HP 3PAR

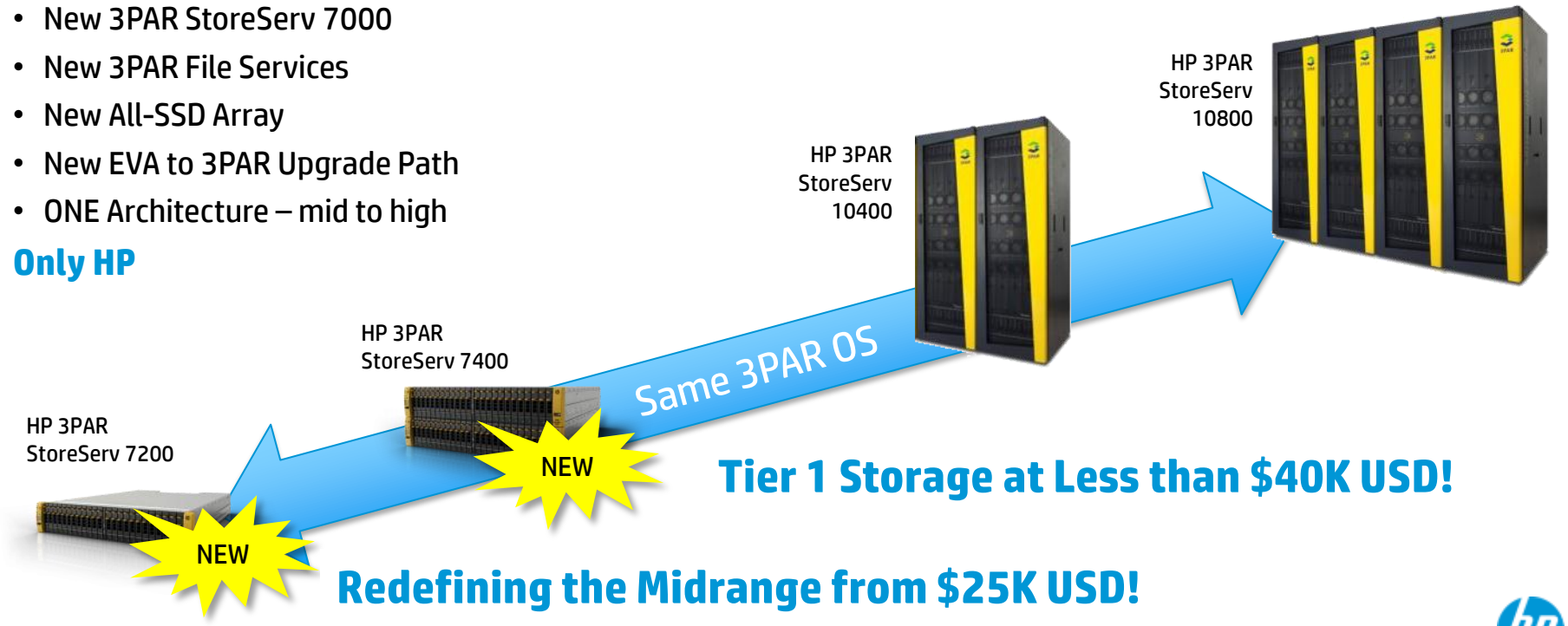
A technical overview of the HP 3PAR Utility Storage
The world's most agile and efficient Storage Arrays

Eliminating distinctions between Midrange and Tier 1

Polymorphic Simplicity: Storage Without Boundaries

- New 3PAR StoreServ 7000
- New 3PAR File Services
- New All-SSD Array
- New EVA to 3PAR Upgrade Path
- ONE Architecture – mid to high

Only HP



Tier 1 Storage at Less than $40K USD!

Redefining the Midrange from $25K USD!

HP 3PAR ASIC

Hardware Based for Performance

Thin Built in Zero Detect

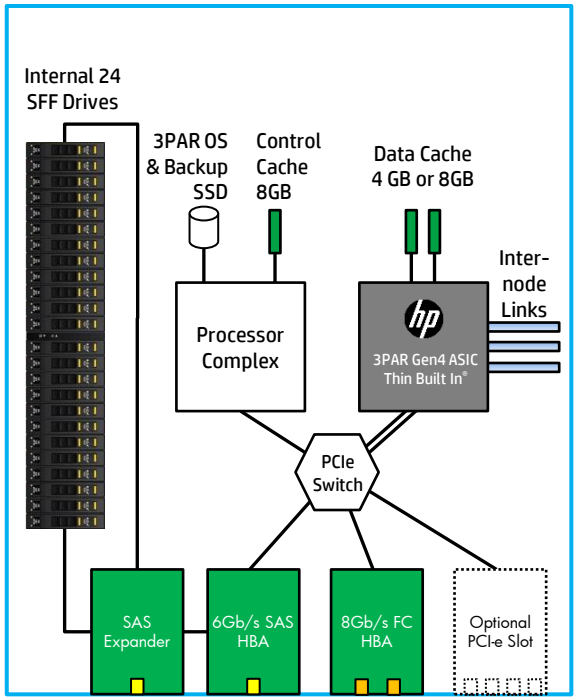
Fast RAID 10, 50 & 60
Rapid RAID Rebuild
Integrated XOR Engine

Tightly-Coupled Cluster
High Bandwidth, Low Latency Interconnect

Mixed Workload
Independent Metadata and Data Processing

HP 3PAR StoreServ 7000 Controller Nodes

2 to 4 nodes per system – installed in pairs

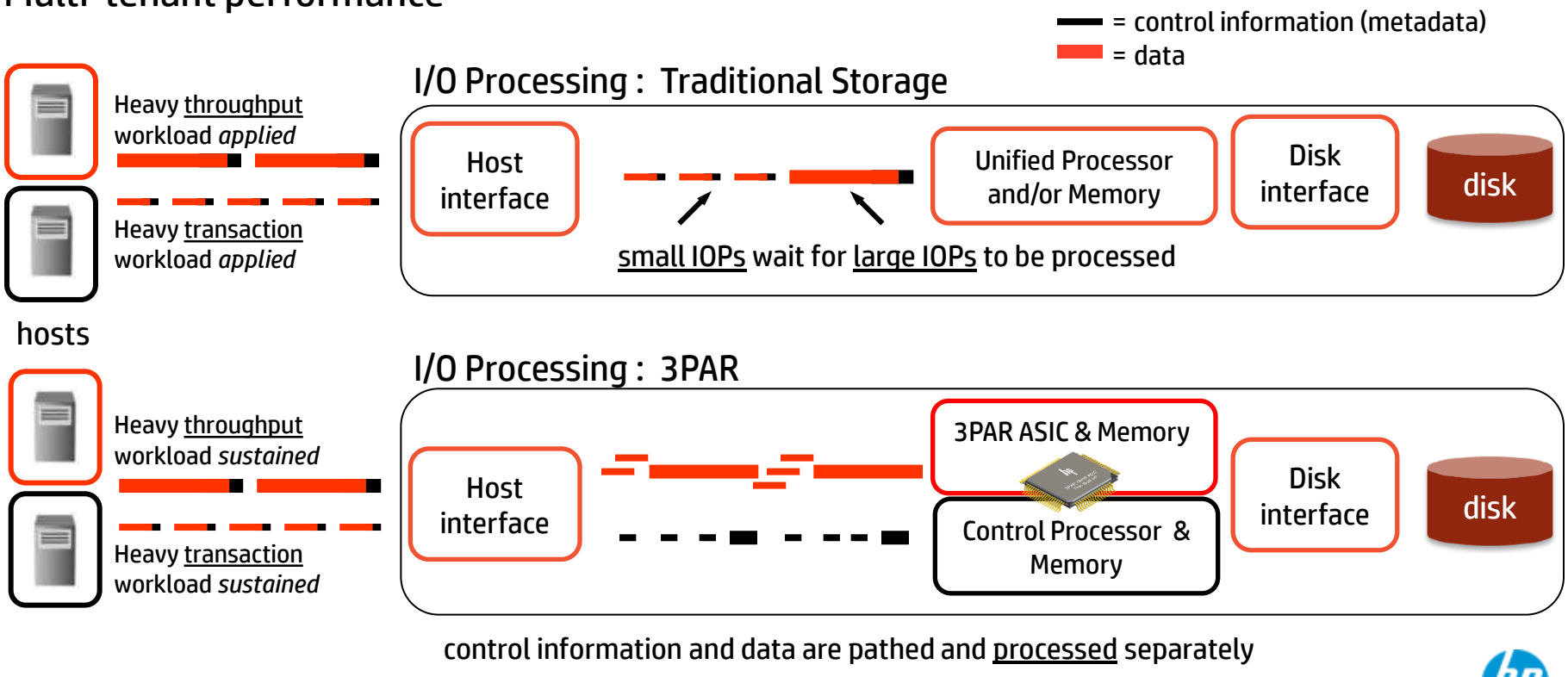


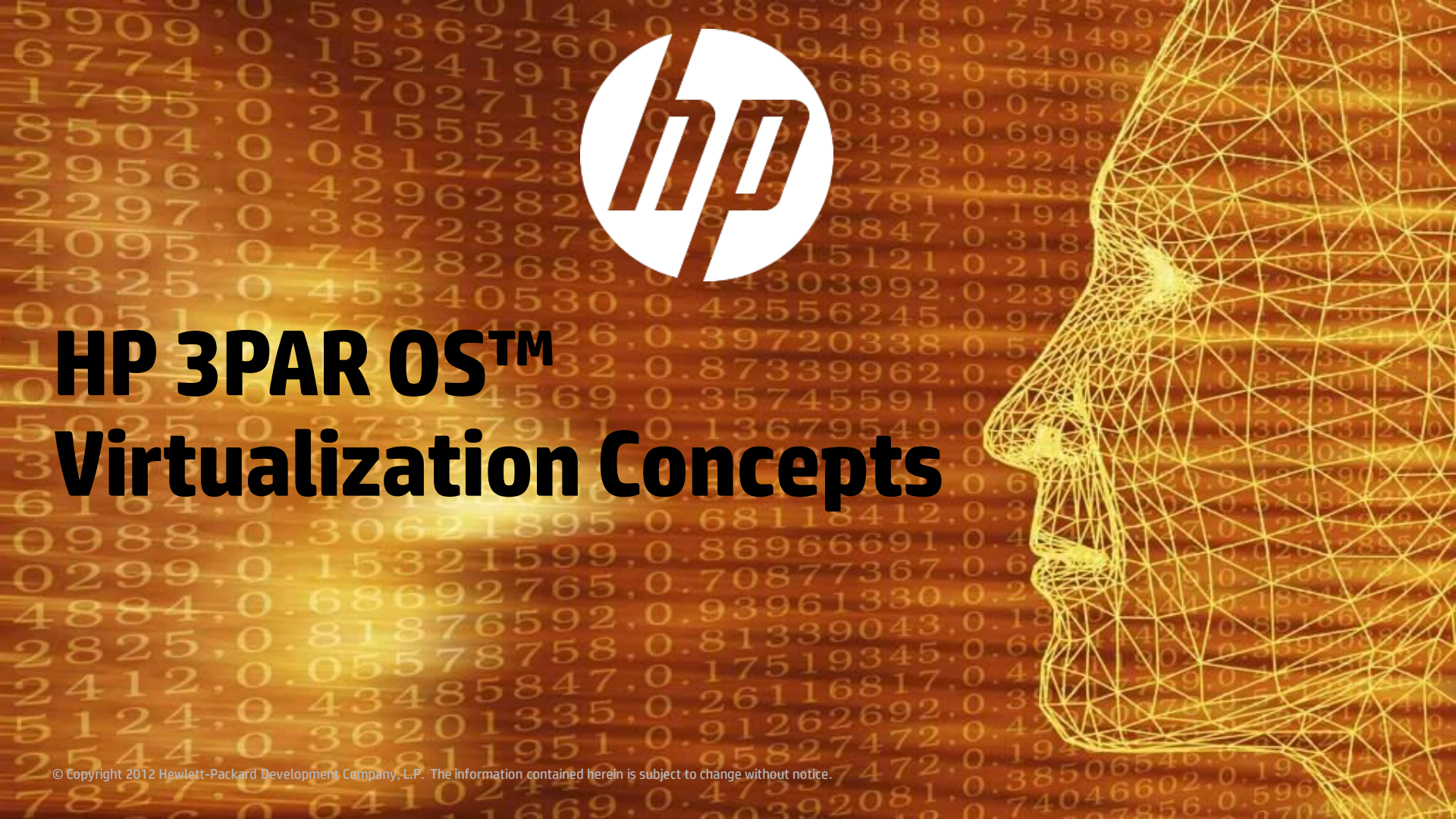
Per Node configuration

- Thin Built In™ Gen4 ASIC
- Intel 1.8 GHz Processor
  - 7200 4-core
  - 7400 6-core
- Data Cache
  - 7200 4GB
  - 7400 8GB
- 8Gb Control Cache
- 2 built-in 8Gb/s FC Ports
- Optional PCI-e Adapter
  - 4-Port 8Gb FC or
  - 2-Port 10Gb/s CNA

