



Serial Attached SCSI (SAS): The Future of Storage is Here Today

Industry Standard Servers, HP

April 27, 2006

For more information please contact eric.a@hp.com



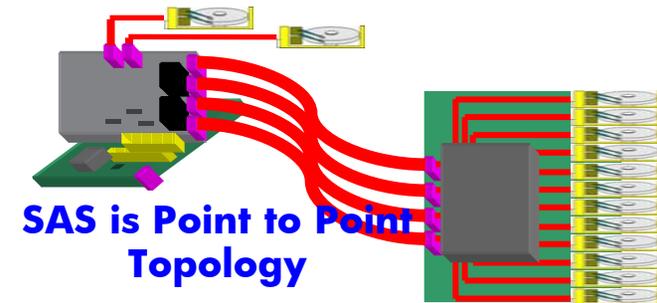
Agenda

- Industry Wide Transition
 - Drivers
 - Customer benefits
- HP Value
 - Unique approach
 - Customer example



New Industry Standard

- HP leadership in standards
 - HP founding member of SAS consortium
 - Enable ubiquitous drive technology
 - Reduced cost & data center complexity
 - Evolutionary Change – Not Revolutionary
- SCSI Trade Association (STA) & T10
 - Organization formalizing SCSI industry strategy
 - Guided development of pSCSI for more than 15 years
 - Storage providers, drive manufactures, and component/infrastructure companies, etc.
 - Unilaterally adopted SAS as next standard
- SAS Uses Best of pSCSI, FC, & SATA
 - Command Set from pSCSI reduces SW stack porting



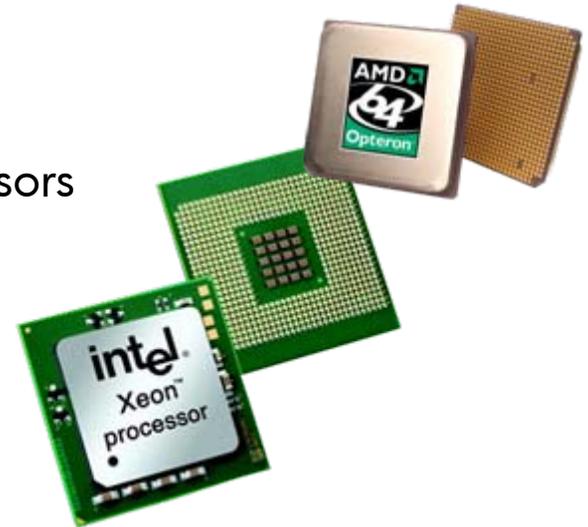
www.scsita.org



Industry Moves to Higher Performance

Small Form Factor SAS is Better for...

- Dual Core Processors
 - Balanced Architecture with new Dual core processors
- Virtualization deploying in production
 - SAS boosts utilization rates
 - Eliminate Storage Bottleneck
- Applications becoming bandwidth intensive
 - Mixed Media needs more than just CPU speed
 - HP: PCI-Express, Fully Buffered DMMs, Multi-Function NICS
- Ideal Storage Solution for HP BladeSystems
- Cost Optimizing Data Centers
 - Firms reducing IT expenses while increasing performance
 - SAS helps lower total cost of IT ownership: 1 design fits all
 - HP's volume leadership creates attractive price point
 - Easier to adopt new technology



HP SFF SAS Advantage

Small Form Factor = New Universal Drive

70% smaller package and half the power draw of 3.5" U320 SCSI

Investment protection

- Small Form Factor (SFF) SAS is the new universal drive
- Smart Array Advantage: ACU, RAID6, Storage Migration
- Transition from 3gb to 12gb SAS Links vs U160 to U320 to U640



Higher reliability

- SAS = 1.75 million MTBF (100% max workload) (Best, Better, Good)
- SCSI = 1.5 million MTBF (100% max workload)
- SATA= 0.5 million hours MTBF (50% max workload)

