Eliminating distinctions between Midrange and Tier 1
Polymorphic Simplicity – Storage without Boundaries

ONE Architecture from Midrange to High-end
• Midrange – Flash – High-end
• Common Tier-1 Feature Set
• Interoperability end-to-end

Only HPE

When Value matters
8200 AFA starting at $19k

When Performance matters
20840 and 20850 with up to 3.2M IOPS @ <1 ms latency
20450 with up to 1.8M IOPS @ <1 ms latency
8450 with up to 1M IOPS @ <1 ms latency

When Scale matters
20800 and 20840 with up to 6 PiB raw capacity
8440 with up to 3 PiB raw capacity
3PAR Industry Leadership
Best storage technology in the market – built for virtual environments

- 3PAR Federation Technologies
- 3PAR Flash Optimization
- 3PAR Optimization and Compaction Technologies
- 3PAR Converged Block, File and Object Access
- 3PAR Thin Technologies
- 3PAR Persistent Technologies
- 3PAR Mesh-Active Architecture
New: HPE 3PAR StoreServ 20840 Storage system
A new class of enterprise flash scale, performance, and density

48TB
Adaptive Flash Cache

Mix and match flash and HDD

3.2 Million IOPs

$1.50GB w/HDD backing

21PBs of usable capacity
### The 3PAR StoreServ Family

#### Same OS, Management Console and Software Features

<table>
<thead>
<tr>
<th>Controller Nodes</th>
<th>8200</th>
<th>8400</th>
<th>8450</th>
<th>8440</th>
<th>20450</th>
<th>20800</th>
<th>20840</th>
<th>20850</th>
</tr>
</thead>
<tbody>
<tr>
<td>16 Gb Fibre Channel Ports</td>
<td>4 – 12</td>
<td>4 – 24</td>
<td>4 – 24</td>
<td>4 – 24</td>
<td>0 – 80</td>
<td>0 – 160</td>
<td>0 – 160</td>
<td>0 – 160</td>
</tr>
<tr>
<td>10Gb iSCSI / FCoE Ports</td>
<td>0 – 4</td>
<td>0 – 8</td>
<td>0 – 8</td>
<td>0 – 8</td>
<td>0 – 40</td>
<td>0 – 80</td>
<td>0 – 80</td>
<td>0 – 80</td>
</tr>
<tr>
<td>1Gb Ethernet IP Ports</td>
<td>0 – 8</td>
<td>0 – 16</td>
<td>0 – 16</td>
<td>0 – 16</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>10Gb Ethernet IP Ports</td>
<td>0 – 4</td>
<td>0 – 8</td>
<td>0 – 8</td>
<td>0 – 8</td>
<td>0 – 24</td>
<td>0 – 48</td>
<td>0 – 48</td>
<td>0 – 48</td>
</tr>
<tr>
<td>Built-in IP Remote Copy Ports</td>
<td>2 – 4</td>
<td>4 – 24</td>
<td>2 – 4</td>
<td>4 – 24</td>
<td>2 – 8</td>
<td>0 – 80</td>
<td>0 – 48</td>
<td>0 – 48</td>
</tr>
<tr>
<td>Cache per node-pair / per system GiB</td>
<td>64 / 64</td>
<td>64 / 128</td>
<td>192 / 384</td>
<td>192 / 384</td>
<td>192 / 384</td>
<td>986 / 1792</td>
<td>448 / 1792</td>
<td>900 / 3600</td>
</tr>
<tr>
<td>Flash Cache per Node-Pair / system GiB</td>
<td>768 / 768</td>
<td>768 / 1536</td>
<td>NA</td>
<td>4000 / 8000</td>
<td>NA</td>
<td>8192 / 32768</td>
<td>12288 / 49152</td>
<td>NA</td>
</tr>
<tr>
<td>Drives per StoreServ array</td>
<td>8 – 240</td>
<td>8 – 576</td>
<td>8 – 480</td>
<td>8 – 960</td>
<td>8 – 512</td>
<td>8 – 1920</td>
<td>8 – 1920</td>
<td>8 – 1024</td>
</tr>
<tr>
<td>SSD</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>15k SAS</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>10k SAS</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
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<tr>
<td>7.2k NL SAS</td>
<td>yes</td>
<td>yes</td>
<td>NA</td>
<td>yes</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Max SSD per StoreServ</td>
<td>120</td>
<td>240</td>
<td>480</td>
<td>480</td>
<td>512</td>
<td>1024</td>
<td>1024</td>
<td>1024</td>
</tr>
<tr>
<td>Max Raw Capacity (TiB)</td>
<td>750</td>
<td>2400</td>
<td>1843</td>
<td>3000</td>
<td>1966</td>
<td>6000</td>
<td>6000</td>
<td>3932</td>
</tr>
<tr>
<td>Distributed</td>
<td>342'000</td>
<td>659'000</td>
<td>786'000</td>
<td>786'000</td>
<td>933'000</td>
<td>1'379'000</td>
<td>1'724'000</td>
<td>1'724'000</td>
</tr>
<tr>
<td>Local Node</td>
<td>400'000</td>
<td>800'000</td>
<td>1'000'000</td>
<td>1'000'000</td>
<td>1'800'000</td>
<td>2'500'000</td>
<td>3'200'000</td>
<td>3'200'000</td>
</tr>
<tr>
<td>Max random IOPS front-end performance</td>
<td>6.1</td>
<td>12.6</td>
<td>12.6</td>
<td>12.6</td>
<td>12.3</td>
<td>30.3</td>
<td>30.3</td>
<td>30.3</td>
</tr>
<tr>
<td>Distributed</td>
<td>11.6</td>
<td>23.2</td>
<td>24</td>
<td>24</td>
<td>38</td>
<td>75</td>
<td>75</td>
<td>75</td>
</tr>
</tbody>
</table>