3PAR Mixed workload support

Multi-tenant performance



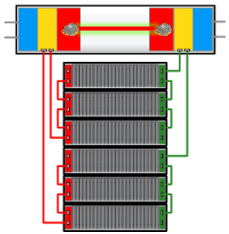


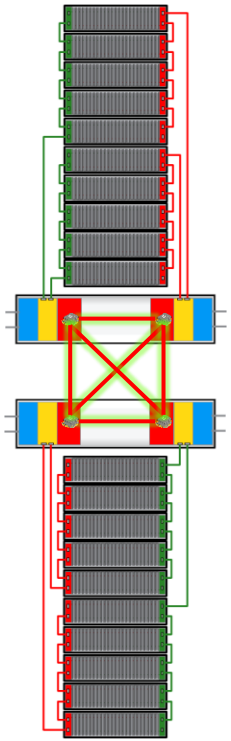
HP 3PAR OS™ Virtualization Concepts

3PAR Hardware Architecture

Cost-effective, scalable, resilient, meshed, active-active

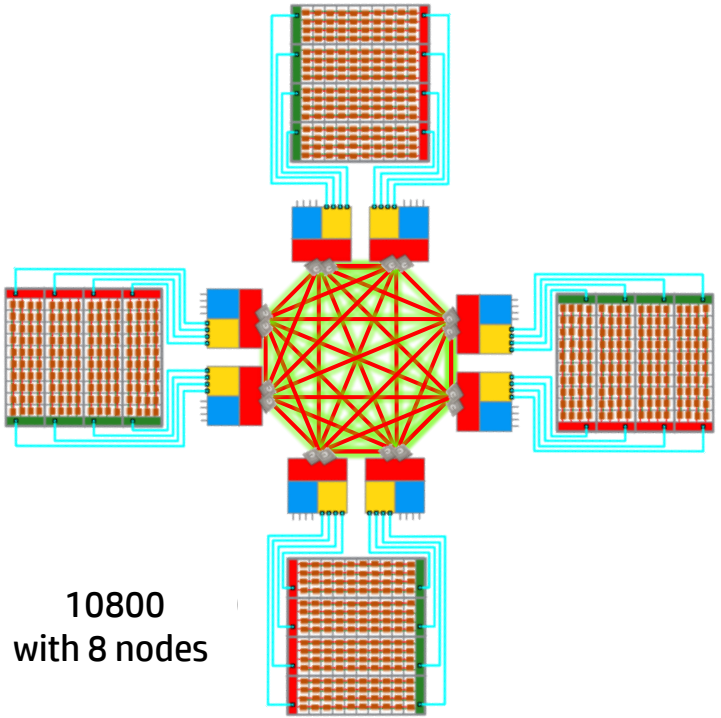
7200
with 2 nodes





7400
with 4 nodes

Host Ports
Cache
Disk Ports

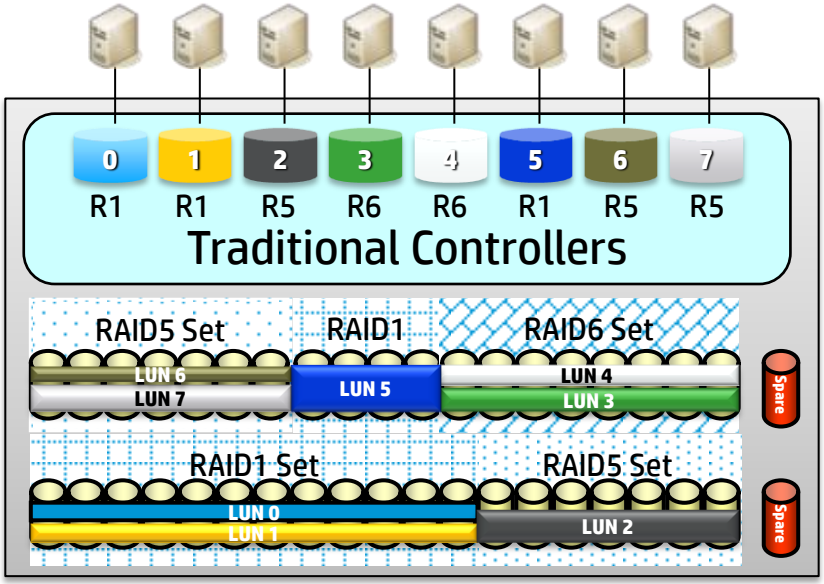


10800
with 8 nodes

HP 3PAR virtualization advantage

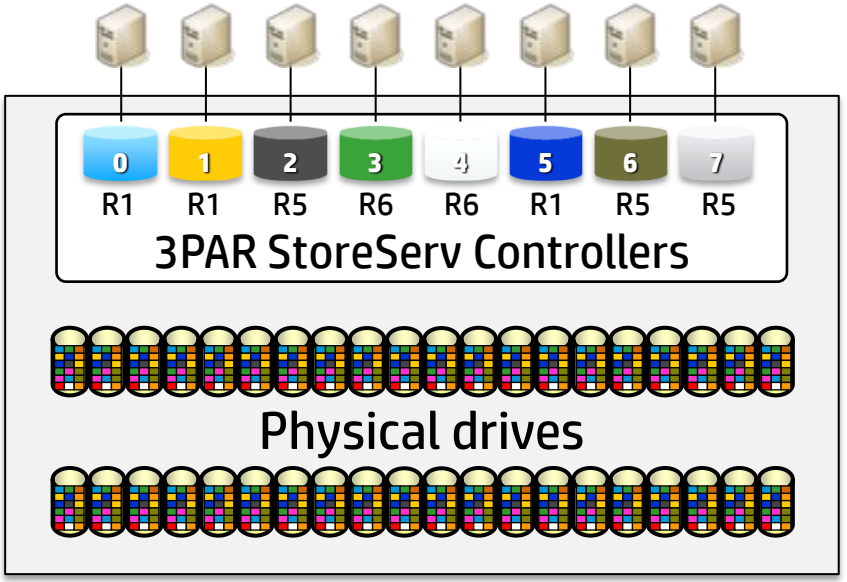
Traditional Array

- Each RAID level requires dedicated drives
- Dedicated spare disk required
- Limited single LUN performance



HP 3PAR

- All RAID levels can reside on same drives
- Distributed sparing, no dedicated spare drives
- Built-in wide-striping based on Chunklets



Why are Chunklets so Important?

Ease of use and Drive Utilization

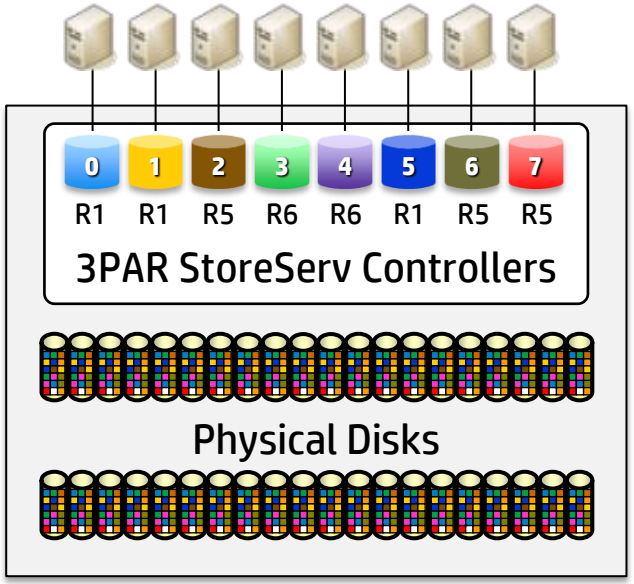
- Same drive spindle can service many different LUNs, RAID types and RAID sizes at the same time
  - RAID1
  - RAID5 – 2:1 to 8:1
  - RAID6 – 4:2; 6:2; 8:2; 10:2; 14:2
- Array managed by policies, not by administrative planning
- Enables easy mobility between drives, RAID types and service levels by using Dynamic or Adaptive Optimization

Performance

- Enables wide-striping across hundreds of drives
- Avoids hot-spots
- Autonomic data restriping after disk installations

High Availability – selectable by CPG

- HA Magazine - Protect against magazine failure (Industry standard)
- HA Cage - Protect against a cage (full disk shelf) failure.



Common Provisioning Groups (CPG)

CPGs are Policies that define Service and Availability level by

- Drive type (SSD, Fast Class, Nearline)
- Number of Drives (striping width)
- RAID level (R10 / R50 2:1 to 8:1 / R60 4:2; 6:2; 8:2; 10:2; 14:2)

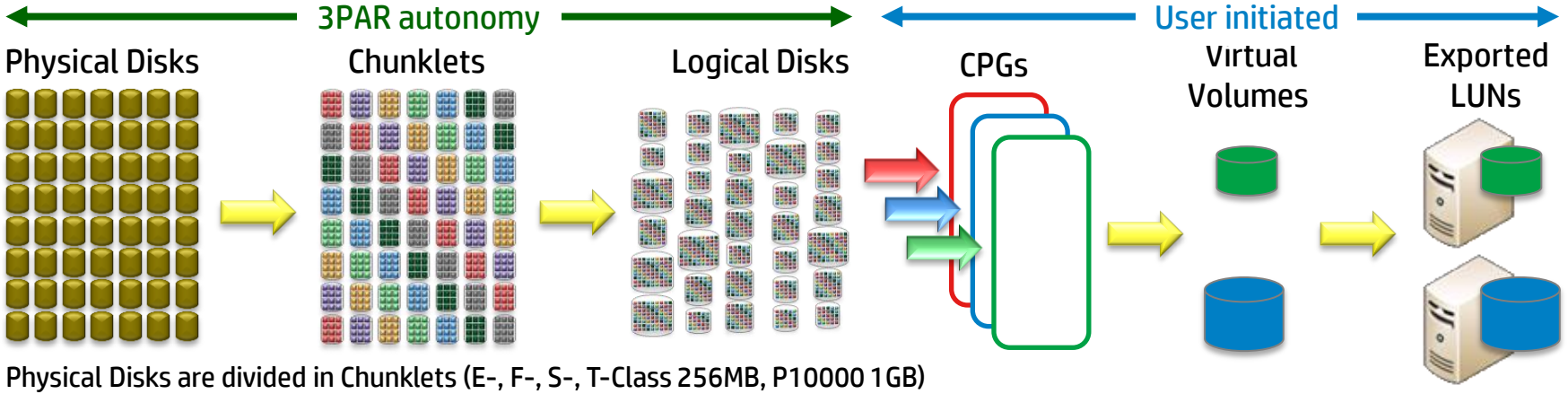
Multiple CPGs can be configured and optionally overlap the same drives

- i.e. a System with 200 drives can have one CPG containing all 200 drives and other CPGs with overlapping subsets of these 200 drives.