Better performance

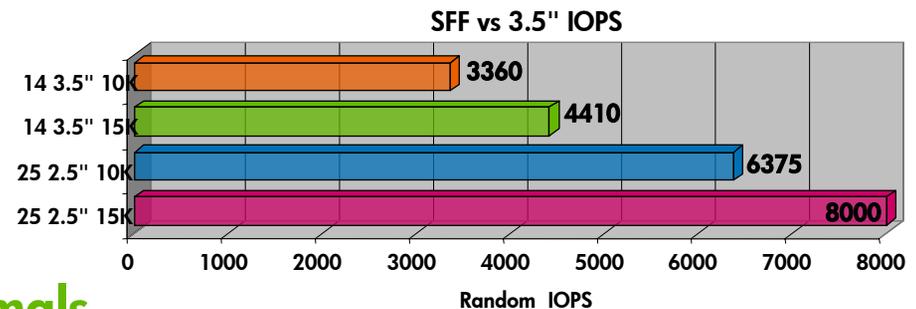
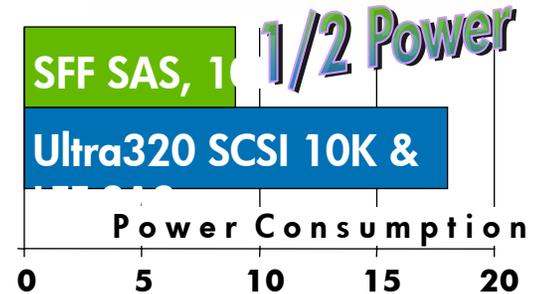
- Serial point-to-point connections
- SAS10K rpm, 3Gb/s transfer rates
- SATA5400 rpm, 1.5Gb/s transfer rates
- More drives per platform = better performance

Flexible configurations

- Mix and match SAS and SATA drives
 - one design fits all, reducing cost
- Enabling New Usage Models

Greater efficiency / improved thermals

- Half the power consumption of 3.5" drives
- Smaller form factor enables better airflow



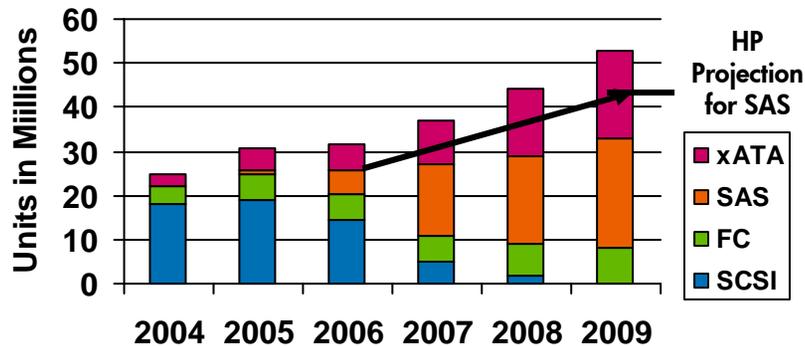
Customer SFF SAS Benefits

- Business Case for SFF SAS Drives
 - SFF Increases Density
 - Customers scale & expand in same space
 - Ideal form factor for BladeSystem Deployment
 - SFF Disk Drives Consume Half the Power
 - Customers save on volatile energy costs
 - IT Growth without pulling in extra power drops
 - Lower heat loads & air-conditioning costs
 - Higher Performance at Lower Prices
 - Future capital expenses minimized
 - Lower TCO through common infrastructure
 - Greater Investment Protection
 - Raid 5 or 6 on an HP 1U server
 - Improved Hard Disk Drive Reliability
 - Universal SFF Drive Carrier
 - Faster Rebuild Times

