling you to secure hosts and ports to specific virtual volumes.
- **Autonomic Groups:** Autonomic Groups is an HP 3PAR OS software feature that brings a new provisioning paradigm to clustered and virtual server environments by building on the same innovation featured by 3PAR Rapid Provisioning.

  Autonomic Groups is designed to reduce room for human error by eliminating manual repetition of tedious commands, thereby making the provisioning process more reliable. This software feature also simplifies reporting by enabling users to pull boot and data disk utilization statistics from different clusters with just a single command.

  In addition, when used together with HP 3PAR Virtual Domains, Autonomic Groups allows multiple independent virtual domains to be grouped as a single logical entity to simplify storage administration while maintaining the integrity of individual virtual domains. For example, backing up an autonomic domain group actually backs up all virtual domains in the group to a single backup server while still maintaining the security and isolation associated with each individual domain.
- **Full Copy:** Full Copy is an HP 3PAR OS feature that allows you to create point-in-time clones with independent service-level parameters. Full Copy offers rapid resynchronizations and is thin provisioning-aware. New with HP OS version 3.1.2, Full Copy clones are immediately available to host while data synchronization takes place in the background.
- **HP 3PAR Persistent Ports:** HP 3PAR Persistent Ports is a Tier 1 resiliency feature that allows for nondisruptive online software upgrades on HP 3PAR StoreServ Storage systems without relying on multipathing software. This feature, available on all HP 3PAR StoreServ models, brings increased Tier 1 resiliency, across the StoreServ product line including the midrange platform by keeping host paths online throughout the software upgrade process. The use of standard NPIV (N_Port ID Virtualization) technology as defined by the Technical Committee T11 in the Fibre Channel-Link Services (FC-LS) specification enables a single host-facing StoreServ port to assume the identity of additional pre-designated partner ports, thus enabling transparent switchover of host path connections.
- **HP 3PAR Autonomic Rebalance:** HP 3PAR Autonomic Rebalance provides the ability to analyze how volumes on the HP 3PAR StoreServ are using physical disk space and makes intelligent, autonomic adjustments to maintain optimal volume distribution when new hardware is added to the system. The best practice is to run the Autonomic Rebalance (Also known as tunesys) after new hardware is added to the system.
- **HP 3PAR Web Services API:** HP 3PAR Web Services API delivers a programming interface for implementing durable automation of storage management tasks with HP 3PAR StoreServ Storage systems. Web Services API provides a

well-defined application programming interface that customers can use to incorporate the storage infrastructure into their platform for end-to-end automation of their service delivery and management. The Web Services API implementation is based on RESTful Web API service using HTTPS, principles of REST, and data structures represented with JSON (JavaScript Object Notation). The server recognizes HTTP versions 1.0 and 1.1.

- **StoreServ Administration Tools:** The HP 3PAR Operating System offers industry-leading ease of use through a simple, unified Management Console and an extremely powerful, scriptable StoreServ Command Line Interface (CLI). Manage your entire utility storage deployment from a single window, including remote replication to disaster recovery sites. The latest version of the StoreServ Management Console is fully integrated with signature HP 3PAR applications such as HP 3PAR Thin Provisioning, Virtual Copy, Dynamic Optimization, Virtual Domains, and Remote Copy—so everything you need to optimize your storage environment is right at your fingertips. The StoreServ CLI gives you powerful customization capabilities that are simple to configure, eliminating the need for extra tools and consulting. Open administration support is provided via SNMP and the Storage Management Initiative Specification (SMI-S).

- **LDAP:** Native support for lightweight directory access protocol (LDAP) within the HP 3PAR OS delivers centralized user authentication and authorization using a standard protocol for managing access to IT resources. With support for LDAP, you can now integrate HP 3PAR Utility Storage with standard, open enterprise directory services. The result is simplified security administration with centralized access control and identity management.

- **Persistent Cache:** HP 3PAR Persistent Cache is a resiliency feature built into the HP 3PAR OS that allows "always on" application and virtual server environments to gracefully handle an unplanned controller failure. Persistent Cache eliminates the substantial performance penalties associated with traditional arrays and "write-through" mode so that HP 3PAR StoreServ Storage can maintain required service levels even in the event of a cache or controller node failure. HP 3PAR Persistent Cache leverages the clustered InSpire Architecture with its unique Mesh-Active design to preserve write-caching by rapidly re-mirroring cache to the other nodes in the cluster in the event of a failure. Persistent Cache is supported on all quad-node and larger HP 3PAR arrays, including the StoreServ F400—making HP 3PAR the only vendor to incorporate this industry-leading service-level protection capability into midrange as well as high-end arrays.

- **RAID MP (Multi-Parity):** HP 3PAR RAID MP (Multi-Parity) introduces Fast RAID 6 technology backed by the accelerated performance and Rapid RAID Rebuild capabilities of the HP 3PAR ASIC. HP 3PAR RAID MP is supported on all StoreServ models and delivers extra RAID protection that prevents data loss as a result of double disk failures. RAID MP delivers this enhanced protection while maintaining performance levels within 15 percent of RAID 10 and with capacity overheads comparable to popular RAID 5 modes. For this reason, HP 3PAR RAID MP is ideal for large disk drive configurations—for example, Serial ATA (SATA) drives above 1 TB in capacity.

- **Rapid Provisioning:** The HP 3PAR OS eliminates array planning by delivering instant, application-tailored provisioning through the fine-grained virtualization of lower-level components. Provisioning is managed intelligently and autonomically. Massively parallel and fine-grained striping of data across internal resources sustains high and predictable service levels for all workload types. Service conditions remain high and predictable as the use of the system grows or in the event of a component failure, while traditional storage planning, change management, and array-specific professional services are eliminated.

- **Scheduler:** HP 3PAR Scheduler also helps automate storage management, reduce administration time, and decrease the chance of administrative error. Scheduler does this by giving users full control over creation and deletion of virtual copy snapshots—a process that is now completely automated with HP 3PAR Utility Storage. When used in conjunction with Autonomic Groups, HP 3PAR Scheduler automates virtual copy snapshots across multiple boot and data volumes with full write consistency across all these different volumes.

- **Thin Copy Reclamation:** An industry first, Thin Copy Reclamation keeps your storage as lean and efficient as possible by reclaiming unused space resulting from deleted virtual copy snapshots and remote copy volumes. Thin Copy Reclamation is built on HP 3PAR Thin Engine, a virtualization mapping engine for space reclamation that is included as part of the HP 3PAR OS.

Additional 3PAR software

- Thin Provisioning
- Thin Conversion
- Thin Persistence
- Virtual Domains
- Adaptive Optimization
- Dynamic Optimization
- Virtual Lock

- Virtual Copy
- Remote Copy
- System Turner

HP 3PAR Thin Suite

HP 3PAR Thin Suite is the most comprehensive thin software suite available. With the Thin Suite, virtual and cloud data centers can:

- **Start thin:** HP 3PAR Thin Provisioning is the most comprehensive thin provisioning software solution available. Since its introduction in 2002, HP 3PAR Thin Provisioning has become widely considered the gold standard in thin provisioning. It leverages HP 3PAR's dedicate-on-write capabilities to help organizations become more efficient and more green by allowing them to purchase only the disk capacity they actually need—and only as they actually need it.

- **Get thin:** With HP 3PAR Thin Conversion, a technology refresh no longer requires a terabyte-for-terabyte replacement. Instead, you can eliminate up to 75 percent of your legacy capacity simply and rapidly. This savings alone can save up to 60 percent on the cost of a technology refresh. HP 3PAR Thin Conversion software makes this possible by leveraging the zero-detection capabilities within the HP 3PAR ASIC and Thin Engine—HP 3PAR's unique virtualization mapping engine for space reclamation—to power the simple and rapid conversion of inefficient, "fat" volumes on legacy arrays to more efficient, higher-utilization "thin" volumes on any HP 3PAR Storage System featuring Thin Built In.

- **Stay thin:** With HP 3PAR Thin Persistence, customers can now leverage next-generation space reclamation technology to minimize storage TCO and maintain the environmental responsibility targets they have worked so hard to achieve.

The Thin Suite includes the following software:

- Thin Provisioning
- Thin Conversion
- Thin Persistence

The Thin Suite is offered on all HP 3PAR StoreServ systems.

HP 3PAR Thin Provisioning software

Start thin. HP 3PAR Thin Provisioning is the most comprehensive thin provisioning software solution available. Since its introduction in 2002, HP 3PAR Thin Provisioning has been widely considered the gold standard in thin provisioning. It leverages HP 3PAR's dedicate-on-write capabilities to help organizations become more efficient and more green by allowing them to purchase only the disk capacity they actually need—and only as they actually need it.

With Thin Provisioning, there is no more up-front capacity allocation. No more dedicating resources for each application. No more paying to house, power, and cool disks that might not be needed for months or years to come—or may never be needed at all.

Product highlights:

- HP 3PAR Thin Provisioning is completely automated

- HP 3PAR uses a reservationless, dedicate-on-write approach to thin provisioning that draws and configures capacity in fine-grained increments from a single free space reservoir without pre-dedication of any kind.

- HP 3PAR Thin Provisioning uses an allocation unit size of just 16 KB, so you don't have to worry about small writes consuming megabytes or even gigabytes of capacity.

- HP 3PAR is the only vendor to feature the clustered 3PAR InSpire Architecture, which uniquely supports thin provisioning by providing massive scalability within a single system so additional capacity can be easily added to fulfill earlier over-allocations.