CPGs have many functions:

- They are the policies by which free Chunklets are assembled into logical disks
- They are a container for existing volumes and used for reporting
- They are the basis for service levels and our optimization products.

HP 3PAR Virtualization – the Logical View



Physical Disks are divided in Chunklets (E-, F-, S-, T-Class 256MB, P10000 1GB)

- The majority is used to build Logical Disks (LD), some for distributed sparing

Logical Disks (LD)

- Are collections of Raidlets -→ Chunklets arranged as rows of RAID sets (Raid 0, 10, 50, 60)
- Are automatically created when required and provide the space for Virtual Volumes, Snapshot and Logging Disks

Common Provisioning Groups (CPG)

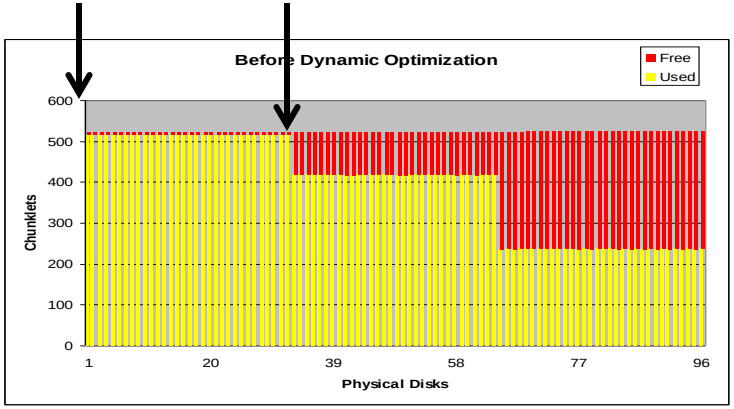
- User created virtual pools of Logical Disks that allocates space to virtual volumes on demand
- The CPG defines RAID level, disk type and number, striping pattern etc.

Virtual Volumes (VV) – Exported LUNs

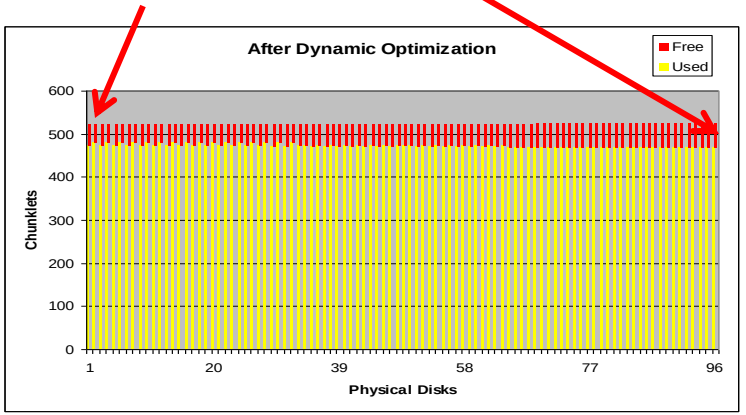
- User created fat or thin provisioned volumes composed of LDs according to the specified CPG policies
- User exports VV as LUN

Rebalancing and Tuning - Tunesys

6,400 IOP's Dbase Application



19,200 IOP's available Dbase Application



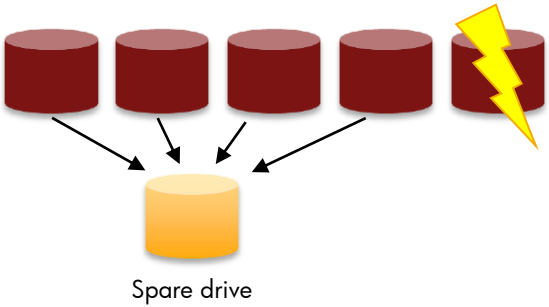
- Intelligently ordered
- Policy-abiding
- Throttled rebalance of all volumes
  - base volumes & snapshots
  - fat & thin, tiered or not
  - Intelligent sub-volume rebalance
- Ability to rebalance after upgrades for nodes and drives without Dynamic Optimization license for the 3PAR StoreServ 7000
- Ability to schedule on a regular basis

Optimize QoS levels with autonomic rebalancing <u>without</u> pre-planning

HP 3PAR High Availability

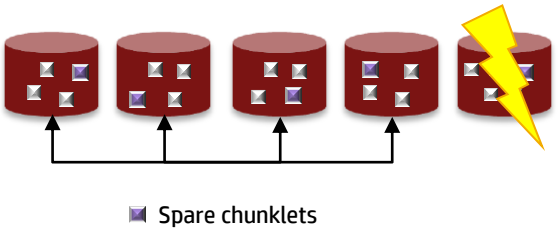
Spare Disk Drives vs. Distributed Sparing

Traditional Arrays



Few-to-one rebuild
hotspots & long rebuild exposure

3PAR StoreServ

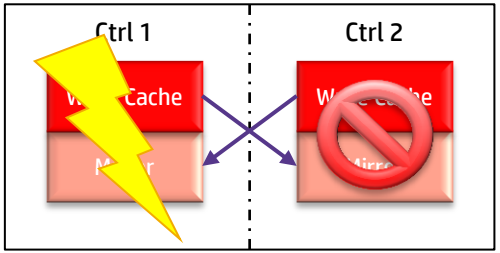


Many-to-many rebuild
parallel rebuilds in less time

HP 3PAR High Availability

Write Cache Re-Mirroring

Traditional Mid-range Arrays

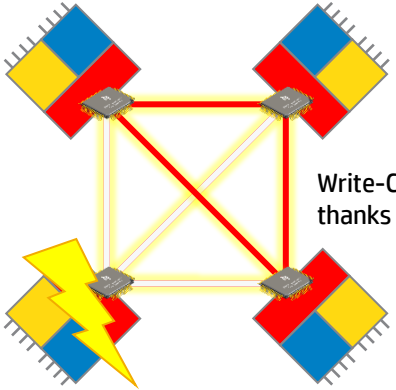


Write-Cache off for data security

Traditional Write-Cache Mirroring

Either poor performance due to write-thru mode or risk of write data loss

3PAR StoreServ



Persistent Write-Cache Mirroring

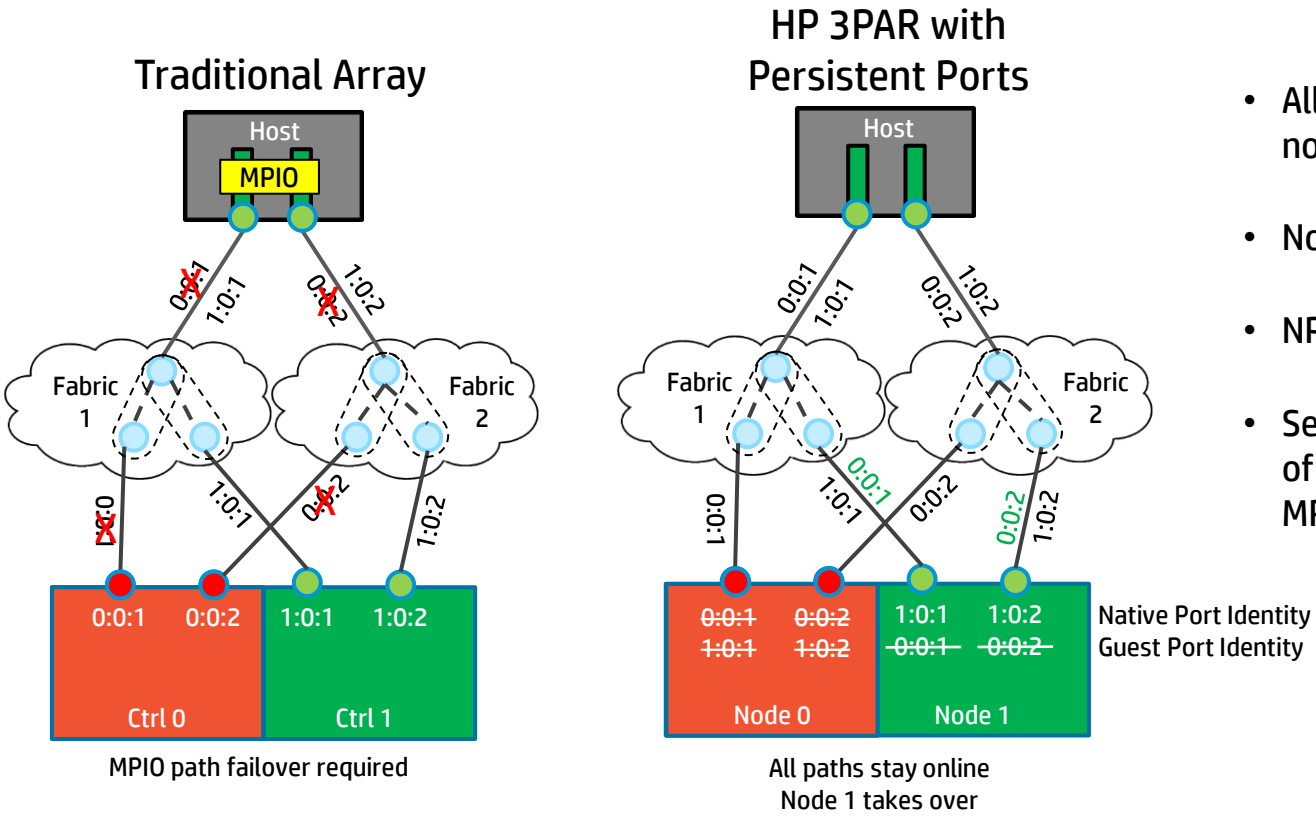
- No write-thru mode – consistent performance
- Works with 4 and more nodes
  - ✓ F400
  - ✓ T400, T800
  - ✓ 7400
  - ✓ 10400, 10800

OnLine Firmware Upgrade

3Par

- Firmware loaded via Service Processor
- Firmware pushed to master node
- All nodes receive new firmware (cluster)
- Nodes independently, one at a time, update to new firmware but run on old till all nodes are updated
- After all nodes update firmware, upgrade finish command points all nodes to new firmware (userspace)
- Copy of old firmware (userspace) is left in altroot in case of a rollback
- NPIV will allow greater failover flexibility during node upgrades

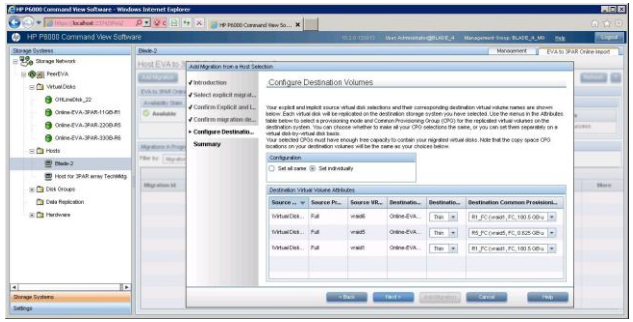
HP 3PAR Persistent Ports



- All paths stay online in case of node maintenance or failure
- No user intervention required
- NPIV based port ID swap
- Server will not “see” the swap of the 3PAR port WWN thus no MPIO path failover required