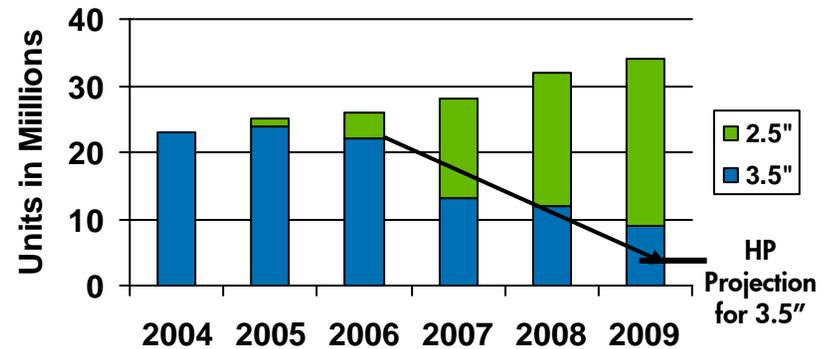


HP Catalyst for Industry Transition to SFF SAS

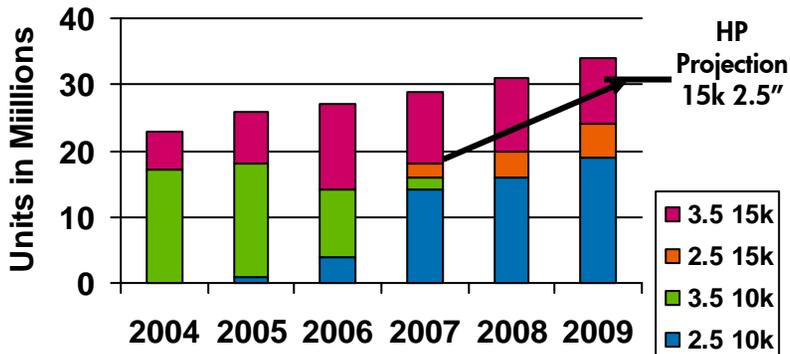
Enterprise HDD by Interface



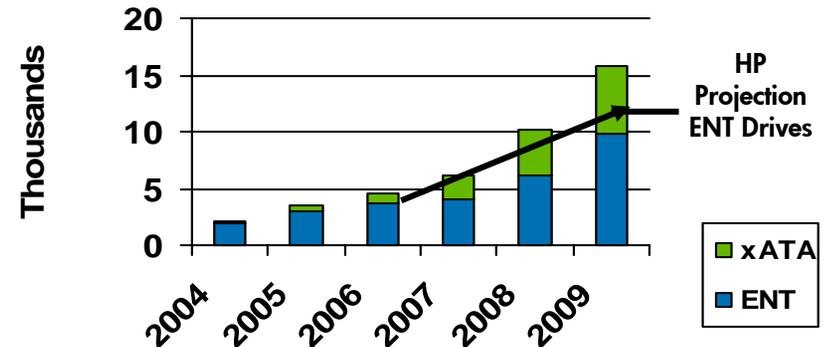
Enterprise HDD Form Factor



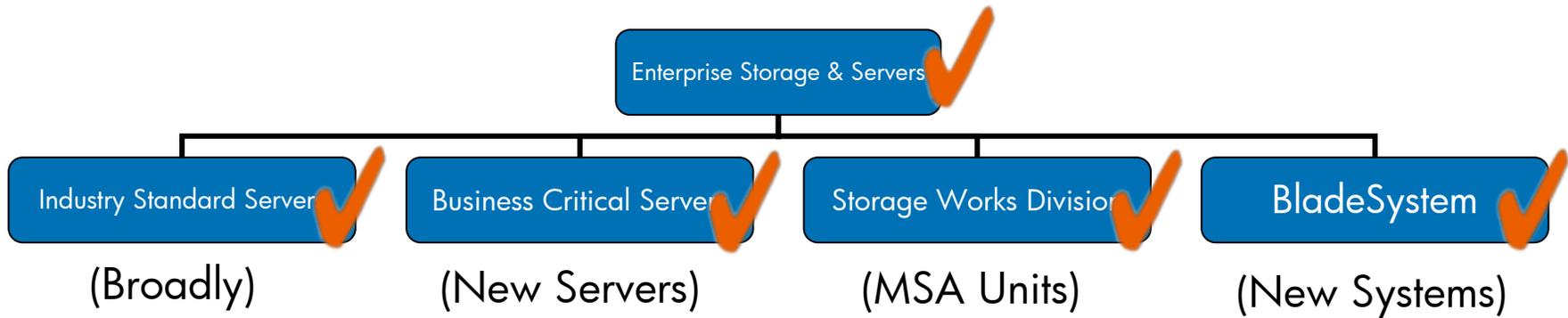
Enterprise HDD RPM



Enterprise Petabyte Shipments



HP's SFF SAS Approach & Strategy



- Enterprise Storage & Server Strategy (ESS)
 - **Simplifying** technology transitions in the year ahead
 - Simple transition to SAS provides customers with greater storage performance & reliability
 - Extends Universal Drive Strategy across ESS
- Industry Standard Servers (ISS)
 - **Simplifying** Technology Transitions in 2006
 - SFF SAS Transition
 - Simple One Step Transition Across the Enterprise
 - Data Center Innovations in Power & Cooling
 - Rising Cost of Energy for Customers
 - SFF Drives consume half the power of 3.5" drives



SFF its about Spindles, performance and lower costs



Large Form Factor

1U/2P

2 15k 146GB LFF SAS
Total Storage: 292GB
Usable w/Raid: 146GB (No RAID 5)
Cost/Usable GB: \$9.71 (drives only)
\$/IOPS: \$1418/630 = \$2.25
\$/IOPS/GB = 0.7 cent