HP 3PAR is the only vendor with arrays built from the ground up to support thin provisioning by eliminating the diminished performance and functional limitations that plague bolt-on thin solutions.

HP 3PAR Thin Conversion software

With HP 3PAR Thin Conversion, a technology refresh no longer requires a terabyte-for-terabyte replacement. Instead, you can eliminate up to 75 percent of your legacy capacity simply and rapidly. This savings alone can save you up to 60 percent on the cost of a technology refresh.

With HP 3PAR Thin Conversion, you can quickly shrink your storage footprint, reduce storage TCO, and meet your green IT targets. HP 3PAR Thin Conversion software makes this possible by leveraging the zero-detection capabilities within the HP 3PAR Gen3 ASIC and Thin Engine—HP 3PAR's unique virtualization mapping engine for space reclamation—to power the simple and rapid conversion of inefficient, "fat" volumes on legacy arrays to more efficient, higher-utilization "thin" volumes on any StoreServ featuring Thin Built In. Getting thin has never been so easy.

The zero-detection capability built into the HP 3PAR Gen3 ASIC combined with Thin Conversion software can effectively and rapidly "thin" a heterogeneous datacenter to one-quarter of its original size—or less—while preserving service levels and without impacting production workloads. This means that now not only is a technology more affordable, but it also reduces up-front capital costs as well as ongoing operational and environmental costs associated with powering, cooling, and housing your storage—and without requiring special host software or professional services.

Product highlights:

- Immediately eliminating storage capacity inefficiencies and permanently reducing disk expenditures
- Reducing SAN ports and storage software fees (physical TB licensing)
- Reducing power, cooling, and floor space costs by eliminating unnecessary drives in the conversion from fat to thin volumes
- Avoiding complex services often required for fat-to-thin volume conversion
- Reducing related storage, system, and DB administrator workloads
- Permitting more application deployments more affordably
- Delivering quicker payback by dramatically compressing the volume migration timeline from months to hours

HP 3PAR Thin Persistence software
With the introduction of HP 3PAR Thin Provisioning software in 2002, HP 3PAR revolutionized data storage by giving customers the ability to meet Green IT goals, reduce capacity purchases, decrease administration time, and address the significant problem of allocated but unused capacity head-on. With HP 3PAR Thin Persistence, HP 3PAR Utility Storage customers can now leverage next-generation space reclamation technology to minimize storage TCO and maintain the environmental responsibility targets they have worked so hard to achieve.

Product highlights:

- Eliminating storage capacity inefficiencies resulting from deleted files
- Deferring disk expenditures necessary to accommodate new data growth
- Reducing SAN ports and storage software fees (physical TB licensing)
- Reducing power, cooling, and floor space costs by eliminating unnecessary capacity
- Providing a simple, quick, and efficient mechanism for "thinning" volumes
- Permitting more application deployments and data growth with fewer capacity assets
- Speeding reclamation of space in minutes versus days or weeks

HP 3PAR Virtual Copy software
Built on thin copy technology, HP 3PAR Virtual Copy is a reservationless, nonduplicative, copy-on-write software product that allows you to protect and share data from any application affordably. Snapshots are available on demand, instantly, in read-only and read/write forms. With Virtual Copy, snapshots are reservationless because capacity is never reserved up-front and nonduplicative because changed data is never duplicated within the snapshot tree.

Coupled with consistency groups and support for hundreds of snapshots per base volume, Virtual Copy efficiency delivers affordable, CDP-like rapid application recovery from multiple points in time. With a single command, you can revert a base volume to any selected snapshot—without impacting other snapshots in the tree. And deleting a snapshot never affects peer snapshots.

Virtual Copy also integrates with HP 3PAR Autonomic Groups and HP 3PAR Scheduler—both built into the HP 3PAR Operating System—to automate the creation and deletion of virtual copy snapshots while giving users fine-grained control over the process. When used in conjunction with Autonomic Groups, Scheduler automates the creation of virtual copy snapshots across multiple boot and data volumes with full write consistency across all these different volumes. In combining these software capabilities, storage management is automated to reduce administration time and decrease the chance of human error.

Product highlights:

- Snapshots available instantly in read-only and read/write forms
- Developer-controlled mySnapshot functionality securely replaces/refreshes selected snapshots to speed development without burdening storage administrators.
- Support for consistency groups, sustaining data integrity across volumes
- Reservationless snapshots; fine-grained capacity consumed only for changed data
- Thin copy-on-writes—changed data is never duplicated within a snapshot tree
- Snapshots of snapshots for fast, flexible sharing of data sets without the need for additional base volumes
- Ability to revert to any snapshot with a single command, at any time
- 128 read/write and 500 read-only snapshots per virtual volume—affordable CDP-like rapid application recovery from multiple points in time
- Thin copy-on-write technology and massive parallelism, meaning little to no performance impact
- Ability to freely delete snapshots without affecting peer snapshots

HP 3PAR Remote Copy software

HP 3PAR Remote Copy is a unique replication technology that allows you to protect and share data from any application more simply, efficiently, and affordably. Remote Copy dramatically reduces the cost of remote data replication and DR on several fronts by leveraging HP 3PAR's unique thin copy technologies, enabling the use of both midrange and high-end arrays, and eliminating the need for professional services. In addition, HP 3PAR is the first storage vendor to offer autonomic DR configuration that enables you to set up and test your entire DR deployment—including multi-site replication using both midrange and high-end arrays—in just minutes, from a single window.

Product highlights:

- **Autonomic configuration:** With the HP 3PAR Management Console, even multi-site DR can be set up and tested in just minutes, and from a single window. Built-in, autonomic configuration capabilities unique to v3PAR Remote Copy enable DR to automatically and intelligently configure itself. With just a few clicks, you can set up and test remote replication with HP 3PAR T-Class, F-Class, or a combination of StoreServ arrays at multiple sites.
- **Multi-protocol support:** With Native IP as well as Fibre Channel (FC) support, HP 3PAR Remote Copy delivers out-of-the-box connectivity over your IP network, enabling you to replicate data more cost-effectively by leveraging your existing infrastructure. Achieve robust DR without the expensive converters and management of a separate, special-purpose infrastructure.
- **Host-independent replication:** HP 3PAR Remote Copy is a host-independent, array-based data mirroring solution that boosts performance by offloading host servers of replication tasks. HP 3PAR Virtual Volumes (VVs) are mirrored from one StoreServ array to another over variable distances using the mode of operation that best fits your needs.
- **Flexible, modular architecture:** HP 3PAR Remote Copy is supported on all StoreServ arrays (both high-end and midrange), all of which are scalable to meet your precise requirements. This flexibility gives you the ability to implement right-sized systems that meet the unique needs of each location. No more purchasing and managing high-end arrays even in DR configurations where smaller midrange arrays could suffice. HP 3PAR Remote Copy also allows you to configure remote mirrors with different RAID properties from their source volumes so you can more precisely tailor protection levels and cost.
- **Balanced performance:** HP 3PAR Remote Copy's line-trunking capability simplifies data transmission by making the most efficient use of all configured network links. Data transfers are autonomically balanced across all links, thus avoiding bottlenecks. Line-trunking also increases availability by automatically rebalancing the load in case of a link failure.
- **Long-distance replication with zero data loss:** HP 3PAR Remote Copy offers a unique synchronous long distance mode that allows you to meet low RTOs and zero-data loss RPOs with complete distance flexibility—while saving on hardware.
- **Thin provisioning awareness:** HP 3PAR Remote Copy is "thin provisioning-aware" so target volumes provide the same cost and ease-of-use benefits as thin source volumes. With the combination of HP 3PAR Thin Provisioning and HP 3PAR Remote Copy, both primary and remote sites can share in the benefits of allocating volumes just once while consuming only necessary physical capacity. The result is unprecedented efficiency in data replication.

HP 3PAR Optimization Suite

HP 3PAR Optimization Suite gives enterprise and cloud data centers the ability to optimize service levels autonomically, on a large scale, and for a lower total cost than any other solution available today.

The Optimization Suite includes the following functionality and features:

- Adaptive Optimization
- Dynamic Optimization
- System Tuner

The Optimization Suite is offered on HP 3PAR V-Class Storage Systems.

HP 3PAR Adaptive Optimization

HP 3PAR Adaptive Optimization software gives enterprise and cloud data centers the ability to optimize service levels autonomically, on a large scale, and for a lower total cost than any other solution available today. Adaptive Optimization takes a fine-grained approach to autonomic storage tiering that optimizes service levels by pairing data at the sub-volume level with the most cost-efficient resource capable of meeting its particular service-level requirement. Policy-driven, granular data movement takes place autonomically, on an ongoing basis—so the right quality of service (QoS) is delivered to the right data at the right time, at all times. Adaptive Optimization is included in the Optimization Suite on HP 3PAR V-Class Storage Systems. Adaptive Optimization is also available as a standalone software product on HP 3PAR V, T, and F-Class Storage Systems.