HP 3PAR Online Import for EVA

Reduce cost and time to migrate your EVA data



Agile

- Migrate your EVA data over to HP 3PAR StoreServ using the new Online Import feature
- HP Services available to help with your datacenter transition

Simple

- Start from what you know - All driven from your known Command View EVA interface
- Avoid the human errors of a manual migration

Efficient

- Get Thin with on-the-fly Thin Conversion
- No need for additional hardware or software needed
  - Online Import license included for free (6 month)

EVA to 3PAR Data Migration Options

Alternatives to HP 3PAR Online Import

Should the customers environment not supportd the use of Online Import, you can still use existing migration technologies, for example:

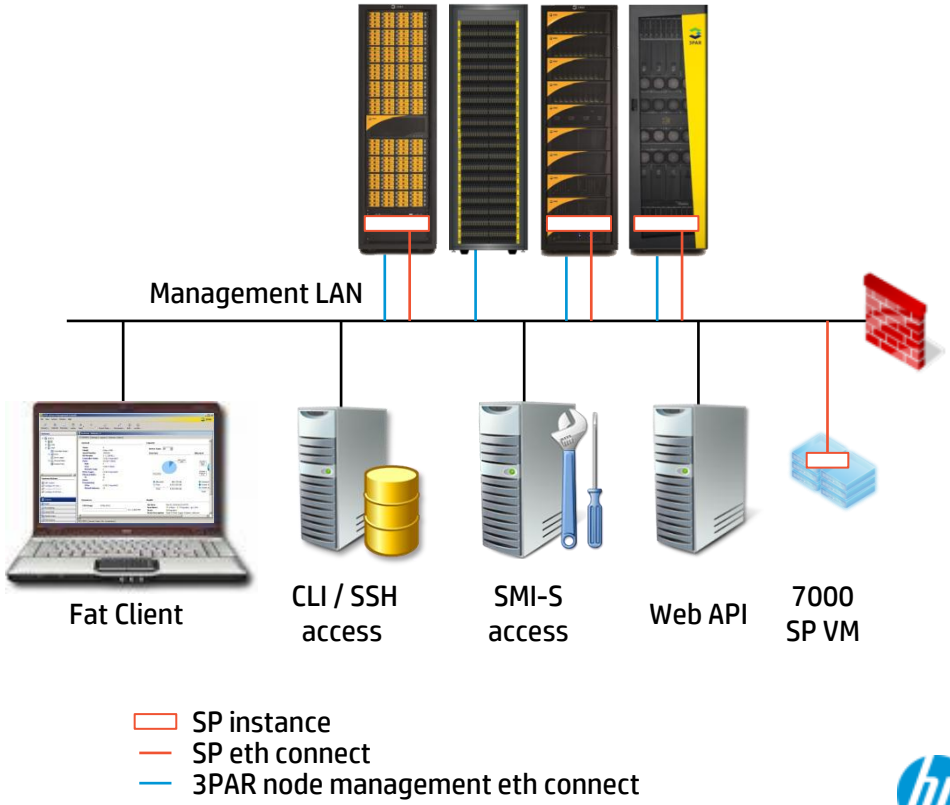
- MPX200
- VMware Storage VMotion
- other host based solutions (e.g. volume manager based mirroring on Unix/Linux)

HP Consulting Services to assess and help the transition

- HP Consulting offers flexible *«EVA to 3PAR Acceleration Consulting Services»* including assessment and migration offering for EVA to 3PAR
- HP Consulting can utilize HP 3PAR Online Import as well as all of the above technologies as part of their Service offering
- Most importantly HP Consulting can help on the overall Infrastructure refresh, that often goes along with a storage migration.

HP 3PAR – Management Options

- **3PAR Management Client (GUI)**
  - Fat client GUI - Windows, RedHat Linux
  - Storage Management GUI
- **CLI**
  - 3PAR CLI or ssh
  - Storage Management Interface
  - Storage Server - very rich, complete command set
- **SMI-S**
  - Management from third party management tools
- **Web API**
  - RESTful Interface
- **Service Processor (SP)**
  - Health checks by collecting configuration and performance data
  - Reporting to HP 3PAR Central
  - Anomalies reported back to customer via OSSA
  - Array management

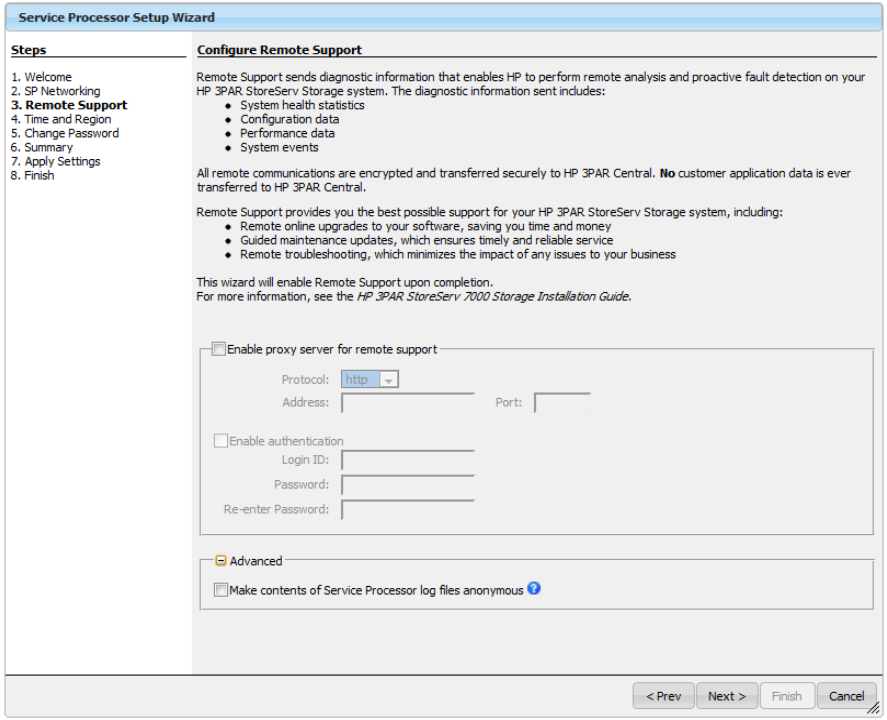


HP 3PAR Virtual Service Processor

Secure Remote Support

Virtual Service Processor

- Cost-efficient, secure gateway for remote connectivity
- Effortless, one-click configuration
- Supported on VMware vSphere
- Enables
  - Remote, online SW upgrade
  - Proactive fault detection with remote call home diagnostics
  - Remote serviceability
  - Alert notifications
- Optional HW Service Processor available



Introducing the HP 3PAR Arrays

- F-Class
- StoreServ7000
- StoreServ10000

3PAR StoreServ 7000

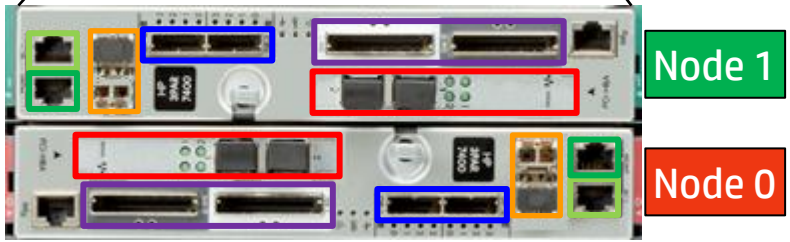
	HP 3PAR StoreServ 7200	HP 3PAR StoreServ 7400	
			
Controller Nodes	2	2	4*
Max SFF drives	144	240	480
Cache	24 GB	32 GB	64GB
8Gbit/s FC ports total (built-in/optional)	12 (4/8)	12 (4/8)	24 (8/16)
optional 10Gbit/s iSCSI/FCOE**	4	4	8
Built-in IP remote copy port	2	2	4
Controller Enclosures 2U with 24 SFF drive slots each	1	1	2
Drive Enclosures 2U with 24 SFF and/or 4U with 24 LFF drive slots each	0 to 5	0 to 9	0 to 18

* Field upgradeable
** FCoE available after first release

3PAR StoreServ 7000 controller enclosure

Rear view

Front view



- Built-in Eth Remote Copy Port
- Eth Mgmt. Port
- 2x built-in 8Gbit/s FC
- 2x 4-lane 6Gbit/s SAS for drive chassis connection
- Optional PCIe card
  - 4x 8GB/s HBA or
  - 2x 10Gbit/s CNA
- Controller interconnect (7400 only)