Small Form Factor



DL360

6 10k 72GB SFF SAS
Total Storage: 432GB
Usable w/Raid 5: 360GB
Cost/Usable: \$6.00 (drives only)
\$/IOPS: \$2154/1530 = \$1.41
\$/IOPS/GB = 0.3 cents

2U/2P

6 15k 146GB LFF SAS
Total Storage: 876GB
Usable w/Raid 5: 730GB
Cost/GB: \$4.86 (drives only)
Cost/Usable GB: \$5.83
\$/IOPS/GB = 0.3 cents



DL380

8 10k 146GB SFF SAS Drives in 2U
Total Storage: 1168GB
Usable w/Raid 5: 1022GB
Cost/GB: \$3.08 (drives only)
Cost/Usable GB: \$3.52
\$/IOPS/GB: 0.15 cents

146GB SFF SAS Drives Available September 2006

Change the Game: Multi-Core +Balanced Architecture + SFF Storage



SFF storage with Raid 5 & HP ADG to 1U servers... New mail and collaborative server platform

The Performance to move the DL360 into the core of data center applications

Full feature High availability and redundancy with enterprise management and server security

Over Twice the Usable Storage with HP Raid 5 than a Dell 1U Server with two 146GB drives



A new paradigm for compute density

Where 3.5" SAS & SATA Makes Sense



- External Storage Capacity
- Entry Level Server Platforms
- 15K rpm sweet spot for SAS
 - 3.5" 10k drives E.O.L. soon
 - No future development on SAS or pSCSI 10k drives
 - Only 1 Drive Supplier producing 10k 3.5" SAS - snowflake



TOWER SERVER ML150



HP 2U SAS or SATA

Customer Success: Starz Encore

Entertainment Firm transforms IT management with HP



Challenges	Solution	Results
<ul style="list-style-type: none"> • Improve performance for accessing video data. • Meet business goals while lowering IT costs • Reduce Data Center Power Consumption • Achieve efficient cooling of data center equipment. 	<ul style="list-style-type: none"> • Deployed ProLiant DL385 servers with small 2.5" SAS drives. • Moved away from parallel SCSI shared bus technology to Serial Attached SCSI (SAS) architecture.  <p>ProLiant DL385 SFF SAS</p>	<ul style="list-style-type: none"> • Increased speed moving videos from disk drives through servers. • Faster and more streamlined video production. • Reduced power consumption results in less energy cost to customer • Better data protection and greater reliability. • Streamlined database performance • E-Week Article http://www.eweek.com/article2/0,1895,1913519,00.asp

Key Take-Away Messages

- Customers value the performance, scalability and density of SFF SAS
- New way of thinking: \$/IOPS instead of \$/GB
- HP is Leading:
 - Providing a simple, one-step migration to SFF
 - ProLiant is priced for volume
 - Customers & HP Sales Force validating our approach
 - 8th Generation Smart Array



Sales Support Information

- All HP External SAS Data
 - <http://www.hp.com/go/serial>
- Customer Testimonials
 - <http://h18004.www1.hp.com/products/servers/proliantstorage/serial/sas/endorsements.html>
- Videos
 - <http://h18004.www1.hp.com/products/servers/proliantstorage/serial/resources.html#tv>
- Presentations & White Papers
 - <http://h18004.www1.hp.com/products/servers/proliantstorage/serial/resources.html#present>

Questions & Answers

www.hp.com/go/serial

For more information please contact
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SAS + SATA + SFF = 1 transition !!!

- Take full advantage of Small Form Factor
 - At 72GB spot: over twice the capacity with SFF SAS
 - 18% more storage with 72GB SFF SAS over 146GB U320
 - 1/2 Power of 3.5" (9W versus 18W)
 - Lower Thermals (heat load)
 - More Spindles – faster drive re-build
- Minimize transition impact
 - Migrate to SFF & SAS in 1 Step

U: unit rack height
1U = 1.75"

Anticipated Drive Pricing from HP in 4th calendar quarter 2006. Does not include server or MSA costs. Future Drive Pricing subject to change without notice.

HP pSCSI

HP SAS SFF



170 3.5" spindles



2.5" spindles doubling the number of drives to 406 vs 170

Near Price Parity per GB but 18% more Storage Capacity with SFF

ProLiant: a well-balanced system architecture



Exclusive

Exclusive



Systems Insight Manager

ProLiant Essentials

Exclusive



Exclusive



Power + Cooling innovations

Exclusive

Smart Array



FB-DIMM

Universal Drives + SFF



Multifunction NICs

TCP/IP offload • iSCSI • RDMA



Unprecedented Performance and Technology Improvements