Product highlights:

- Reduce cost by:
  - Delivering sub-volume level, bidirectional data optimization
  - Enabling broad deployments with application-specific controls
- Gain agility by:
  - Offering application prioritization modes with QoS gradients
  - Autonomically delivering policy-driven data optimization
- Minimize risk by:
  - Leveraging a proven, fine-grained data movement engine
  - Controlling data movement timing

HP 3PAR Dynamic Optimization and Policy Advisor

HP 3PAR Dynamic Optimization and HP 3PAR Policy Advisor for Dynamic Optimization are autonomic storage tiering tools that give your organization the ability to react quickly to changing application and infrastructure requirements. Used together, these unique HP 3PAR utilities alleviate the problem of costly and time-consuming quality of service (QoS) level optimization—even in the largest and most demanding environments. Dynamic Optimization is included in the Optimization Suite on HP 3PAR V-Class Storage systems. Dynamic Optimization is also available as a standalone software product on HP 3PAR V, T, and F-Class Storage systems.

Product highlights—Dynamic Optimization:

- Autonomically applies the right storage resources to the right volume at the right time without scheduling, planning, or impacting application performance
- Eliminates the cost of over-provisioning to accommodate usage spikes and manual migration of data to lower-cost storage resources
- Enables service-level change orders on demand
- Aligns appropriate storage resources as needed with the changing value of data
- Autonomically, intelligently, and nondisruptively rebalances an entire system with a single button
- Allows for large-scale performance optimization after adding new resources to the system or moving a large number of volumes between tiers

Product highlights—Policy Advisor for Dynamic Optimization[1]:

- Autonomically and nondisruptively rebalances multiple volumes with a single command based on configurable policies
- Allows for large-scale performance optimization after adding new resources to the system or moving a large number of volumes between tiers

HP 3PAR System Tuner

Because maintaining good balance is critical to high and predictable performance levels, the HP 3PAR Operating System autonomically distributes volumes widely and evenly across all available StoreServ resources. HP 3PAR System Tuner builds on this already well-balanced system to maintain optimal performance over time, even as your system grows and you bring new applications online. With System Tuner, your StoreServ arrays remain at their peak performance—no matter what. System Tuner autonomically detects and eliminates hotspots and bottlenecks without disruption to applications, impact to service levels, or changes to pre-existing service-level characteristics such as RAID type. Your storage performance remains optimized over time, and you don't even have to think about it. System Tuner is included in the Optimization Suite on HP 3PAR V-Class Storage Systems and is offered as a standalone software feature on HP 3PAR T and F-Class Storage Systems.

HP 3PAR Virtual Domains

HP 3PAR Virtual Domains is virtual machine software that delivers secure access and robust storage services for different applications and user groups, also known as virtual private arrays. By providing secure administrative segregation of users and hosts within a consolidated, massively parallel HP 3PAR StoreServ array, Virtual Domains allows individual user groups and applications to affordably achieve greater storage service levels (performance, availability, and functionality) than previously possible.

HP 3PAR Virtual Domains is ideal for enterprises or service providers looking to leverage the benefits of consolidation and deploy a purpose-built infrastructure for their private or public cloud.

Product highlights:

- Provides secure, isolated storage (virtual private arrays) to multiple applications, departments, and customers
- Delivers the robust service levels available from a wide-striped, massively parallel array—without sacrificing security
- Retains the economic benefits of a virtualized storage infrastructure and storage consolidation
- Enables users or departments to securely and independently administer their own individual virtual private arrays
- Integrates fully with all HP 3PAR software products and features, including HP 3PAR Remote Copy, System Reporter, LDAP support, and Autonomic Groups

HP 3PAR Virtual Lock software

The need for secure data retention is a fact of doing business in the information age. HP 3PAR Virtual Lock gives you an efficient and cost-effective way to comply with internal governance and provides a foundation for performing electronic discovery (eDiscovery).

HP 3PAR Virtual Lock prevents deletion of virtual volumes (including thin volumes created with HP 3PAR Thin Provisioning software) and volume copies (such as those created with HP 3PAR Virtual Copy or 3PAR Full Copy software) for a specified period of time. Applying a user-configurable retention period, Virtual Lock secures volumes and copies so they cannot be deleted, even by a HP 3PAR StoreServ user with the highest-level privileges.

When coupled with reservationless, nonduplicative, read-only virtual copies (snapshots), Virtual Lock enables you to retain frozen, point-in-time copies of your data to assist with internal data retention and simplify compliance with internal governance procedures.

HP 3PAR Peer Motion software

HP 3PAR Peer Motion software is the first nondisruptive, do-it-yourself data migration tool for enterprise storage area networks. With Peer Motion, HP 3PAR StoreServ customers can load balance I/O workloads across systems at will, perform technology refresh seamlessly, cost-optimize asset lifecycle management, and lower technology refresh capital expenditures. Unlike traditional block migration approaches, Peer Motion enables customers to migrate storage volumes between any HP 3PAR StoreServ Storage systems online, nondisruptively and without complex planning or

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[1] Policy Advisor for Dynamic Optimization is applicable to HP 3PAR Storage Systems that are running HP 3PAR Operating System 2.3.1.

dependency on extra tools. Peer Motion leverages HP 3PAR Thin Built In technology to power the simple and rapid conversion of inefficient, "fat" volumes on source arrays to more efficient, higher-utilization "thin" volumes on the destination HP 3PAR StoreServ system. Peer Motion Manager is an add-on application that orchestrates all stages of the data migration lifecycle to keep data migration simple and foolproof.

HP 3PAR Peer Persistence software

HP 3PAR Peer Persistence software allows companies to federate their HP 3PAR StoreServ Storage Systems across geographically separated data centers. This inter-site federation of storage allows customers to use their data centers more effectively by allowing them to move applications from one site to another as per their business need—and, more importantly, without any application downtime.

Peer Persistence leverages the robust high availability solutions already available on HP 3PAR StoreServ systems, and extends it even further by enabling a peer relationship between two 3PAR StoreServ Storage Systems located at geographically separated sites.

Peer Persistence enables failover/failback between two sites/data centers to be transparent to hosts and without any disruption to applications running on them. Peer Persistence is deployed with Remote Copy without the need for any additional hardware or appliance

HP 3PAR StoreServ Host software

The following host-based software products from HP 3PAR address the needs of specific application environments through solutions including plug-ins for VMware vSphere in addition to multipathing and historical performance and capacity management software:

- **HP 3PAR Recovery Manager for VMware vSphere:** HP 3PAR Recovery Manager for VMware vSphere allows VMware administrators to create hundreds of VM-aware snapshots and initiate rapid online recovery directly from within the VMware vCenter Server virtualization management console.

- **HP 3PAR Plug-In for VMware vCenter:** The HP 3PAR Plug-In for VMware vCenter gives VMware administrators enhanced visibility into storage resources and precise insight into how individual virtual machines are mapped to datastores and individual storage volumes. When used in conjunction with HP 3PAR Recovery Manager for VMware vSphere, this plug-in gives administrators the power of seamless, rapid online recovery from within the vCenter Server virtualization management console.

- **HP 3PAR Recovery Manager for Microsoft Exchange:** HP 3PAR Recovery Manager for Exchange is an extension to HP 3PAR Virtual Copy that intelligently creates and manages snapshots, which can be used to quickly restore Exchange instances or databases (or nondisruptively back them up to tape) for near-continuous data protection.

- **HP 3PAR Recovery Manager for Oracle:** HP 3PAR Recovery Manager for Oracle is an extension to HP 3PAR Virtual Copy that intelligently creates, manages, and presents time-consistent snapshot images of Oracle databases for rapid application recovery, near-continuous data protection, data sharing, and nondisruptive backup.

- **HP 3PAR Recovery Manager for Microsoft SQL Server:** HP 3PAR Recovery Manager for Microsoft SQL Server is another extension to HP 3PAR Virtual Copy that eases costs and administration by providing rapid, affordable online recovery of Microsoft SQL Server databases from multiple, highly granular point-in-time snapshots. Quickly recover a database to a known point in time, speeding up a variety of operations including rapid recovery of the production SQL Server.

- **HP 3PAR System Reporter:** HP 3PAR System Reporter is a historical performance and capacity management tool for storage reporting, monitoring, and troubleshooting.

- **HP 3PAR Host Explorer:** Running as an agent on the server, HP 3PAR Host Explorer automates host discovery and collection of detailed host configuration information critical to speeding provisioning and simplifying maintenance. Host Explorer automatically and securely communicates host information such as Fibre Channel Worldwide Name (WWN) and host multipath data to the StoreServ system to reduce manual administration.

- **HP 3PAR Multipath I/O for IBM AIX:** HP 3PAR MPIO for IBM AIX provides multipathing for IBM AIX hosts featuring multiple active/active paths, load balancing, and automatic failover and recovery.

- **HP 3PAR Multipath I/O for Microsoft Windows 2003:** HP 3PAR MPIO for Microsoft Windows 2003 provides multipathing for Microsoft Windows hosts featuring multiple active/active paths, load balancing, and automatic failover and recovery.

HP 3PAR StoreServ 7000 software suites

HP 3PAR StoreServ 7000 Storage supports the same operating system and software offerings as the other members of the HP 3PAR StoreServ family, but with these specific StoreServ models you have the opportunity to purchase software bundled into a series of suites designed to be affordable and simple to purchase. Select software titles can also be purchased separately, as indicated below.

HP 3PAR Operating System Software Suite

HP 3PAR 7000 Operating System Software Suite is the foundation software of HP 3PAR StoreServ 7000 Storage, combining advanced virtualization capabilities with simple storage management, high efficiency, and world class performance. The included comprehensive thin provisioning capabilities allow your storage to start thin, get thin and stay thin. System Tuner and Autonomic Rebalance help maintain high performance over time. Migrating your existing data from HP EVA and 3PAR systems to the HP 3PAR StoreServ 7000 system is easy with the included 180-day Online Import license. HP 3PAR SmartStart software, included in the suite, guides you through the configuration of the service processor, StoreServ Storage, and the application hosts—making storage setup virtually effortless. HP 3PAR 7000 Operating System Software Suite is a required purchase.