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1) 100% random reads, 8kB, no Cache hits
2) 100% sequential reads, 256kB, no Cache hits
3PAR Gen5 Thin Express ASIC
The Heart of every 3PAR

- Thin & SHA256 based Dedupe Built In
- All IO go through the ASIC
- Tightly-Coupled Clustering
- High Bandwidth, Low Latency Interconnect
- Fast RAID 10, 50 & 60
  Rapid RAID Rebuild
  Integrated XOR Engine
- Data Integrity
  T10-PI Persistent Checksum
- Low Latency Cache Mirroring
  Minimal CPU cycles required
- Mixed Workload & CPU Offload
  Independent Metadata and Data Processing

Watch the “Understand the 3PAR ASIC” video: http://www.youtube.com/watch?v=LmQmWNGA7E
HPE 3PAR SPC validated performance
Both SPC-1 and SPC-2 certified

**SPC-1 Benchmark**
HPE 3PAR StoreServ 8450

- $0.24/IOPS
  Lowest cost-performance external storage system
- 545,000 IOPS
  Highest performance of any active mid-range system

**SPC-2 Benchmark**
HPE 3PAR StoreServ 20850 / 20840

- #1
  First top-10 all-flash system for price-performance
- >62GB/s
  World Record SPC-2 result
3PAR 8000 and 20000 Software Suites
Simplified Software Licensing based on Suites

Operating System SW Suite

Security SW Suite

File Persona SW Suite

Data Optimization SW Suite

Replication SW Suite

Application Software Suites

<table>
<thead>
<tr>
<th>StoreServ</th>
<th>License Cap</th>
</tr>
</thead>
<tbody>
<tr>
<td>8200</td>
<td>48</td>
</tr>
<tr>
<td>8400, 8450</td>
<td>168</td>
</tr>
<tr>
<td>8440</td>
<td>320</td>
</tr>
<tr>
<td>20450</td>
<td>168</td>
</tr>
<tr>
<td>20850</td>
<td>320</td>
</tr>
<tr>
<td>20800</td>
<td>480</td>
</tr>
</tbody>
</table>
3PAR 8000 and 20000 Software Title Details

**Replication SW Suite**
- Virtual Copy (VC)
- Remote Copy (RC)
- Peer Persistence (PP)
- Cluster Extension Windows (CLX)

**Data Optimization SW Suite**
- Dynamic Optimization
- Adaptive Optimization
- Peer Motion
- Priority Optimization

**Security SW Suite**
- Virtual Domains
- Virtual Lock

**Smart SAN for 3PAR**

**3PAR Operating System SW Suite**
- Rapid Provisioning
- Autonomic Groups
- Autonomic Replication Groups
- Autonomic Rebalance
- LDAP Support
- Access Guard
- Host Personas
- Adaptive Flash Cache
- Persistent Cache
- Persistent Ports
- Management Console
- Web Services API
- SMI-S
- Real Time Performance Monitor