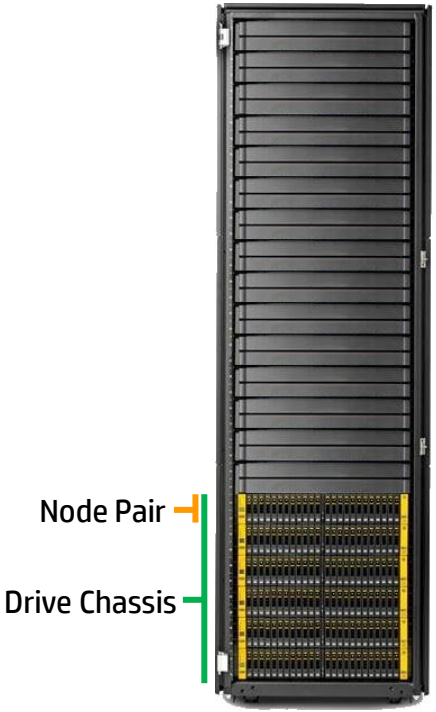
3PAR 7000 disk chassis

Mix and match drives and shelves as required

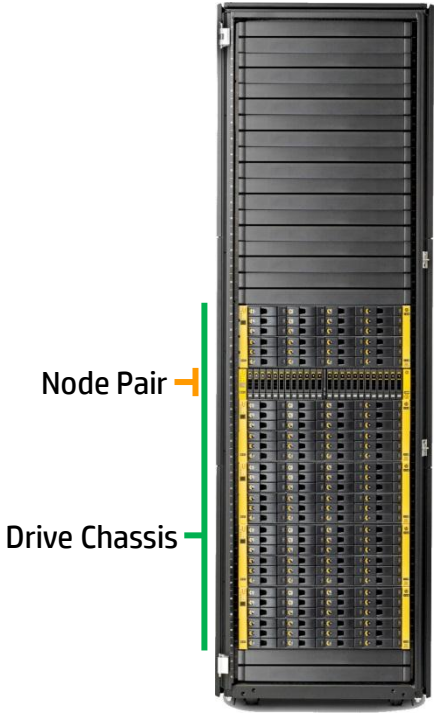
2U with 24 SFF drive slots

4U with 24 LFF drive slots

3PAR 7200 max. Configurations

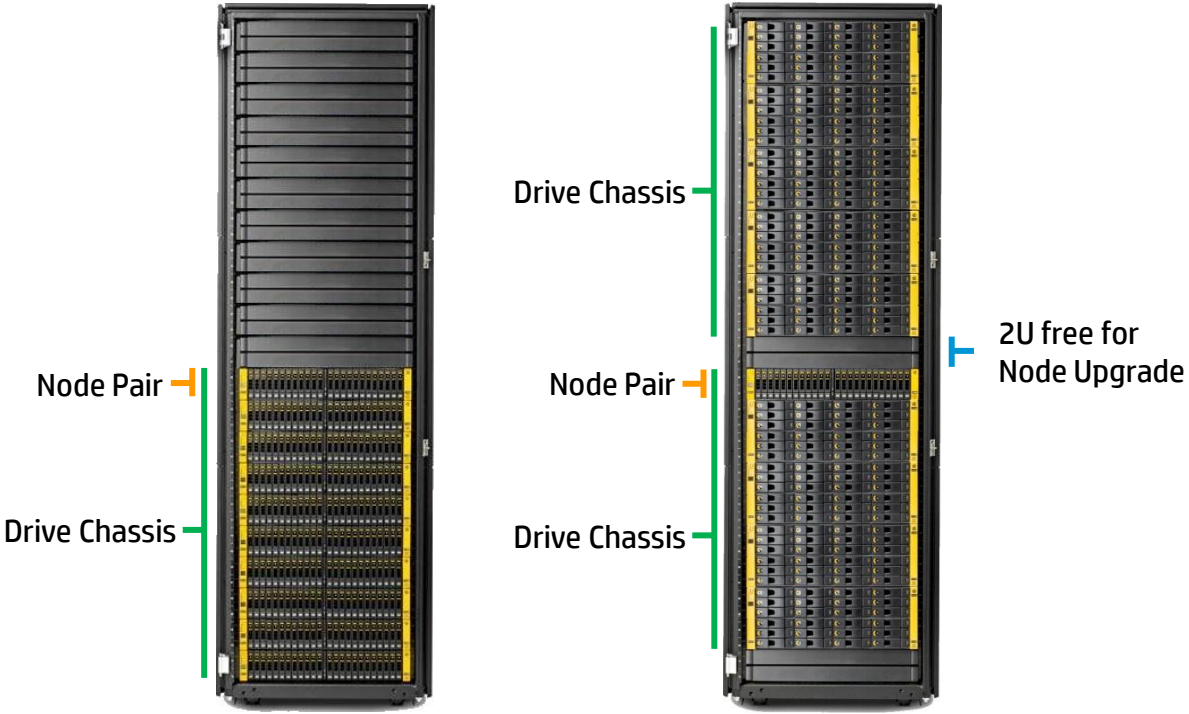


144 SFF drives



24 SFF + 120 LFF drives

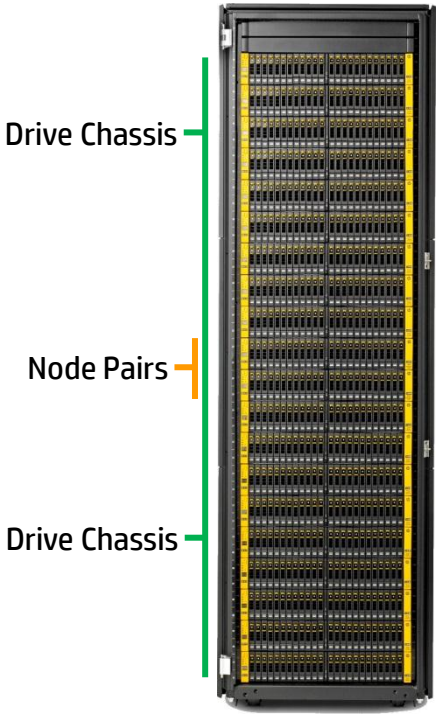
3PAR 7400 2-node max Configurations



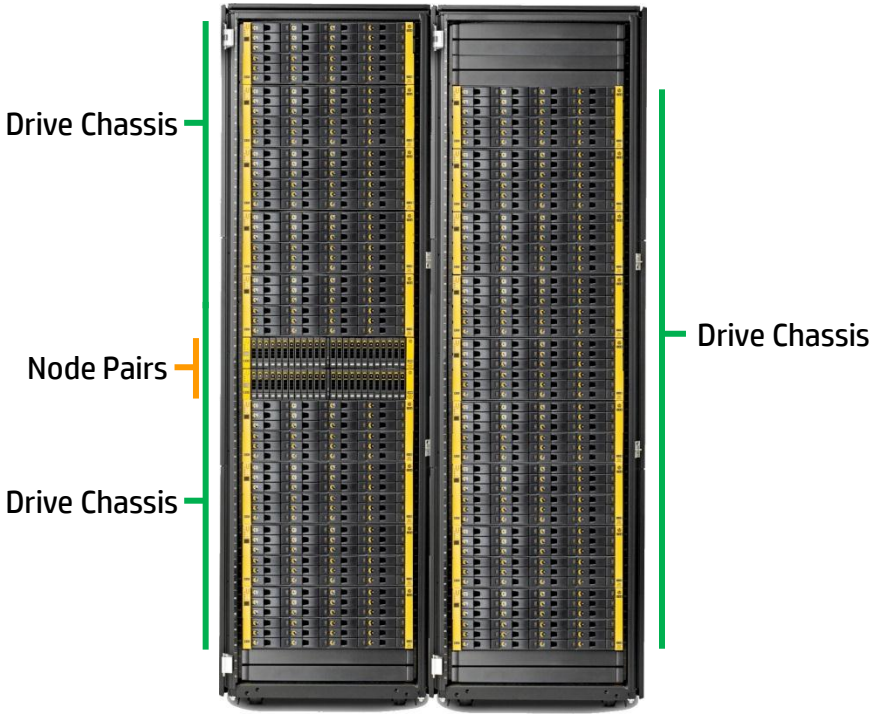
240 SFF drives

24 SFF + 216 LFF drives

3PAR 7400 4-node max Configurations



480 SFF drives



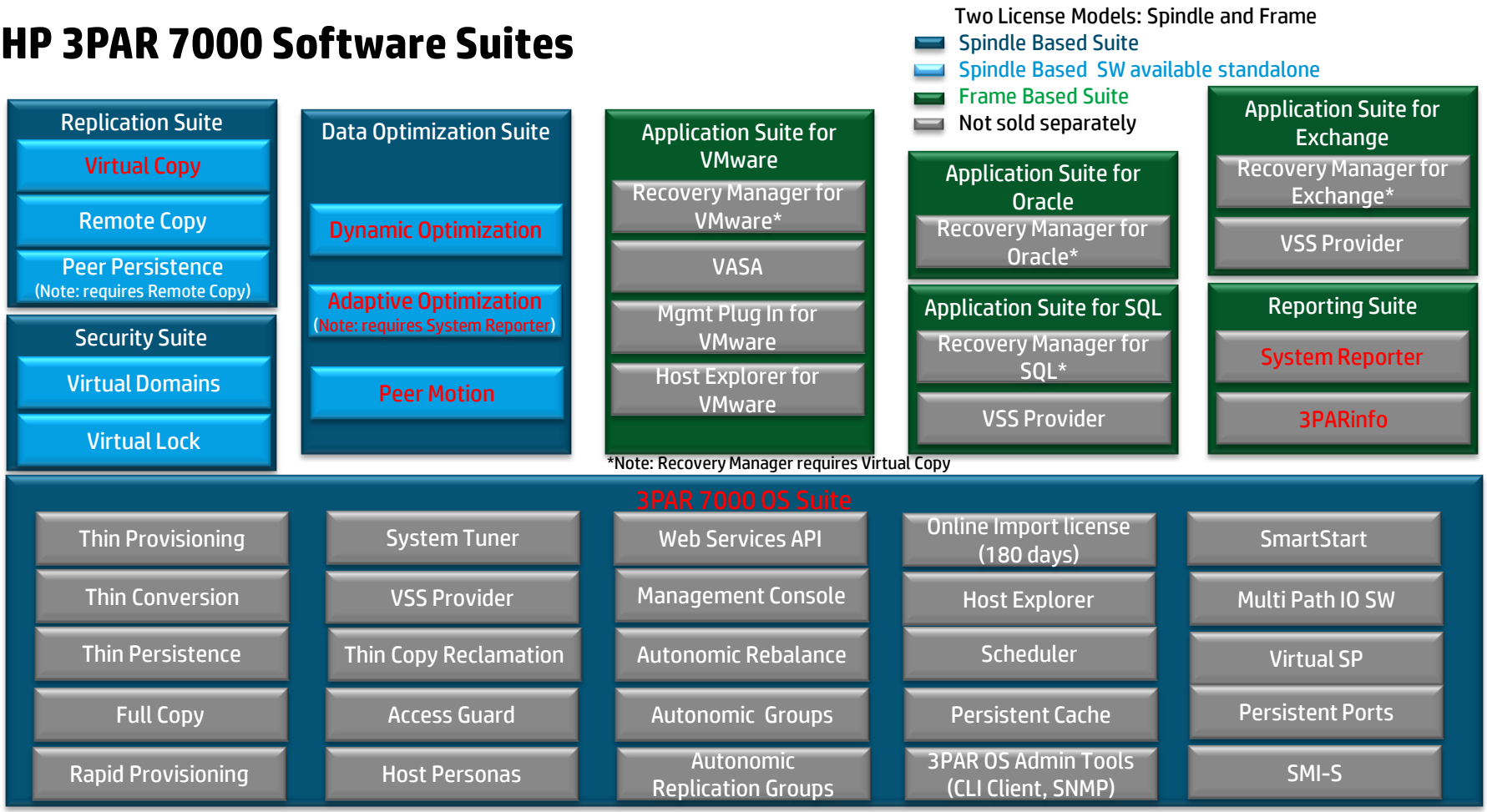
48 SFF + 432 LFF drives

Drive Specification Overview

Feature		HP 3PAR StoreServ 7200 2 Node System	HP 3PAR StoreServ 7400 2 Node System	HP 3PAR StoreServ 7400 4 Node System
RAID Levels		RAID 0, 10, 50, 60	RAID 0, 10, 50, 60	RAID 0, 10, 50, 60
RAID 5 Data to Parity Ratios		2:1 to 8:1	2:1 to 8:1	2:1 to 8:1
RAID 6 Data to Parity Ratios		4:2; 6:2; 8:2; 10:2; 14:2	4:2; 6:2; 8:2; 10:2; 14:2	4:2; 6:2; 8:2; 10:2; 14:2
Available SFF 2.5” Drives	SSD 15krpm 10krpm 7.2krpm	100GB, 200GB SLC SSD 300GB SAS 450GB, 900GB SAS NA	100GB, 200GB SLC SSD 300GB SAS 450GB, 900GB SAS NA	100GB, 200GB SLC SSD 300GB SAS 450GB, 900GB SAS NA
Available LFF 3.5” Drives	SSD 15krpm 10krpm 7.2krpm	100GB, 200GB SLC SSD NA NA 2TB, 3TB MDL SAS	100GB, 200GB SLC SSD NA NA 2TB, 3TB MDL SAS	100GB, 200GB SLC SSD NA NA 2TB, 3TB MDL SAS
Density	2U node chassis 2U drive chassis 4U drive chassis	24 SFF drives 24 SFF drives 24 LFF drives	24 SFF drives 24 SFF drives 24 LFF drives	24 SFF drives 24 SFF drives 24 LFF drives
# of 24 drive add-on Drive Chassis		0 to 5	0 to 9	0 to 18
# of Drives		8 to 144	8 to 240	8 to 480

HP 3PAR Software and Features

HP 3PAR 7000 Software Suites



HP 3PAR StoreServ 7000 software & support licensing

Software Suites

- 9 suites (4 main array software suites, 4 application suites, 1 reporting suite)
- Standalone software titles still available if needed—suites provide 25+ percent price advantage
- 3PAR OS Suite includes Thin Suite, rebalancing, and 180-day Online Import license

Licensed per drive

- HP 3PAR 7000 OS Suite
- HP 3PAR 7000 Replication Suite
- HP 3PAR 7000 Data Optimization Suite
- HP 3PAR 7000 Security Suite

Licensed per system

- HP 3PAR 7000 Application Suite for VMware
- HP 3PAR 7000 Application Suite for Exchange
- HP 3PAR 7000 Application Suite for SQL
- HP 3PAR 7000 Application Suite for Oracle
- HP 3PAR 7000 Reporting Suite

*Software Installation and Startup services available for Replication Suite, Data Optimization Suite, App Suite for VMware, Microsoft® Exchange, SQL, and Reporting Suite.