The Operating System Suite includes the following functionality and features:

- HP 3PAR Thin Provisioning
- HP 3PAR Thin Conversion
- HP 3PAR Thin Persistence
- HP 3PAR Thin Copy Reclamation
- HP 3PAR Autonomic Rebalance
- HP 3PAR System Tuner
- HP 3PAR Management Console
- EVA to 3PAR Online Import[2]
- HP 3PAR Host Explorer
- HP 3PAR SmartStart
- HP 3PAR Virtual Service Processor
- HP 3PAR Multipath Software for Windows 2003

For more information, see http://h18006.www1.hp.com/storage/software/3par7000/oss/index.html

HP 3PAR Data Optimization Software Suite

The HP 3PAR 7000 Data Optimization Software Suite makes sure that data is on the right storage asset at the right time. This suite rebalances, redistributes, and refreshes storage nondisruptively with features that provide autonomic storage tiering and dynamic data mobility, reducing cost and increasing agility. Adaptive Optimization provides highly reliable, nondisruptive, cost-optimized storage tiering at the sub-volume level to deliver the right QoS to the right data at the right time on a large scale, and Dynamic Optimization delivers it at the volume level. Peer Motion software enables seamless technology refresh and cost-optimized asset lifecycle management, and lowers technology refresh capital expenditure.

The Data Optimization Suite bundles the following products:

- HP 3PAR Adaptive Optimization
- HP 3PAR Dynamic Optimization
- HP 3PAR Peer Motion

For more information, see http://h18006.www1.hp.com/storage/software/3par7000/dos/index.html

HP 3PAR Security Software Suite

HP 3PAR 7000 Security Software Suite provides secure administrative segregation of users and hosts, allowing individual user groups and applications to confidently share a 3PAR StoreServ 7000 system. It also allows you to secure

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[2] 180-day Online Import license

volumes and copies so they cannot be deleted, even by a 3PAR StoreServ 7000 user with the highest level privileges. When coupled with reservationless, nonduplicative, read-only virtual copies (snapshots), the Virtual Lock feature enables you to retain frozen, point-in-time copies of your data to assist with internal data retention and simplify compliance with internal governance procedures.

The Security Suite includes the following products:

- HP 3PAR Virtual Domains
- HP 3PAR Virtual Lock

For more information, see http://h18006.www1.hp.com/storage/software/3par7000/ss/index.html

HP 3PAR Reporting Software Suite

HP 3PAR Reporting Suite provides flexible, simple-to-use performance and capacity management tools that aggregate fine-grained performance and capacity usage data. It also provides useful information on the volume mapping between the HP 3PAR StoreServ Storage and the application host.

The Reporting Suite includes the following products:

- HP 3PAR System Reporter
- HP 3PARinfo

For more information, see http://h18006.www1.hp.com/storage/software/3par7000/rs/index.html

HP 3PAR Application Software Suite for VMware

HP 3PAR Application Suite for VMware provides VMware administrators enhanced visibility into storage resources and precise insight into how individual virtual machines are mapped to datastores and individual storage volumes. It also gives administrators the power of seamless, rapid online recovery from within the vCenter Server virtualization management console.

The Application Suite for VMware includes the following functionality and features:

- HP 3PAR Recovery Manager for VMware vSphere
- HP 3PAR Management Plug-in for VMware vCenter
- HP 3PAR VASA provider
- HP 3PAR Host Explorer for VMware vSphere

For more information, see http://h18006.www1.hp.com/storage/software/3par7000/as-vmware/index.html

HP 3PAR Application Software Suite for Exchange

HP 3PAR Application Suite for Exchange provides administrators the power of seamless, rapid online recovery of Microsoft Exchange application. It is an extension to Virtual Copy that enables creation of application consistent snapshots without sacrificing performance, availability, or versatility.

The Application Suite for Exchange includes the following functionality and features:

- HP 3PAR Recovery Manager for Exchange
- HP 3PAR VSS hardware provider

For more information, see http://h18006.www1.hp.com/storage/software/3par7000/as-exchange/index.html

HP 3PAR Application Software Suite for SQL

HP 3PAR Application Suite for SQL provides administrators the power of seamless, rapid online recovery of the Microsoft SQL application. It is an extension to Virtual Copy that enables creation of application consistent snapshots without sacrificing performance, availability, or versatility.

The Application Suite for SQL includes the following functionality and features:

- HP 3PAR Recovery Manager for SQL
- HP 3PAR VSS hardware provider

For more information, see http://h18006.www1.hp.com/storage/software/3par7000/as-sql/index.html

HP 3PAR Application Suite for Oracle provides administrators the power of seamless, rapid online recovery of Oracle database application. It is an extension to Virtual Copy that enables creation of application consistent snapshots without sacrificing performance, availability, or versatility.

The Application Suite for Oracle database includes the following functionality and features:

- HP 3PAR Recovery Manager for Oracle

For more information, see http://h18006.www1.hp.com/storage/software/3par7000/as-oracle/index.html

HP 3PAR Peer Persistence

HP 3PAR Peer Persistence software allows companies to federate their 3PAR StoreServ Storage systems across geographically separated data centers. This inter-site federation of storage allows customers to use their data centers more effectively by allowing them to move applications from one site to another as per their business need—and, more importantly, without any application downtime.

Peer Persistence leverages the robust high availability solutions already available on HP 3PAR StoreServ systems, and extends it even further by enabling a peer relationship between two 3PAR StoreServ Storage systems located at geographically separated sites.

Peer Persistence enables failover/failback between two sites/data centers to be transparent to hosts and without any disruption to applications running on them. Peer Persistence is deployed with Remote Copy with no need for any additional hardware or appliance.

Software licensing for HP 3PAR StoreServ varies by model. For the 10000 model, software is licensed à la carte but with the option to license the HP 3PAR Thin Suite, including HP 3PAR Thin Provisioning, Thin Conversion, and Thin Persistence, as well as the HP 3PAR Optimization Suite, which includes 3PAR Dynamic Optimization and Adaptive Optimization. For the 7000 model, software titles are licensed in the suites. For more information about the HP 3PAR 7000 Software Suite, refer to the HP 3PAR 7000 Software Suite data sheet or the HP 3PAR StoreServ 7000 QuickSpecs.

Getting started with HP 3PAR StoreServ Storage

Setting up your HP 3PAR StoreServ system ports

Port locations and nomenclature

The HP 3PAR CLI and/or Management Console displays the controller node, Fibre Channel, iSCSI, and Gigabit Ethernet port locations in the following format: <Node>:<Slot>:<Port>. For example: `2:4:1`.

- Node: Valid node numbers are 0–7, depending on the number of nodes installed in your system. When viewing a system from the rear of a cabinet:
  - F-Class nodes are numbered 0–3 from top to bottom.
  - T-Class nodes are numbered 0–7 from left to right, top to bottom.
  - 7000 nodes are numbered 0–3 from bottom to top.
  - 10000 nodes are numbered 0–7 from left to right, bottom to top.
- Slot: Valid node slot numbers are 0–9, depending on the class of nodes installed in your system.
  - F-Class slots are numbered 0–5 from left to right.
  - T-Class slots are numbered 0–7 from left to right.
  - 7000 has a single slot in each node, numbered starting at 0.
  - 10000 slots are numbered 0–9 from left to right, bottom to top in a node in the lower chassis. In the upper chassis, slots are numbered 0–9 from left to right, top to bottom.
- Port: Valid node port numbers are 1–4 for all host bus adapters (HBAs).
  - F-Class ports are numbered from top to bottom.
  - T-Class ports are numbered from top to bottom.

– 7000 ports are horizontal and labeled beginning with 1 on the HBA or iSCSI adapter.

– 10000 ports are numbered from bottom to top in a node in the lower chassis. In the upper chassis, ports are numbered from top to bottom.

Front-end port cabling

Best practice: Each HP 3PAR StoreServ controller node should be connected to two fabrics. This is to enable HP 3PAR Persistence Ports, a feature that allows a node pair to transparently failover and back with no interruption or pause of host I/O. Host ports should be zoned in partner pairs. For example, if a host is zoned into point 0:1:2 (node 0, slot 1, port 2), then it should also be zoned into port 1:1:2 (node 1, slot 1, port 2).

Best practice: Ports of the same pair of nodes with the same ID should be connected to the same fabric.

Example:

- 0:2:3 and 1:2:3 on fabric 1
- 0:2:4 and 1:2:4 on fabric 2

Best practice: Odd ports should connect to fabric 1 and even ports to fabric 2.

Example with a four-node F400 with eight host ports:

Fabric 1	Fabric 2
0:2:3, 1:2:3, 2:2:3, 3:2:3	0:2:4, 1:2:4, 2:2:4, 3:2:4

Example with a 4-node V400 with 32 host ports:

Fabric 1	Fabric 2
0:2:1, 0:2:3, 0:5:1, 0:5:3, 1:2:1, 1:2:3, 1:5:1, 1:5:3, 2:2:1, 2:2:3, 2:5:1, 2:5:3, 3:2:1, 3:2:3, 3:5:1, 3:5:3	0:2:2, 0:2:4, 0:5:2, 0:5:4, 1:2:2, 1:2:4, 1:5:2, 1:5:4, 2:2:2, 2:2:4, 2:5:2, 2:5:4, 3:2:2, 3:2:4, 3:5:2, 3:5:4

FC hosts zoning

Best practice: Single initiator—single target zones should be preferred (1-to-1 zones)

Best practice: Zoning should be done using Worldwide Port Names (WWPN, the WWN of each individual port on HP 3PAR StoreServ).