**File Persona SW Suite**
- Policy Server
  - Policy Manager Software

**Data Encryption**

**Policy Server**
- Policy Manager Software

**Recover Manager Central for vSphere**

**Application SW Suite for Oracle**

**Application SW Suite for MS SQL**

**Application SW Suite for MS Exchange**

**Application SW Suite for MS Hyper-V**

**3PAR OS Administration Tools**
- CLI client
- SNMP

**Data Optimization SW Suite**
- Dynamic Optimization
- Adaptive Optimization
- Peer Motion
- Priority Optimization

**Security SW Suite**
- Virtual Domains
- Virtual Lock

**Smart SAN for 3PAR**
3PAR Leadership –
Priority Optimization – part of Data Optimization Suite

- Protect your mission critical applications
- Assure tenant/application level QoS by assigning priorities, targets and caps to VV sets and/or Virtual Domains
  - Max limit – IOPS or bandwidth per object
  - Min goal – Min floor for IOPS or bandwidth
  - Latency goal – Service level target for an object
  - Priority level – throttle order for object

What’s New: Accelerating the move to the All-Flash Data Center

Leading performance, workload support and scalability to 21 PB
The new 3PAR 20840 delivers up to 21 PBs of usable capacity and up to 3.2 million IOPS with industry-leading throughput.

75 percent less capacity and zero guesswork – guaranteed
The new HPE Get Thinner Guarantee program offers a free, up-front workload assessment and a written assurance of 75 percent capacity savings that removes guesswork in migrating from legacy storage onto all-flash HPE 3PAR arrays.

Most affordable AFA as demonstrated by the new SPC-1 benchmark
New SPC-1 result for the 3PAR StoreServ 8450 All-Flash Array, where it achieved a world-leading result of $0.23 SPC-1 $/IOPS™ – making it THE most affordable external all flash array on the planet.

Source: Based on comparison of publically available pricing, capacity, and performance information.
Total Drive Revenue - % per Drive Type (SSD vs HDD)
For the first time in FY15Q4 we have more revenue from SSDs
SSD Efficiency – A game changer enabled by HPE Storage

- 4X better density
- 20% more capacity with Adaptive Sparing
- > 2 PB per Rack
- 5 Years Warranty

TB Usable!

<table>
<thead>
<tr>
<th>Year</th>
<th>SSD Type</th>
<th>Capacity (TB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>920 GB SSD</td>
<td>17</td>
</tr>
<tr>
<td>2014</td>
<td>1.92 TB SSD</td>
<td>35</td>
</tr>
<tr>
<td>2015</td>
<td>3.84 TB SSD</td>
<td>69</td>
</tr>
<tr>
<td>2016</td>
<td>7.68 TB SSD</td>
<td>140</td>
</tr>
<tr>
<td></td>
<td>HPE Deduplication</td>
<td>280</td>
</tr>
<tr>
<td></td>
<td>HPE Compression</td>
<td>560</td>
</tr>
</tbody>
</table>
## Disk versus Flash Storage

<table>
<thead>
<tr>
<th></th>
<th>HPE All Flash</th>
<th>HPE Disk based</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3,84TB SSDs</td>
<td>1,2TB disk drives</td>
</tr>
<tr>
<td>(2:1 Compaction)</td>
<td>(2:1 Compaction)</td>
<td></td>
</tr>
<tr>
<td>Capacity</td>
<td>1PB</td>
<td>1PB</td>
</tr>
<tr>
<td>IO per second</td>
<td>400,000</td>
<td>129,000</td>
</tr>
<tr>
<td>IO Latency</td>
<td>&lt;1ms</td>
<td>&lt;6ms</td>
</tr>
<tr>
<td>Power consumption</td>
<td>3,4kW</td>
<td>19,1kW</td>
</tr>
<tr>
<td>Floor space</td>
<td>1 Rack</td>
<td>4 Racks</td>
</tr>
</tbody>
</table>
3PAR Flash efficiency
SSD Data Deduplication: Inline — Scalable — Fast

**Thin Deduplication**

Inline deduplication offloaded to the ASIC

1. hash generated inline by the ASIC
2. bit-to-bit compare on match offloaded to ASIC
3. only unique data written to SSD