Licensing

- Separate software LTUs per model (7200 vs. 7400)
- Licenses are enforced by the 3PAR Array

Drive-based licenses

- Two licenses to buy software title
  - Base LTU: one per system
  - Drive LTU: one per drive up to the system cap
- Software caps
  - 48 LTUs for 7200
  - 168 LTUs for 7400

System-based licenses

- 1 LTU per system

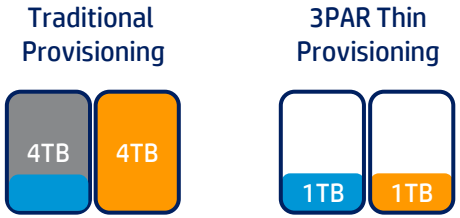
Service and Support

- Software Installation and Startup (I&S) services keyed to Base LTU SKUs* only; I&S is optional, although highly recommended for new array deployment
- Software support keyed to Base LTU SKUs only (system-based license)
- Support contract required to receive support, patches, and updates

HP 3PAR
Thin Technologies

HP 3PAR Thin Technologies Leadership Overview

Start Thin

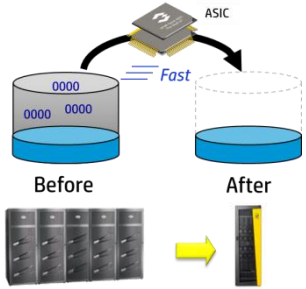


Thin Provisioning

- No pool management or reservations
- No professional services
- Fine capacity allocation units
- Variable QoS for snapshots

Buy up to 75% less storage capacity

Get Thin



Thin Conversion

- Eliminate time & complexity of getting thin
- Open, heterogeneous migrations for any array to 3PAR
- Service levels preserved during conversion

Reduce Tech Refresh Costs by up to 60%

Stay Thin

Symantec
ORACLE
vmware
Microsoft

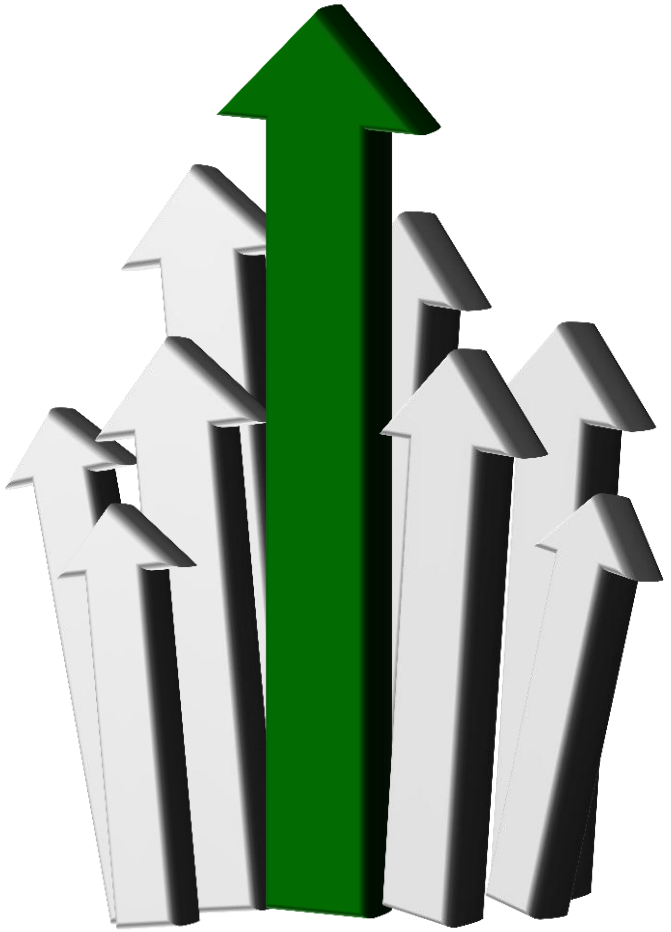
Thin Persistence

- Free stranded capacity
- Automated reclamation based on T10 write same or unmap operations
- Snapshots and Remote Copies stay thin

Thin Deployments Stay Thin Over time

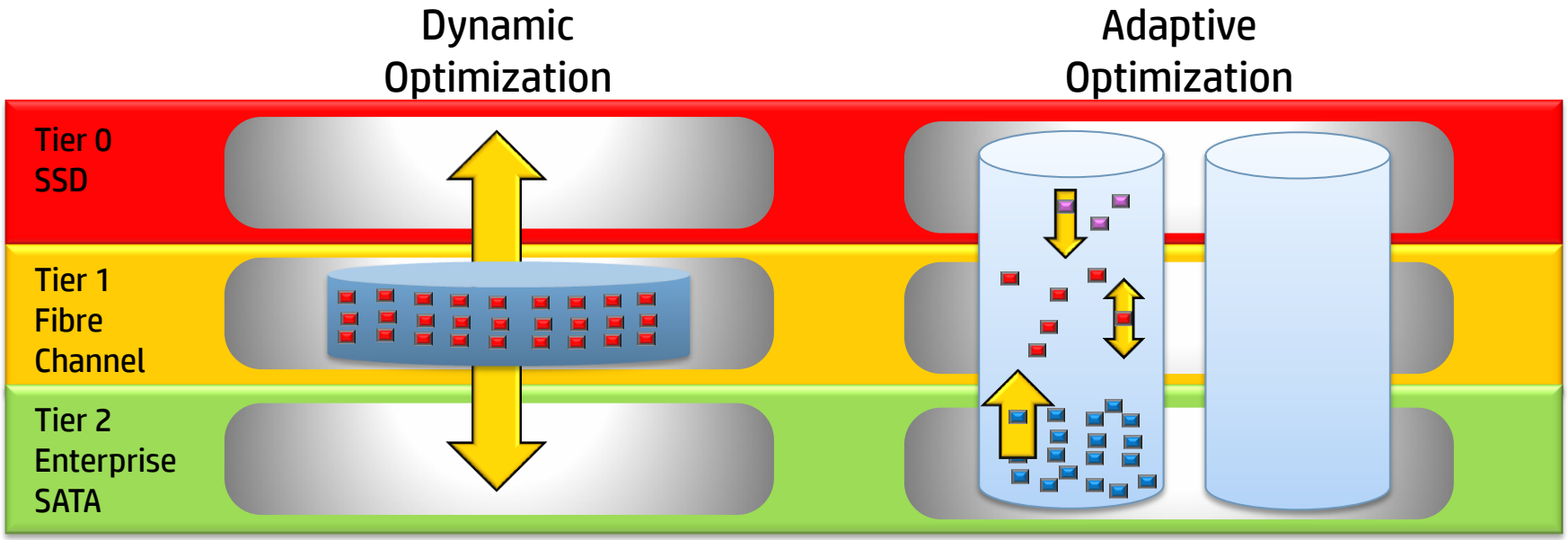
HP 3PAR Optimization

- Dynamic Optimization
- Adaptive Optimization



HP 3PAR Dynamic and Adaptive Optimization

Manual or Automatic Tiering



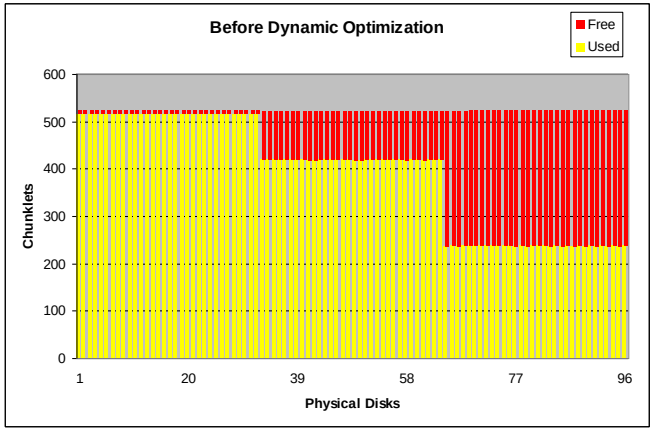
Autonomic data movement, single/full volume level

Autonomic tiering and data movement, sub-volume level

HP 3PAR Dynamic Optimization at a Customer

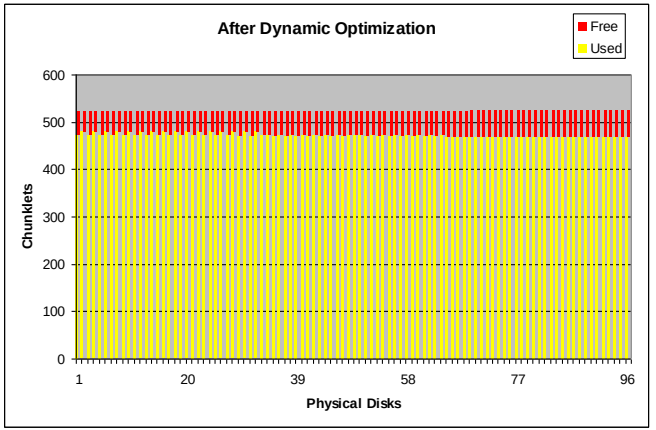
Optimize QoS levels with autonomic rebalancing without pre-planning