You should not use hardware zoning (switch port/DID) or Worldwide Node Name zoning (WWNN, the global WWN of HP 3PAR StoreServ).

Best practice: A host should be zoned with a minimum of two ports from the two nodes of the same pair. In addition, the ports from a host's zoning should be mirrored across nodes. This is to support HP 3PAR Persistent Ports.

- Example from a single host: 0:2:1 and 1:21

Hosts do not need to be connected to all nodes because of the way the volumes are spread on all the nodes. A connection to two nodes is enough.

Best practice: Hosts need to be mirrored to node pairs—for example, zoned to nodes 0 and 1 or to nodes 2 and 3. Hosts should NOT be zoned to nonmirrored nodes, such as 0 and 3.

Best practice: No more than 64 initiators are supported per front-end/host port.

When using hypervisors, avoid connecting more than 16 initiators per 4 Gb/s port or more than 32 initiators per 8 Gb/s port.

Best practice: Each HP 3PAR StoreServ system has a maximum number of initiators supported that depends on the model and configuration. In regard to this maximum, *1 Initiator = 1 path from a host.*

A single HBA zoned with two FC ports will be counted as two initiators.

A host with two HBAs, each zoned with two ports, will count as four initiators.

In order to keep the number of initiators below the maximum supported value, use the following recommendation:

- Hypervisors: four paths maximum, preferably to four different nodes
- Other hosts (not hypervisors): two paths to two different nodes on the same port pairs

Hosts and host sets

Best practice: When creating hosts, follow the implementation guide for each platform.

Selecting the correct Host Persona for each host is important. Implementation guides are available for download at the following address:

hp.com/go/storage

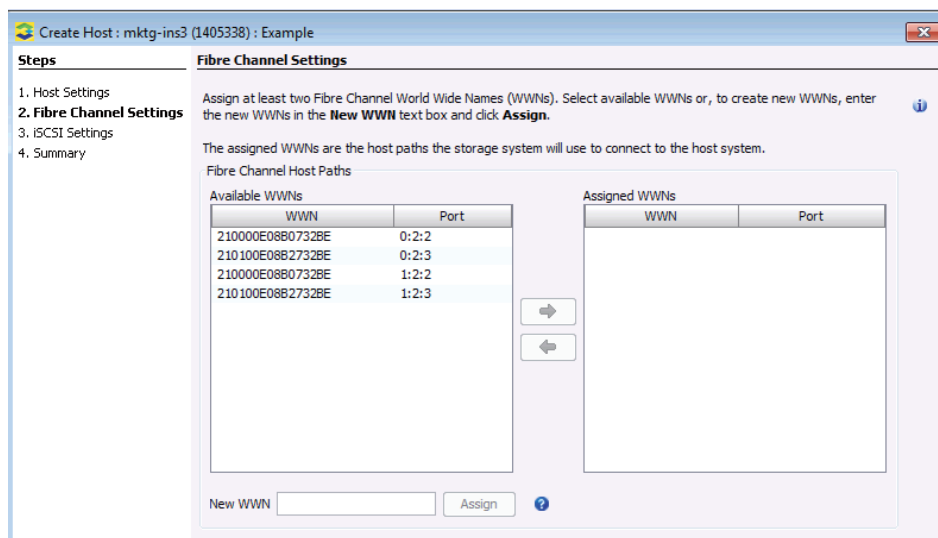Each physical server should have a different host defined, containing the WWNs or iQNs for this host.

Best practice for creating a new host (Windows, SparcSolaris, VMware, and RH Linux)

1. Install the Host Explorer software in the host if available for the host platform.
2. Zone in all the ports according to the zoning best practices.
3. From the host CLI, execute tpdhostagent–start; then tpdhostagent–push
4. This will automatically create the host on the HP 3PAR StoreServ Storage system.

Best practice for creating a new host manually

1. Zone in host ports to HP 3PAR StoreServ using the zoning best practices, one host at a time.
2. For each host, select the host and then create the new host.
3. In the WWN selection screen, select the WWNs associated with the new host.
4. Zone in a single host and then create the host on the HP 3PAR StoreServ to reduce the possibility of assigning incorrect WWNs to a host. Repeat until all hosts are zoned in.

Figure 2. Creating a host in the Management Console

Best practice: For clusters, create a host set containing all the hosts used by the cluster.

This will allow export of shared virtual volumes to all hosts of the cluster in a single operation.

Provisioning from HP 3PAR StoreServ Storage

Common provisioning groups (CPGs)

Notes regarding CPGs

- CPGs primarily act as templates for the creation of logical disks (LDs).
- If there are no volumes created "inside" a CPG it will consume no space.
- CPGs define:
  - The RAID level for the LDs to be created
  - Availability level (HA CAGE, HA MAG, or HA PORT)
- CPGs will only be created across drives of the same type.

Best practice: When creating CPGs, always accept defaults if possible.

High availability

Best practice: When creating CPGs, always select HA cage availability if possible.

There are three levels of availability that can be selected with HP 3PAR StoreServ.

First, it is important to understand that drive magazines consist of four drives for HP 3PAR StoreServ 10000. Drive magazines consist of only a single drive in the F-Class and HP 3PAR StoreServ 7000 Storage systems.

- **HA CAGE** means that no two members of the same RAID set can be in the same drive enclosure. For example, to support RAID 5 3+1 (set size 4), four drive chassis connected to the same node pair are required. This helps ensure that data is still available in the event that access to an entire drive cage is lost. This applies to drive chassis that are point-to-point **connected** to the nodes (no daisy chain).
- **HA MAG** means that no two members of the same RAID set are in the same drive magazine. This allows a wider stripe with fewer drive chassis; for example, a RAID 5 stripe size of 7+1 (set size 8) would be possible with only four drive chassis, provided each chassis had at least two drive magazines.
- **HA PORT** applies only to daisy-chained drive chassis. When this level of availability is selected, no two members of the same RAID set can be in drive chassis that are dependent on one another for node connectivity. For example, in a system in which there are eight drive chassis with four of the drive chassis connected to another drive chassis for node access, HA PORT would only allow RAID 5 3+1 (set size 4) in order to prevent the loss of one drive chassis from causing a loss of data access.

Best practice: The number of CPGs should be kept to a minimum.

Maximum VVs per CPG is 8,192 for 3PAR StoreServ 7000 (3PAR OS 3.1.2), F-Class systems; 12,288 on 3PAR StoreServ 10000 systems with HP 3PAR OS 3.1.1 and later.

Maximum TPVVs per CPG is 4,095.

Best practice: There are, however, cases in which having more CPGs than the minimum will be required.

- When using Virtual Domain software, a given CPG can only be in one domain.
- When using Adaptive Optimization software, a given CPG can only be in one Adaptive Optimization policy.
- When requiring easy capacity reporting by customer or application, creating a different CPG or set of CPGs per customer/application will make capacity planning easier.
- When Virtual Copy snapshots are heavily used, if the snapshots are to be kept in a different tier than the source data, use a different CPG for the User CPG and the Copy CPG of a virtual volume.
- When Virtual Copy snapshots are heavily used, if reporting of the snapshots' overall capacity is required, use a different CPG for the User CPG and the Copy CPG of a virtual volume.

Best practice: Do not set "growth limits" on CPGs.

If a warning threshold is required, set a "growth warning" (warning in terms of capacity), not an "allocation warning" (warning in percentage).

Best practice: Never create RAID0 CPGs or virtual volumes.

RAID 0 does not offer any protection against drive failure.

Best practice: When using thin provisioning, schedule regular CPG compactions during low activity periods (HP 3PAR OS 3.1.1 and earlier).

CPG compaction will allow capacity that is allocated to a CPG but no longer being used to hold data to be returned to the pool of free chunklets.

This should be scheduled during periods of low activity to reduce the potential performance impact of chunklet initialization (zeroing), which happens automatically when chunklets are freed.

In order to schedule a nightly CPG compaction at midnight, execute the following CLI command:

```
cli% createsched "compactcpg -f -pat *" "0 0 * * *" compactcpg
```

Note: if using Adaptive Optimization on all the CPGs, scheduling a CPG compaction is not required. CPG compaction is part of the Adaptive Optimization process.

SSD CPGs

Best practice: SSD CPGs should be of the RAID 5 type with a "Set size" of 3+1 by default.

This will bring the best performance/capacity ratio. If maximum performance is required, use RAID 1.

Best practice: The growth increment should be set to the minimum value, which is 8 GB per node pair.

On 2-node systems, set the value to 8 GB, on 4-node systems to 16 GB, on 6-node systems to 24 GB, and on 8-node systems to 32 GB.

In order to set the CPG growth increment to a lower value than the default, the "Show advanced option" box must be checked.

Best practice: Availability should be left to "Cage-level" availability (the default option) if the system's configuration allows for it.

If not, it should be set to "Magazine-level" availability. This can be changed using the "Advanced options" checkbox of the StoreServ Management Console.

Other advanced settings such as "Preferred chunklets" and "Step size" should not be changed from their default values. No disk filtering should be used either.