**Express Indexing**

Fast lookups

LBA

Hash L1

Hash L2

Hash L3

L1 Table

L2 Table

L3 Table

**Thin Clones**

Non Duplicative VM clones

VM cloning leverages XCOPY and ODX

• Clones are created on-the-fly without pre-allocating any storage
• New data is deduplicated inline

Hypervisor

3PAR Volume

VM

VM

VM

VM

VM

VM

VM

VM

VM

VM

VM

VM

VM

VM

VM

VM

VM

VM
Consolidate Traditional Tier-1 Storage

3 x EMC VMAX 400K arrays:
7x the sprawl
8x the power
8x the heat

12 PBs Usable
21 Racks
90% HDD / 10% SSD

Scalable. Flexible. Resilient. Futureproof
3PAR StoreServ 20800 Converged Flash Storage
- Up to 15 PB usable
- Up to 2.5M IOPS @ <1ms* latency
- Tier-1 Resiliency
- Federated data mobility

3 x EMC VMAX 400K arrays:
7x the sprawl
8x the power
8x the heat

12 PBs Usable
3 Racks
100% SSD

VS.

12 PBs Usable
3 Racks
100% SSD

1

1

1

1

Hewlett Packard Enterprise
400 GB SSD
The next step in the HP 3PAR StoreServ Solid State journey

**Investment Protection**
Built for I/O creates a “future-proof” advantage. 3PAR architecture enables seamless transition to 3D NAND!

**Low Cost**
Smallest SSD in our portfolio with the lowest starting price

**Near All-flash performance**
Adaptive Flash Cache (included in 3PAR OS suite) provides true extension of DRAM cache to SSD

15%
Entry flash

Hewlett Packard Enterprise
SAN Virtualization
There are more and less complex solutions

Traditional SAN Virtualization appliances like
• EMC VPLEX
• IBM SVC
• Falconstore NSS
• DataCore SANsymphony
introduce more layers in the IO stack and thus more dependencies and more to management.

3PAR Peer Persistence provides transparent storage presentation without the burden of an additional virtualization layer.
3PAR Peer Persistence
Never lose access to your data volumes

What does it provide?
• High Availability across data centers

How does it work?
• Automatic or manual transparent LUN swap based on 3PAR Remote Copy and OS MPIO
  • Primary RC Volume presented with active paths
  • Secondary RC Volume presented with passive paths
• Automated LUN swap arbitrated by a Quorum Witness (preferably on a 3rd site)

Requirements:
• FC, iSCSI or FCoE cross-site Server SAN
• Two synchronous Remote Copy links (RCFC or RCIP)
• Max replication link latency of 5ms RTT (~500km)
• 3PAR Remote Copy and Peer Persistence Licenses

Supported environments:
• Windows 2008 R2/2012 R2; standalone, Cluster, Hyper-V
• ESX vSphere 5.0, 5.1, 5.5 incl. HA, Failsafe and uniform vSphere Metro Storage Cluster
• RHEL 6; standalone, Cluster
• HP-UXv3; standalone, Cluster
• Oracle RAC on RHEL 6, Windows 2008/12, HP-UX
• IBM AIX 6.1, 7.1 with the ANTEMETA PP4AIX driver

Also see the Peer Persistence product page
Reference Architecture
HPE 3PAR StoreServ 20800 Oracle RAC Stretched Cluster with Peer Persistence

- Designed to test a cluster stretched across two datacenters
- Oracle RAC provides server redundancy
  - Active/Active Server cluster
  - Client connection availability
- HPE 3PAR Peer Persistence provides
  - Storage redundancy and high availability
  - On-line configuration flexibility
  - Effortless failover between sites
- Benefits of Oracle RAC with 3PAR Peer Persistence
  - Highly Available
  - Seamless load balancing across systems and sites
  - Flexibility to meet changing performance SLAs

RA available since February 2016
Recovery Manager Central for vSphere (RMC-V)

RMC communication based on REST API

- **vCenter Administrator**: Manages vCenter server connections.
- **VCenter server**: Centralizes management of virtual machines.
- **RMC call to mount Consistent Snapshots on RMC appliance**: Initiates the process of snapshot mounting.
- **VMWare vSphere**: The virtualization platform where snapshots are managed.
- **Host Server Hardware**: Includes FC-HBA and IP NIC components.
- **RMC-V Appliance**: Data mover in a VM, moves snapshot data to the StoreOnce deduplicated Catalyst Store.
- **RMC Administrator**: Manages the RMC-V appliance.
- **IP Network**: Enables communication between networked devices.
- **FC SAN**: Connects virtual volumes and snapshots through FC adapters.
- **Catalyst Store**: StoreOnce Backup System for managing backups.
- **Snapshot Backups**: Records backup data for recovery.
- **3PAR StoreServ Disk Array**: Provides virtual volumes and snapshots functionality.
- **Catalyst API data movement**: Indicates data movement processes.