Distribution after 2 disk upgrades



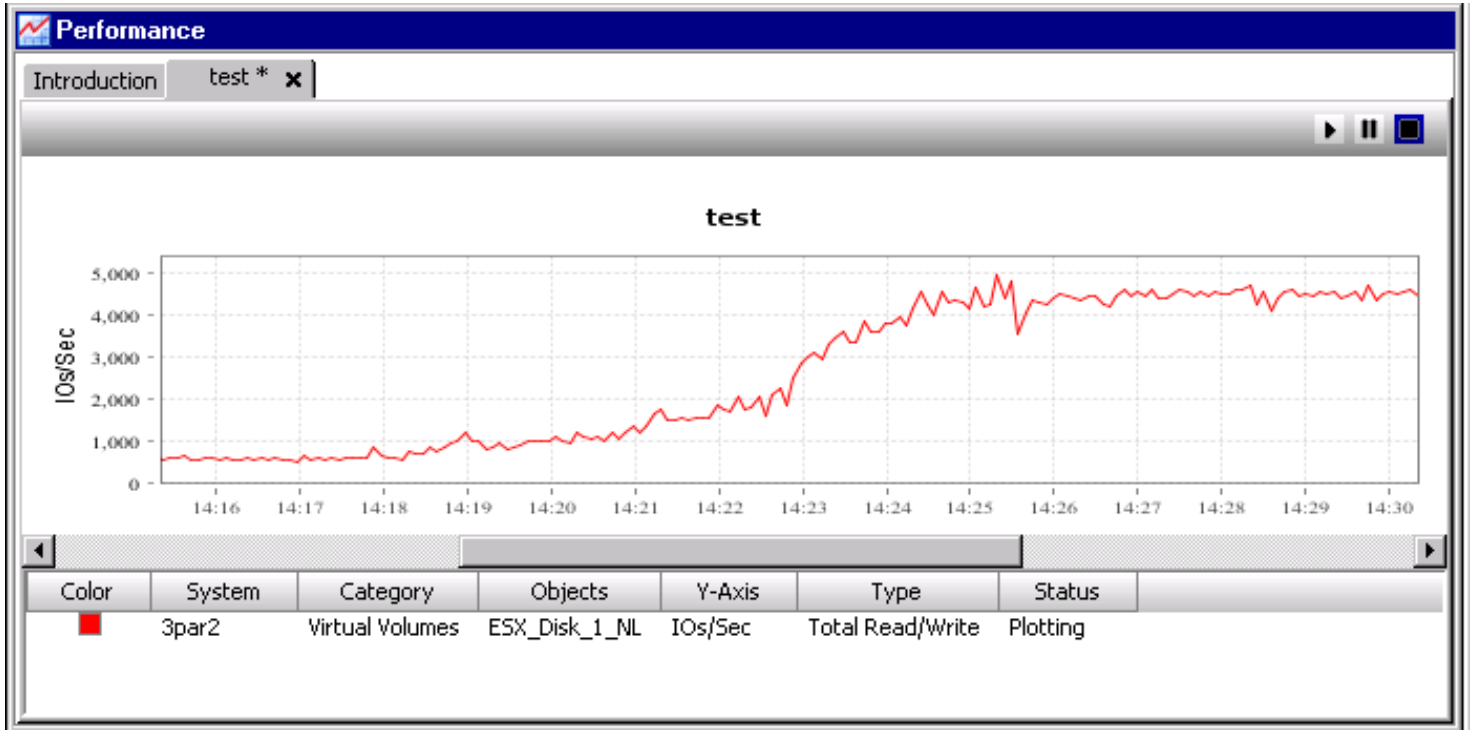
REBALANCE

Distribution after Dynamic Optimization



Performance Example with Dynamic Optimization

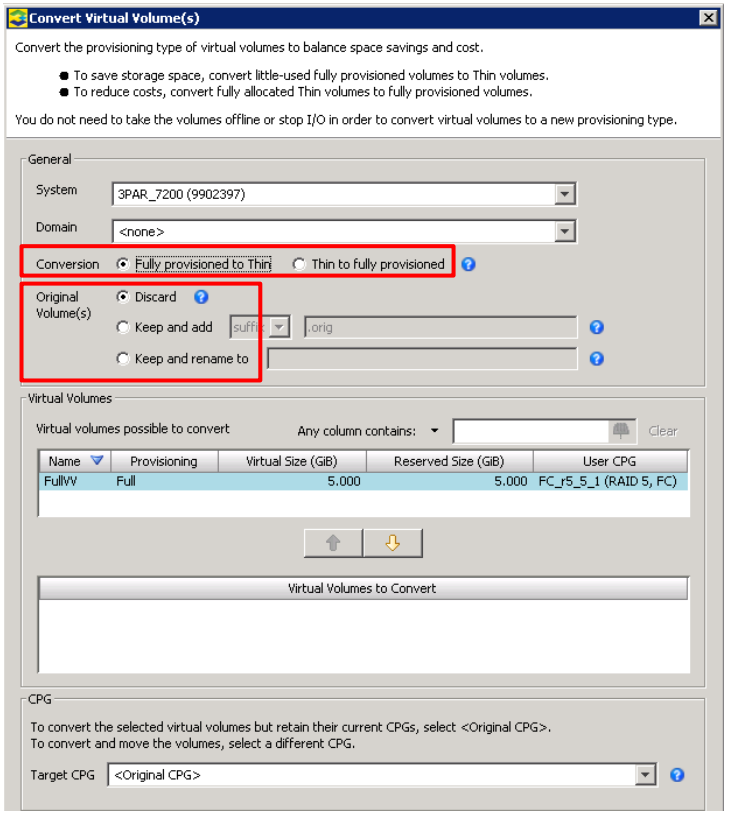
Volume Tune from R5, 7+1 SATA to R5, 3+1 FC 10K



Online fat-to-thin conversion

Part of Dynamic Optimization

- Non-disruptively migrate
  - fat-to-thin
  - thin-to-fat
  - between CPGs
- Original volume can either be
  - kept
  - kept and renamed
  - deleted



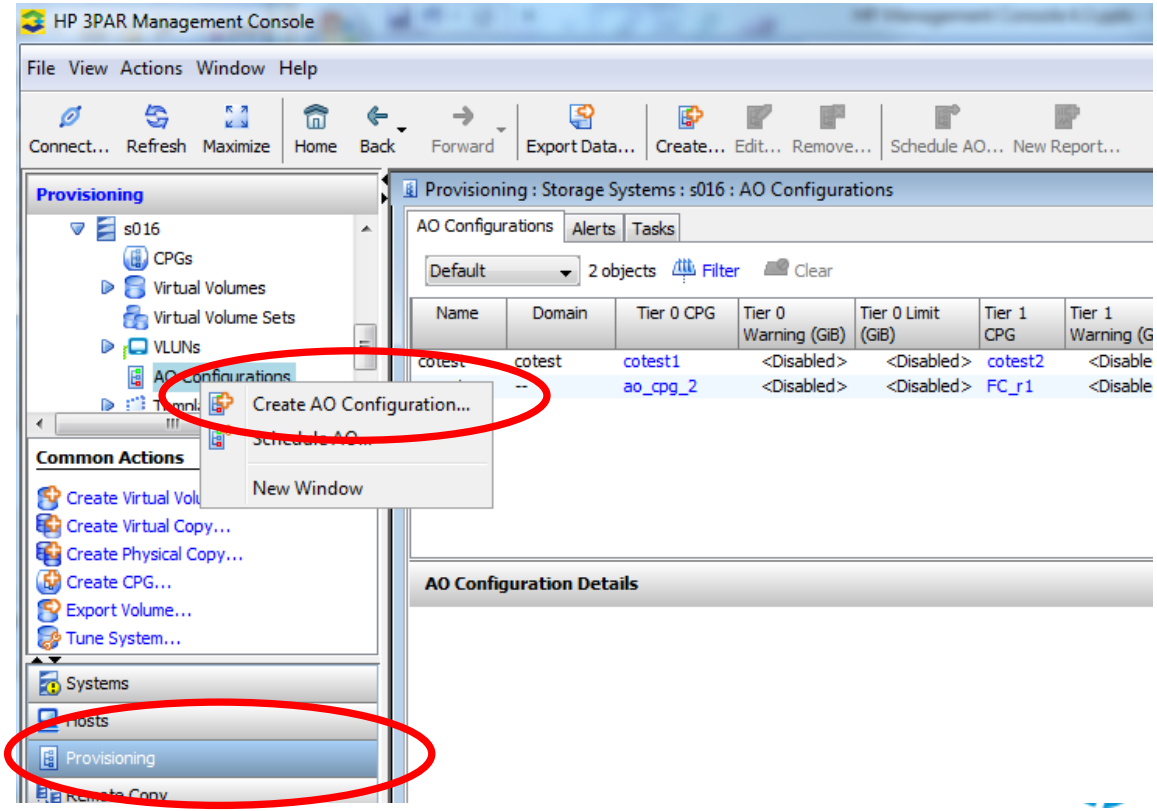
On-Node Adaptive Optimization

A new version of AO which runs entirely on the InServ

HP 3PAR Adaptive Optimization

Create a configuration

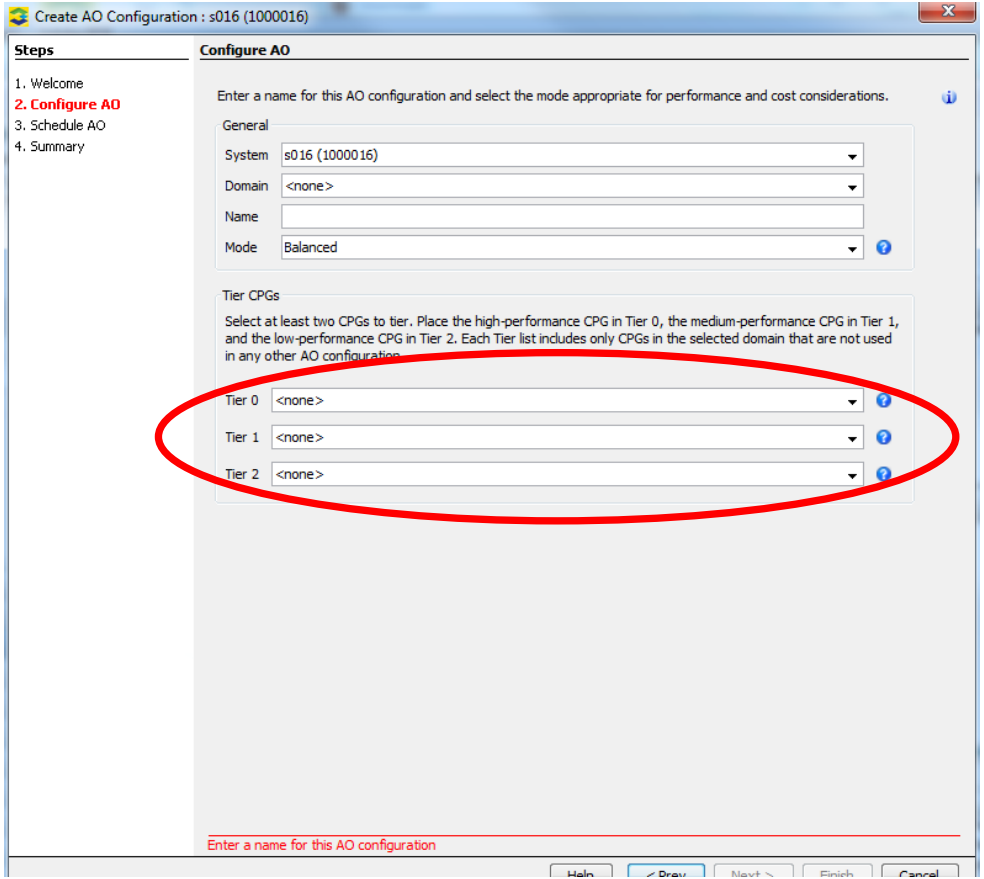
- Adaptive Optimization is defined in policies by tiers and schedules
- Up to 128 policies for different workload can be defined per 3PAR
- Each policy can be scheduled individually