Fast Class (Fibre Channel/SAS) CPGs

Best practice: FC CPGs should be of the RAID 5 type by default. This will bring the best performance/capacity ratio.

The "Set size" (data to parity ratio) can be changed from the default value of 3+1 if the system configuration supports it. If unknown, use 3+1.

Best practice: For applications that have a very high write ratio (over 50 percent of the access rate), create a CPG using RAID 1 if maximum performance is required.

Best practice: The growth increment should be left to the default value (32 GB per node pair).

Best practice: Availability should be left to "Cage level" (the default option) if the system's configuration allows for it.

If not, it should be set to "Magazine-level" availability. This can be changed using the "Advanced options" checkbox of the Management Console.

Other advanced settings such as "Preferred chunklets" and "Step size" should not be changed from their default values. No disk filtering should be used either.

NL CPGs

Best practice: NL CPGs should be of the RAID 6 type by default.

The "Set size" (data to parity ratio) can be changed from the default value of 8 (6+2) if the system configuration supports it.

RAID 5 is not recommended with NL disks.

Best practice: The growth increment should be left to the default value (32 GB per node pair).

Best practice: Availability should be left to "Cage level" (the default option) if the system's configuration allows for it.

If not, it should be set to "Magazine-level" availability. This can be changed using the "Advanced options" checkbox of the Management Console.

Other advanced settings such as "Preferred chunklets" and "Step size" should not be changed from their default values. No disk filtering should be used either.

Virtual volumes

Best practice: Zero Detection should be enabled on TPVVs that are periodically "zeroed out."
Zero Detection is enabled by default in HP 3PAR OS version 3.1.2 and later.

Best practice: Thinly provisioned virtual volumes can have an Allocation Warning, but should never have an Allocation Limit. Do not set an Allocation Limit, not even 100 percent.

Best practice: Virtual volumes should have both a "User CPG" and "Copy CPG" selected.

A "Copy CPG" is required to use any of the following features:

- Full copy (clones)
- Virtual copy (snapshots)
- Remote copy (remote replication)

The User CPG and Copy CPG can be different CPGs. This can be useful if snapshots are to be created in a different class of service from the source data.

Unless this functionality is specifically required, use the same CPG for User CPG and Copy CPG.

Virtual LUNs (exports) and volume sets

Best practice: Virtual volumes should be exported to host objects, not to ports for all hosts.

Best practice: "Matched sets" (a combination of export to hosts and exports to ports) should not be used.

Limiting the number of paths for a given host should only be done by zoning the host with only specific front-end ports.

Best practice: Boot from SAN virtual volumes should be exported with LUN 0.

Best practice: Use volume sets when exporting multiple virtual volumes to a host or host set.

Volume sets allow multiple volumes to be exported to the same host or host set in one operation. When exporting a volume set to a host or host set, the user chooses which LUN ID will be used for the first virtual volume of the volume set, and the LUN IDs are incremented for every virtual volume in the volume set.

Best practice: Individual volumes (belonging only to one host) should be exported with LUN IDs starting from 1. Volume sets should be exported with LUN IDs starting from 10.

Best practice: Always leave a gap of LUN IDs between two volume sets.

When adding a new virtual volume to a volume set that is already exported, the next LUN ID needs to be free or the operation will fail.

Therefore, it is important that if multiple volume sets are exported to the same host/host set, there are gaps left for adding later virtual volumes to the volume set.

Example: If exporting two volume sets containing 10 virtual volumes each to a host set:

- Export the first volume set with LUN ID 10.
  - LUN IDs 10 to 19 will be used
- Export the second volume set with LUN ID 30.
  - LUN IDs 30 to 39 will be used

Remote Copy

Best practice: Follow the *Remote Copy User's Guide* strictly when configuring Remote Copy.

It is available for download at
http://h20000.www2.hp.com/bizsupport/TechSupport/DocumentIndex.jsp?lang=en&cc=us&contentType=SupportManual&prodTypeId=18964&prodSeriesId=5044394&docIndexId=1255.

Best practice: There should only be one Remote Copy FC port configured per controller node.

At the current time, no other port apart from the single Remote Copy FC port of a given controller node should be configured for Remote Copy, even if they are not connected except on the HP 3PAR StoreServ 7000 Storage models.

Best practice: Remote Copy FC ports should only be in one zone with one Remote Copy FC port from another HP 3PAR StoreServ system.

Do not zone hosts or other devices with the Remote Copy FC other than the destination Remote Copy FC port.

In HP 3PAR OS version 3.1.1 and earlier, only one type of replication (synchronous or periodic asynchronous) is supported between two HP 3PAR systems in a 1:1 relationship. In HP 3PAR OS version 3.1.2 and later, concurrent synchronous and asynchronous connections are supported in a 1:1 Remote Copy configuration.

HP 3PAR OS version 3.1.2 supports both synchronous and periodic asynchronous using both RCFC and RCIP as the transports assigned to individual RC groups.

For SLD RC deployments, a given Remote Copy group will support both transport methods.

Best practice: All virtual volumes belonging to the same application should be added to the same Remote Copy group.

Virtual volumes that have logical links include:

- Virtual volumes used by the same application (data and log volumes, for example)
- Virtual volumes used by the LVM volume group
- Virtual volumes that contain virtual disks of the same VM

A Remote Copy group can contain up to 100 virtual volumes.

Best practice: Do not add virtual volumes that have no logical link (host or application) to the same Remote Copy group.

This will give the best granularity of Remote Copy failover by allowing a failover of only one host or application.

Best practice: Source and destination virtual volumes must have the same size.

Best practice: While source and destination virtual volumes do not need to be of the same type of disk or RAID level, consider performance before mixing different types of disks/RAID levels on the source and destination systems.

When using Remote Copy in synchronous mode, it is not advised to replicate FC virtual volumes to NL virtual volumes, as the reduced performance of the NL disks might impact the primary virtual volume performance.

Best practice: When using Remote Copy in combination with Virtual Domains, the source and destination virtual volumes must be in domains of the same name on the source and destination systems.

However, they do not need to be of the same type (type of provisioning, RAID, or disk).

Best practice: In case of complete communication failure between two 3PAR StoreServ systems, wait for a period of low activity before restarting the Remote Copy groups.

The re-synchronization process can add a significant overhead on the destination system.

Best practice: If the hosts on the secondary sites are powered on, do not export the secondary (destination) virtual volumes unless using a geographically distributed cluster with automatic failover, such as CLX, MetroCluster, or GeoCluster, where this is specifically required.

Best practice: For operating systems that identify volumes based on their WWID/LUN WWN, change the destination virtual volume WWN to match the source.

On HP 3PAR StoreServ systems running OS 3.1.1, the default behavior is to have a different virtual volume WWN on the primary and secondary systems. Changing the secondary virtual volume WWN to match the primary will make the failover process easier as no reconfiguration will be required on the hosts. On HP 3PAR OS version 3.1.2 and later, there is an option to create this same WWN automatically.

Operating systems where this is recommended are:

- VMware ESX 4.x or later, only if Site Recovery Manager is not in use
- Linux, when using Device-mapper Multipath

Use the "showvv -d" command to find out the WWN of the primary virtual volume.

Use the "setvv -wwn" command to change the WWN of the secondary virtual volume.

Note: HP 3PAR OS v3.1.1 or later is required to be able to use the "setvv -wwn" command.

Example:

```
PRIMARY cli% showvv -d vSphere5_datastore1
Id Name          Rd Mstr Prnt Roch Rwch PPrnt PBlkRemain -----VV_WWN----- ------CreationTime--
----
452 vSphere5_datastore1 RW 2/3/- --- 1742 ---  ---     -- 50002AC001C40C56 2011-09-06
12:01:33 CEST

SECONDARY cli% setvv -wwn 50002AC001C40C56 vSphere5_datastore1
F200 cli% showvv -d vSphere5_datastore1
 Id Name          Rd Mstr Prnt Roch Rwch PPrnt PBlkRemain -----VV_WWN----- ------CreationTime-
-----
2168 vSphere5_datastore1 RW 0/1/- --- --- ---  ---     -- 50002AC001C40C56 2011-10-24
11:15:02 CEST
```

Adaptive Optimization

Best practice: The following combinations are acceptable within the same Adaptive Optimization configuration (policy):

- SSD, FC/SAS, and NL
- FC/SSD and FC
- FC/SAS and NL

It is acceptable to use different RAID levels within the same policy.

Table 2. Recommended Adaptive Optimization configurations

Configuration type	SSD Tier	SAS 10K/15K Tier	NL Tier
2 tiers SSD-FC/SAS	At least 2.5% of the capacity[1]	97.5% of the capacity	N/A
	Maximum 50% of the IOPS target*	Minimum 50% of the IOPS target	
2 tiers FC/SAS-NL	N/A	Minimum 40% of the capacity	Maximum 60% of the capacity
		100% of the IOPS target	0% of the IOPS target
3 tiers SSD-FC/SAS-NL	At least 2.5% of the capacity[1]	Minimum 37.5% of the capacity	Maximum 60% of the capacity
	Maximum 50% of the IOPS target*	Minimum 50% of the IOPS target	<5% of the IOPS target

Note: Configurations with SSD and NL tiers only are not recommended
4 controller configurations require the same type of drives behind controller pairs
* SSD performance is subject to data locality and will vary depending on application and use case
[1] Or minimum disk requirement for SSD

Best practice: Configurations that only contain SSD and NL are not recommended unless this is for a well-known application with a very small ratio (1–2 percent) of active capacity compared to the total usable capacity.