**Data Flow**:
- **Snapshot** to **Backup & Recovery**
- **Virtual volumes** and **Snapshots** within the **3PAR StoreServ Disk Array**
- **Catalyst Store** holds backups

**HPE RMC vCenter Plug-in for vSphere**: Facilitates integration and management of RMC-V within vCenter.
3PAR OS 3.2.2 EMU2

- A new HPE 3PAR model, the 20840
- Dedup enhancements, scale and defrag support
- FC 16Gb/s Direct Attach
- More than double the Peer Persistence scalability - from 600 to 1,500 volumes
- Express Layout which results in more usable capacity for entry level AFA configs
- Asynchronous Steaming robustness
- SSMC 2.3 packed with new features and usability changes
- File Persona enhancements
- 8TB NL Drive Support
Converged Block, File, and Object Access
For the 7000, 8000 and 20000 family

One Converged controller
One capacity group
One Management experience

Applications
FC, iSCSI, FCoE

Databases
FC, iSCSI, FCoE

Virtualization
FC, iSCSI, FCoE

File Serving
CIFS, NFS

Object Access
REST API
HPE 3PAR File Persona Software Suite
– Managed through the StoreServ Management Console, 3PAR CLI, & OpenStack

Enables rich **file protocols** and key **file data services**

- SMB 3.0, 2.1, 2.0, 1.0 for Microsoft Windows and Apple OS X
- NFSv4 and v3 for Linux and UNIX
- Object Access (REST) API
- User authentication
- Quota management
- File snapshots with user-driven restore
- Virus scanning integration
- Network share and NDMP-based backup

while leveraging core block services

- Thin Provisioning and Thin Deduplication
- Adaptive Optimization and Dynamic Optimization
- Adaptive Flash Cache
- Remote Copy
- Virtual Copy
- Data-at-Rest Encryption
Feature set and capability expanded over the last 12 months

**3.2.1 MU1**
January 2015
- Unified management with SSMC, 3PAR CLI, & OpenStack
- SMB 1.0, 2.0, 2.1, 3.0; NFSv3 & v4; Object Access API; multi protocol access
- Active Directory, OpenLDAP, & local authentication
- Capacity & user/group quotas
- File snapshots with user driven restore
- McAfee & Symantec virus scanning
- Network share & NDMP-based backup
- Leveraged block services: Thin Provisioning; Adaptive & Dynamic Optimization; Adaptive Flash Cache; Remote Copy; DAR Encryption
- 1GbE NIC with Mode 1 & 6 bonding; 10GbE NIC with Mode 1

**3.2.2**
August 2015
- Simplified management of share ACLs
- Trend Micro virus scanning support
- Leveraged block services: Thin Deduplication
- Mode 6 bonding for 10GbE
- Onboard RCIP port support

**3.2.2 MU2**
February 2016
- Up to 2.5X NFS random read performance
- Up to 1.5X NFS & SMB random write performance
- FPGs aligned to 16KB deduplication boundary
- Quota accounting that excludes snapshots
- Static routes for VLANs
Planned features

**Higher scalability**: 64TiB FPG and 256TiB usable capacity per node pair
Larger file system and higher total file capacity per node pair

**Improved file sharing**: Cross protocol locking and static user mapping
Group file sharing more seamless between SMB and NFS protocols

**Storage efficiency**: Support for Thin Persistence
Effective storage space management with Thin Persistence via SCSI unmap

**Data preservation**: New File Lock feature for retention and WORM
File immutability and retention for regulatory compliance SEC 17a-4(f) and governance

**Configurable compute resources**: Persona Optimization on 3PAR StoreServ
Flexibility of using 3PAR system for block-only or block centric or file centric workloads
Thank you
adam.tekieli@hpe.com