HP 3PAR Adaptive Optimization

Creating a configuration

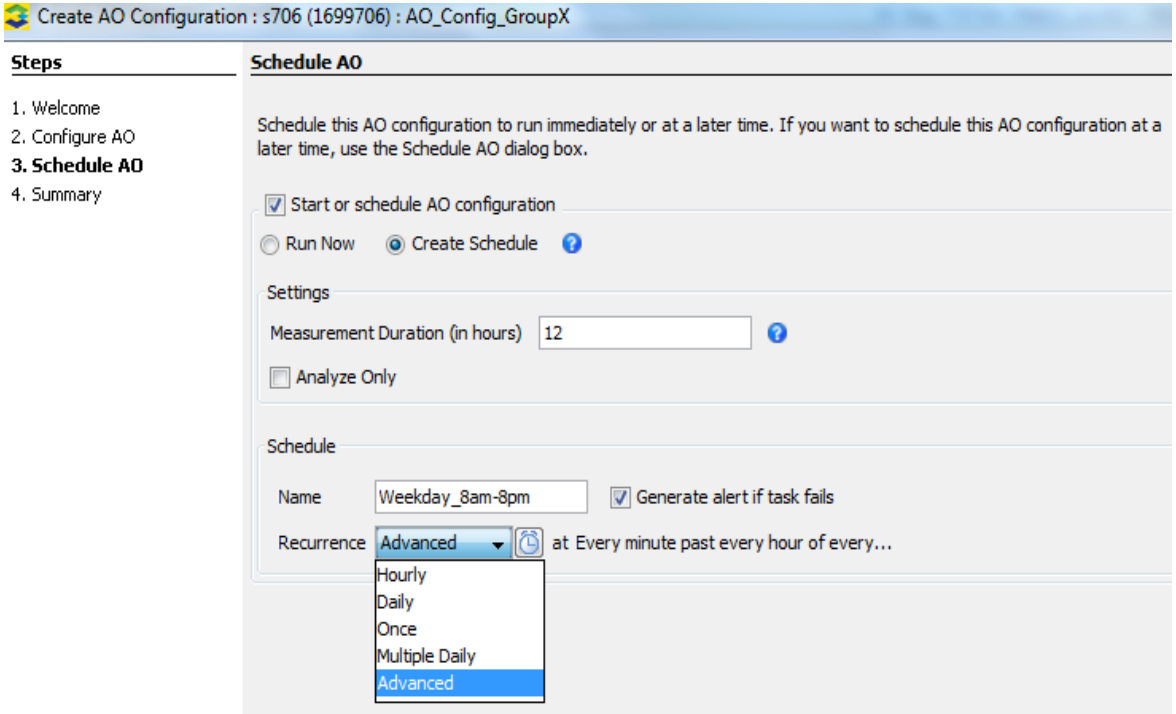
- Each Mode is either Cost, Balanced or Performance based
  - Cost: more data is kept in lower tiers
  - Performance: more data is kept in higher tiers
  - Balanced (default): balance between the two above
- 2 to 3 tiers per policy can be defined
- Each tier is defined by a selected CPG
- A CPG defines drive type, RAID level, redundancy level and step size



HP 3PAR Adaptive Optimization

Creating a configuration

- Tier movement is based on analyzing the following parameters
  - Average tier service times
  - Average tier access rate densities
  - Space available in the tiers



Adaptive Optimization

Best Practices

SSD recommendations; Default CPG growth

- For SSDs, the CPG grow size should be set to as small as the system will allow so as little space as possible is left empty (SSD space is expensive!).
  Min: 8GB / Node Pair
- For SSD, set a growth warning to use up to 95% of the capacity

- Make sure that the default CPG for VV growth (both data/USR or copy/SNP) should have plenty of space to grow. (default growth increment recommended)

- The default growth CPG for VVs in an AO configuration should NOT be in an SSD CPG.

Sizing configurations for AO

Always include FC disks. When using AO, locality of IOs matters!

If unsure of what Tiers distribution should be, use the following rule of thumb:

- SSD : 1% of useable capacity – should be able to do 1/3 of workload
- FC : 40% of useable capacity – should be able to sustain 2/3 of workload
- NL : 59% of useable capacity – (not contributing to performance)

Always ensure that no less than 1/3 of the overall capacity is on FC or SAS disks and it can sustain 2/3 of the applications workload

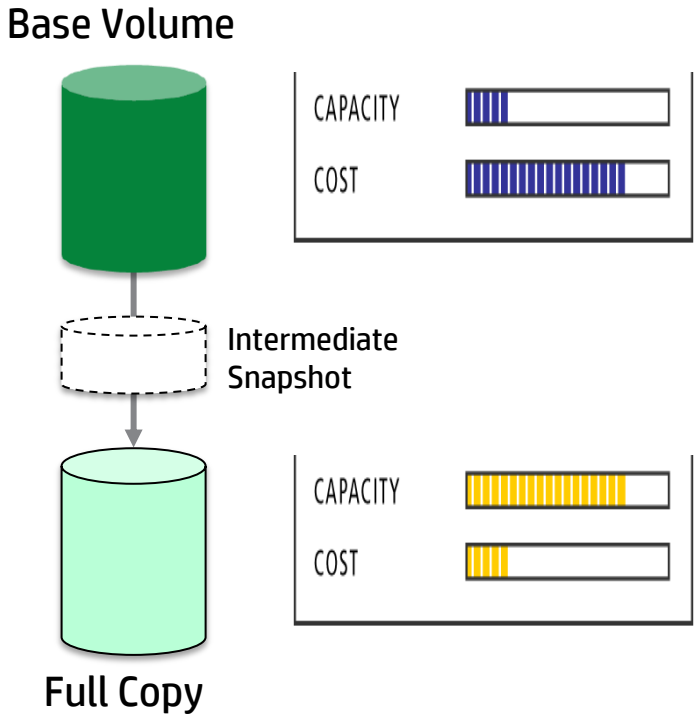
Tiers should be evenly distributed throughout all disk chassis and node pairs

HP 3PAR
Full and Virtual Copy

HP 3PAR Full Copy V1– restorable copy

Part of the base 3PAR OS

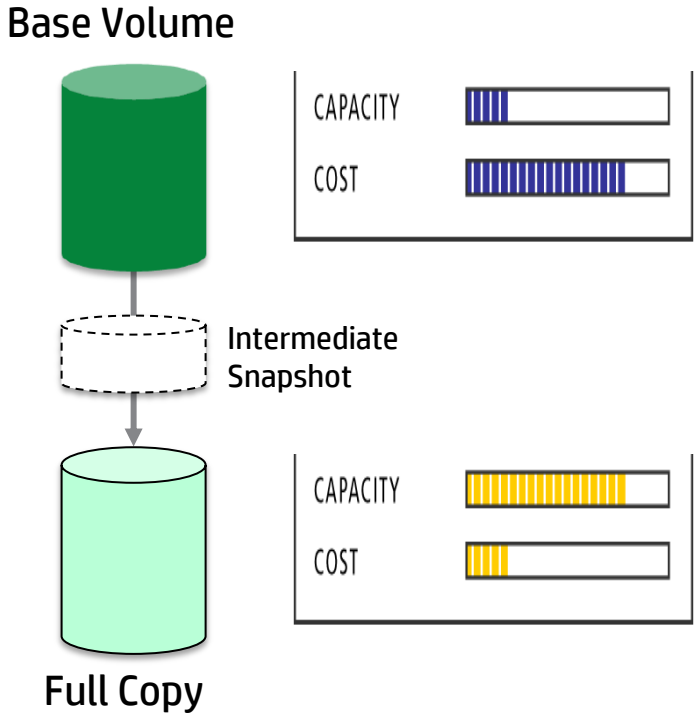
- Full physical point-in-time copy
- Provisionable after copy ends
- Independent of base volume's RAID and physical layout properties
- Fast resynchronization capability
- Thin Provisioning-aware
  - Full copies can consume same physical capacity as thinly provisioned base volume



HP 3PAR Full Copy V2 – instantly accessible copy

Part of the base 3PAR OS

- Share data quickly and easily
- Full physical point-in-time copy
- Immediately provisionable to hosts
- Independent of base volume's RAID and physical layout properties
- No resynchronization capability
- Thin Provisioning-aware
  - Full copies can consume same physical capacity as thinly provisioned base volume



HP 3PAR Virtual Copy – Snapshot at its best

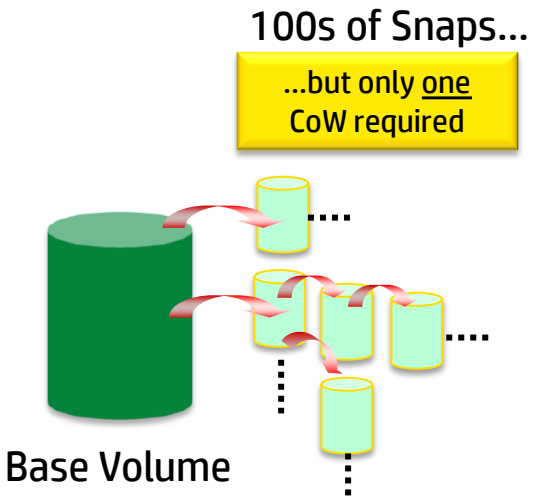
Smart
- Individually erasable and promotable
- Scheduled creation/deletion
- Consistency groups

Thin
- No reservation, non-duplicative
- Variable QoS

Ready
- Instantaneously readable and/or writeable
- Snapshots of snapshots of …
- Virtual Lock for retention of read-only snaps
- Automated erase option

Integrated
- MS SQL
- MS Exchange
- Oracle
- vSphere
- HP Data Protector
- …

Up to 8192 Snaps per array



Top 10 Arrays WW as of July 2012

# of Snapshots	Model
6559	V800
6172	S800
6156	S800
5138	S800
4666	S400
4482	S800
4341	T800
4295	T800
3991	T400
3871	T800

Be careful - Keep spinning disk utilisation below 50%

Response Time of different drive technologies

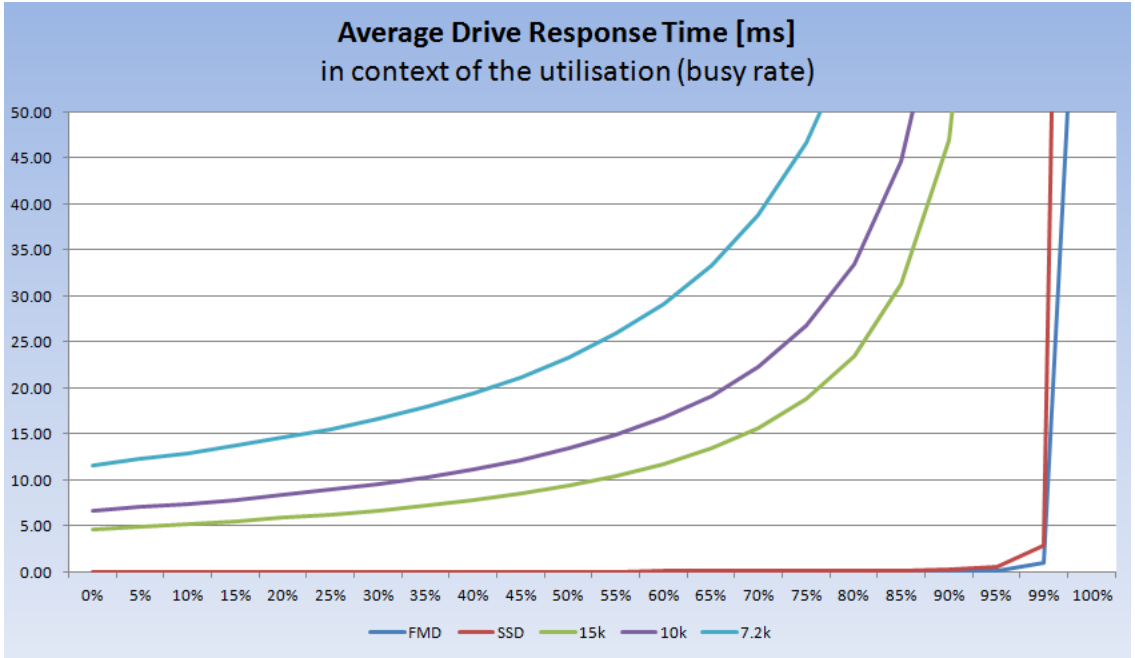
Rule of thumb

- Spinning disks should operate below 50% utilization

utilisation	~0%	~50%
15k	4.7ms	9.4ms
10k	6.7ms	13.4ms
7.2k	11.7ms	23.4ms

- FMD & SSD may operate up to 95% utilization

utilisation	~0%	~95%
FMD	0.01ms	0.2ms
SSD	0.03ms	0.6ms



HP 3PAR the right choice!

Thank you