Best practice: When using thin provisioning volumes along with Adaptive Optimization, select a CPG using FC disks for the User CPG of the thin provisioning volumes.

This means that when new data is written, it will be on a good performance tier by default.

Best practice: Ensure that the default tier (FC) has enough capacity and performance to accommodate the requirement of new applications until data is migrated to other tiers.

When new data is created (new virtual volumes or new user space for a thin volume), it will be created in the FC tier, and Adaptive Optimization will not migrate regions of data to other tiers until the next time the Adaptive Optimization configuration is executed.

It is therefore important that the FC disks have enough performance and capacity to accommodate the performance or capacity requirements of new applications (or applications that are in the process of being migrated to HP 3PAR StoreServ) until the moment when the regions of data will be migrated to the other tiers.

Best practice: If SSDs are used in Adaptive Optimization configurations, no thin provisioning volumes should be directly associated with SSD CPGs. The thin provisioning volumes should only be associated with FC CPGs.

This will help ensure that SSD capacity is consumed by Adaptive Optimization and will allow this capacity to be safely used to 95 percent or even 100 percent.

To help ensure that no TPVV is associated with an SSD or NL CPG, run the "showcpg" command and confirm that only the FC CPG reports a TPVV value greater than 0.

In the following example, only the FC CPG has TPVVs associated with it:

```
                         --------------------(MB)--------------------
              -Volumes- -Usage- ------- Usr ------- --- Snp ---- ---- Adm ---
Id Name       Domain Warn% VVs TPVVs Usr Snp   Total    Used  Total  Used  Total
 4 AO_01_SSD    -      -  0   0  0  0  1201792  1201792  11648    0  16384
 8 AO_01_FC     -      - 469 469 469  0 11665920 11665920 8560128   0 120832
12 AO_01_NL     -      -  0   0  0  0 29161088 29161088  729472    0 325632
```

Best practice: All CPGs used in an Adaptive Optimization configuration should have the same level of availability.

Using a CPG with "Magazine-level" availability in an Adaptive Optimization configuration with CPGs with "Cage-level" availability will mean that all virtual volumes will have an effective availability equivalent to "Magazine level."

Best practice: CPGs for SSDs should use RAID 5, with the minimum growth increment supported (8 GB per node pair). CPGs for FC disks should use RAID 5, with the default growth increment. CPGs for NL disks should use RAID 6, with the default growth increment.

Refer to the "Common provisioning groups (CPGs)" section for details of CPG best practices.

Best practice: Create a different Adaptive Optimization configuration and its associated CPGs for every 100 TB of data or so.

In HP 3PAR OS 3.1.1 and before, Adaptive Optimization supports a maximum of 125 TB of data per Adaptive Optimization configuration (sum of used data in all the CPGs that make up the Adaptive Optimization configuration).

Best practice: Schedule the different Adaptive Optimization configurations to run at the same time, preferably at night.

Adaptive Optimization will execute each policy in a serial manner but will calculate what needs to be moved at the same time.

Best practice: It is preferable not to set any capacity limit on the Adaptive Optimization configuration level, or on the CPG (no allocation warning or limit).

This will allow the Adaptive Optimization software to make the best use of the different tiers available in the system.

When creating the Adaptive Optimization configuration through System Reporter policies with HP 3PAR OS version 3.1.1 and earlier, a size is required for each tier. Enter a value of "999999" (999 TB) for each tier.

In HP 3PAR OS version 3.1.2 and later, use the IMC to set the CPG capacities.

If a capacity limit is required for a given tier, set a capacity *warning* threshold (not limit) on the CPG itself through the Management Console or the CLI. Adaptive Optimization will not attempt to move more data to a CPG than the capacity warning set on the CPG.

Best practice: Always ensure that at least one of the CPGs used by the Adaptive Optimization configuration does not have any growth warning or limit.

Ideally, this should be the CPG to which the virtual volumes are linked—the CPG in which new user space will be created if needed.

Best practice: Use a simple Adaptive Optimization configuration model as often as possible.

For most applications, use generic Adaptive Optimization configurations that:

- Use all the tiers available in the system
- Are set to use 999 TB for each tier
- Run during the days of the work week only (for example, Monday–Friday)
- Execute once a day, preferably at night
- Use a measurement/hours of 24
- Use a mode of "Balanced"

For well-known applications that require a high level of performance, use tailored Adaptive Optimization configurations that:

- Preferably use all the tiers available in the system
- Are set to use 999 TB for each tier
- Execute immediately at the end of the high-activity period
- Use a measurement/hours that only covers the length of the high-activity period
- Use a mode of "Performance"

For test environments where performance is not a requirement, use an Adaptive Optimization configuration that:

- Uses only FC and NL tiers
- Is set to use 999 TB for each tier

- Runs during the days of the work week only (for example, Monday–Friday).

- Executes once a day, preferably at night

- Uses a measurement/hours of 24

- Uses a mode of "Cost"

Best practice: Do not mix Adaptive Optimization with any other application or process that moves data on a LUN or between LUNs.

Any applications or processes that move data on a LUN or between LUNs, such as VMware Storage DRS, should be disabled, as they might conflict with each other.

Only Adaptive Optimization, being the lowest level (storage level), should be used.

Security

Best practice: Change the password for the "3paradm" user.

The password of the "3parcim" user can also be changed if the CIM/SMI-S service is enabled.

Do not change the password or remove the accounts for the "3parsvc," "3parservice," "3paredit," or "3parbrowse" users. These are randomly generated at the time of the initialization of the system and are required for communication between the service processor and the 3PAR StoreServ system.

Best practice: Create a different user for each system administrator that will use the system.

Alternatively, configure the system to use Active Directory and make sure all users use their own accounts to log in to the system.

Best practice: When scripting, use the lowest privilege level required.

If a script requires only read access to the system, use a Browse account. If a script doesn't need to remove objects, use a Create account.

Best practice: Do not use a Super user (such as "3paradm") for the System Reporter user.

In HP 3PAR OS 3.1.1 and earlier versions, use a Browse user if Adaptive Optimization is not required, or a 3PAR_AO user if Adaptive Optimization is required. In 3.1.2 and later versions of the HP 3PAR OS, user selection is no longer necessary.

Naming convention

A good naming convention is important to effectively manage an HP 3PAR StoreServ Storage system. A naming convention should be consistent and descriptive.

Use hierarchical names that allow multiple objects of the same classification group to start with the same characters.

For example:

- prd.unix.datavg01
- prd.unix.appvg02

A good naming convention should allow all objects of the same type to be grouped together when sorting on the name field.

The name should also allow effective search of all object when using patterns like "?" or "*".

Example: "showvv prd.*"

Define the naming convention early in the installation project.

Hosts

Host names support up to 31 characters.

Host names will be of the form <TYPE>.<OS>.<HOST>

- <TYPE> can be "prd" for production servers, "dev" for development servers, "tst" for test servers
- <OS> can be "win" for Windows hosts, "vmw" for VMware hosts, "lin" for Linux hosts, "sol" for Solaris hosts, "aix" for AIX hosts, "hpux" for HPUX hosts
- <HOST> is the host name

Examples:

- prd.win.server1
- prd.hpux.server2
- dev.lin.server3

Host sets

Host set names support up to 31 characters.

Host set names will be of the form <TYPE>.<OS>.<CLUSTER NAME>

- <TYPE> can be "prd" for production servers, "dev" for development servers, "tst" for test servers
- <OS> can be "win" for Windows hosts, "vmw" for VMware hosts, "lin" for Linux hosts, "sol" for Solaris hosts, "aix" for AIX hosts, "hpux" for HPUX hosts
- <CLUSTER NAME> is the name of the cluster

Examples:

- prd.win.sqlcluster1
- prd.vmw.esxcluster2
- dev.lin.cluster3

Virtual volumes

Virtual volume names support up to 31 characters.

For standalone servers, the virtual volume name will be of the form

<TYPE>.<OS>.<HOST>.<FS NAME>.<ID>

- <TYPE> can be "prd" for production servers, "dev" for development servers, "tst" for test servers
- <OS> can be "win" for Windows hosts, "vmw" for VMware hosts, "lin" for Linux hosts, "sol" for Solaris hosts, "aix" for AIX hosts, hpux for HPUX hosts
- <HOST> is the host name
- <FS NAME> is the file system name or drive letter
- <ID> is an optional ID for volume groups containing multiple LUNs

Examples:

- prd.win.server1.e
- prd.hpux.server2.datavg1.01
- dev.lin.server3.data1

For clusters, the virtual volume name will be of the form <TYPE>.<OS>.<CLUSTER>.<RES NAME>.<ID>

- <TYPE> can be "prd" for production servers, "dev" for development servers, "tst" for test servers
- <OS> can be "win" for Windows hosts, "vmw" for VMware hosts, "lin" for Linux hosts, "sol" for Solaris hosts, "aix" for AIX hosts, "hpux" for HPUX hosts
- <CLUSTER> (optional) contains the cluster name

- <RES NAME> is the resource name of the cluster object mapped to this virtual volume
- <ID> is an optional ID for volume groups containing multiple LUNs

Examples:

- prd.win.cluster1.sql1.m
- prd.vmw.datastore1
- prd.aix.datavg1.01

Virtual volume sets

Virtual volume set names support up to 31 characters.

Virtual volume set names will be of the form <TYPE>.<OS>.<HOST/CLUSTER>.<FS NAME>

- <TYPE> can be "prd" for production servers, "dev" for development servers, "tst" for test servers
- <OS> can be "win" for Windows hosts, "vmw" for VMware hosts, "lin" for Linux hosts, "sol" for Solaris hosts, "aix" for AIX hosts, "hpux" for HPUX hosts
- <HOST/CLUSTER> is the host name or cluster name
- <FS NAME> is the OS name for the group of LUNs, volume group, datastore group

Examples:

- prd.win.hyperv.vmdata1
- prd.vmw.esx.datastoregrp2
- dev.lin.server3.datavg

CPGs

CPG names support up to 31 characters.

CPGs not used in an Adaptive Optimization configuration will use a name of the form <TYPE>.<CLASS>.<DISK TYPE>.<RAID TYPE>.<ID>

- <TYPE> (optional) can be "prd" for production data, "dev" for development data, "tst" for test data, or can contain the virtual domain name
- <CLASS> is the name of the different classes of service of data, or used to differentiate application environments
- Examples of classes of service include:
  - "platinum" / "gold" / "silver" / "bronze"
  - "premium" / "standard"
  - "tier1" / "tier2" / "tier3"
- <DISK TYPE> reflects the type of disk used by this CPG and can be "fc", "nl" or "ssd"
- <RAID TYPE> reflects the RAID level used by this CPG and can be "r1", "r5", or "r6"
- <ID> is an optional ID for multiple CPGs of the same type

Examples:

- dev.win.nl.r6.01
- platinum.ssd.r5
- gold.fc.r1
- silver.fc.r5
- bronze.nl.r6
- domain1.silver.fc.r5

CPGs used in an Adaptive Optimization configuration will us a name of the form

<TYPE>.<CLASS>.<AO NAME>.<AO TIER>.<DISK TYPE>.<RAID TYPE>

- <TYPE> (optional) can be "prd" for production data, "dev" for development data, "tst" for test data, or can contain the virtual domain name
- <CLASS> is the name of the different classes of service of data, or used to differentiate application environments
- Examples of classes of service include:
  - "platinum" / "gold" / "silver" / "bronze"
  - "premium" / "standard"
  - "tier1" / "tier2" / "tier3"
- <AO NAME> contains the name of the Adaptive Optimization configuration and should at least contain the two letters "ao"
- <AO TIER> is the ID of the Adaptive Optimization tier that this CPG is configured as and can be 0, 1 or 2
- <DISK TYPE> reflects the type of disk used by this CPG and can be "fc", "nl" or "ssd"
- <RAID TYPE> reflects the RAID level used by this CPG and can be "r1", "r5", or "r6"

Examples:

- prd.unix.ao.01.0.ssd.r5, prd.unix.ao.01.1.fc.r5, prd.unix.ao.01.2.nl.r6
- premium.ao.0.ssd.r5, premium.ao.1.fc.r5
- standard.ao01.1.fc.r5, standard.ao01.2.nl.r6

System Reporter

Best practice: If you are running System Reporter off-node on a host, System Reporter should not be installed using the SQLite database. Always use MySQL or Oracle.

Refer to the System Reporter installation guide for details on the installation procedure.

MySQL and Oracle will handle a large amount of sample insertion better than MS SQL with the default settings; use them with HP 3PAR OS 3.1.1 or earlier.

Best practice: Size the System Reporter server using the Excel sizing tool provided on the System Reporter CD.

If the System Reporter server and database are running on the same host, double the values found by the sizing tool. Running System Reporter in virtual machines is acceptable as long as the VMs are sized correctly.

Best practice: Do not increase the default retention times for high-resolution and hourly data.

If a longer history is required than the default allows, schedule automatic reports to be created every day. This will allow the data to be viewed for a long time without requiring a lot of CPU, memory, and disk resources.

Best practice: To secure access to the System Reporter Web server, the easiest way to secure a System Reporter server is to enable the local firewall and prevent remote access to the HTTP port 80.

This will ensure that only users who can connect locally to the System Reporter server will be able to access the System Reporter Web server.

It is also possible to configure Apache to require password authentication. See the following link for a quick tutorial on how to do so: http://sniptools.com/vault/windows-apache-and-htaccess-authentication.

Best practice: Do not use a Super user (such as "3paradm") for the System Reporter user. Use a Browse user.

Best practice: Schedule high-resolution reports every day for VLUN, PD, CPU, and port performance.

This will make detailed performance analysis possible long after the high-resolution data has been purged by System Reporter. For every 3PAR StoreServ system managed by System Reporter, schedule high-resolution reports (through the Policy Settings page) to be executed every day at the same time and kept (Retention) for the length of the support period of the system.
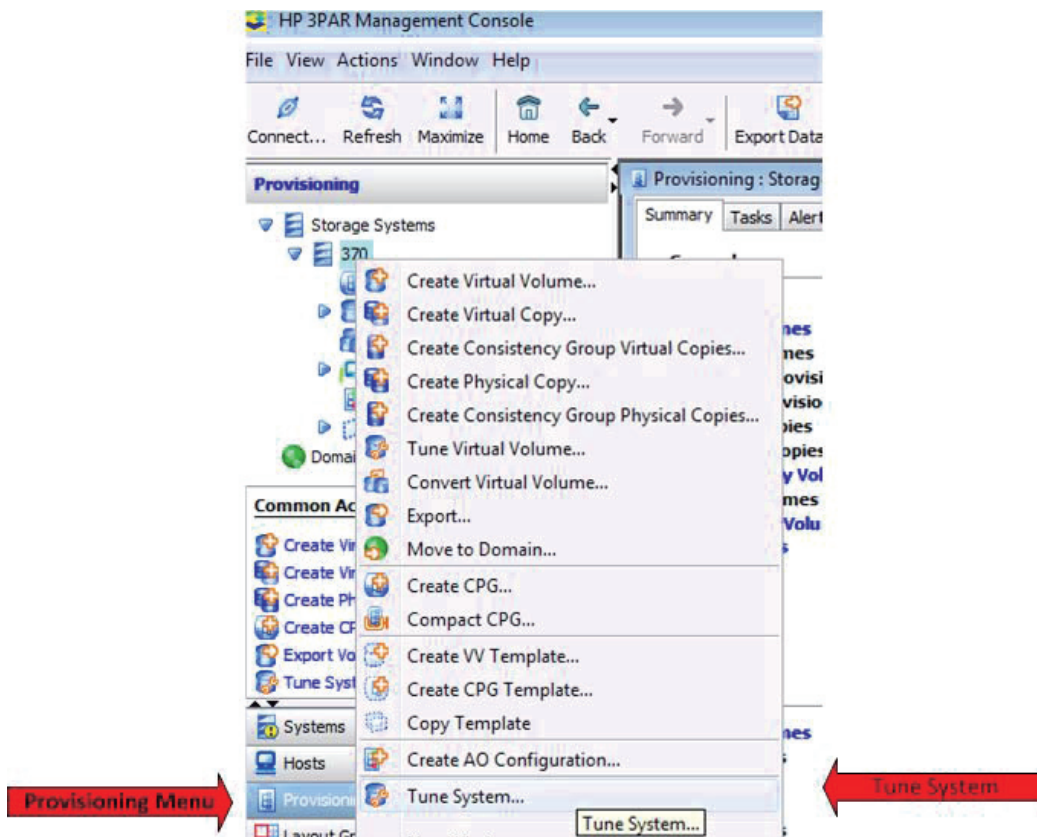
These scheduled reports should cover: VLUNs, ports (hosts, disks, and Remote Copy), PDs (individual reports for SSD, FC, and NL), CPU, as well as Adaptive Optimization (region density, space moved, and VV tiers).

Ongoing management and growth

Autonomic rebalance

With HP 3PAR StoreServ 7000 Storage, the rebalancing of data after hardware upgrades is now an integrated feature, not requiring a Dynamic Optimization license. It remains separately licensed on all other platforms. After purchasing and installing new hardware, the rebalancing can be started by selecting the 3PAR StoreServ in the GUI and selecting "Tune System."

Figure 3. Autonomic rebalancing selection

Autonomic rebalancing (Tune System) can also be started from the CLI by typing *tunesys.*

Depending on the amount of hardware added to a system and the degree to which the system may have been unbalanced before, the releveling process can take several hours to several days or longer to complete. It is also possible that if the system was near capacity before the hardware upgrade it may take multiple runs of *tunesys* to level the system out. Other variables will also affect how long *tunesys* takes to complete including the speed of the drives affected by the releveling, how close to capacity the previously installed drives are at upgrade, how busy the system is, etc. The autonomic rebalancing process will give priority to servicing host I/O.

Summary

HP 3PAR StoreServ storage is the last storage architecture you will ever need—regardless of whether your organization is a small- or medium-sized business or a large global enterprise. With a range of models to meet the needs of small to large data centers running key business applications up through enterprise-wide deployments of mission-critical applications and beyond, HP 3PAR StoreServ Storage has you covered. It's storage that offers the effortless performance and flexibility you need to accelerate new application deployment and support server virtualization, the cloud, ITaaS, or whatever else your future may hold. It's one of the most advanced storage platforms, and it is here to help you master unpredictability—effortlessly, without exception, and without compromise.

For more information

To read more about HP 3PAR Storage, go to: hp.com/3par

Get connected

hp.com/go/getconnected

Current HP driver, support, and security alerts
delivered directly to your desktop