



SAS Benefits

Industry Standard Server Division
2006

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Agenda

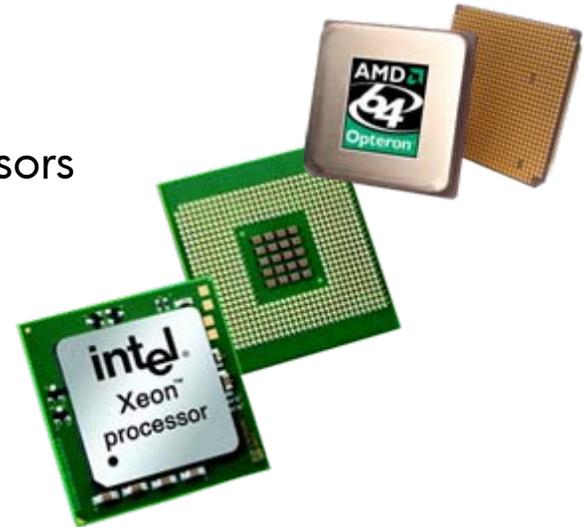
- Industry Wide Transition
 - Drivers
 - Customer benefits
- Expected Transition
- SATA vs SAS Position
- Performance Benefits
- HP Value
 - Unique approach
 - Customer example



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 = Very Best Reliability (100% max workload)
- SCSI = Good Reliability (100% max workload)
- SATA= Adequate Reliability (50% max workload)

Better performance

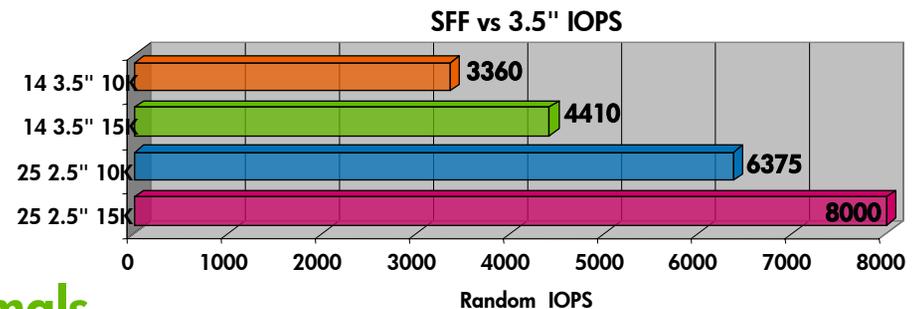
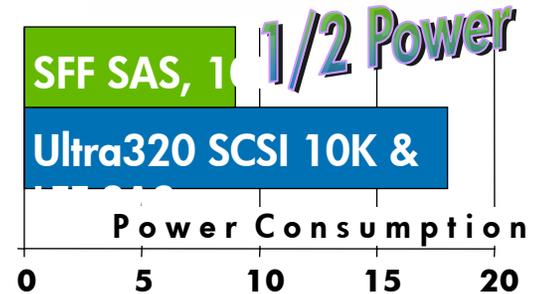
- Serial point-to-point connections
- SAS10K rpm, 3Gb/s transfer rates
- SATA5400 rpm, 1.5Gb/s transfer rates
- More drives per platform = better performance

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



Small Form Factor Serial SCSI (SAS) is the Best Choice for Servers

	Ultra320 SCSI	Large Form Factor Serial Attached SCSI	Small Form Factor Serial Attached SCSI
Reliability	 24/7 duty cycle	 24/7 duty cycle	 Very Highest MTBF Best AFR 24/7 duty cycle
Performance	 Parallel: Shared Bus BW... Limited by Bus Architecture Max bandwidth 320MB	 Point to Point Limited spindles/system. Performance limited by total HDD	 15%-20% higher IOs/S Point to Point More Spindles / System Faster rebuild times.
Power	 18 Watts/disk drive	 18Watts/disk drive	 9 Watts/disk drive
Usable Storage Density Solutions	 DL360w/300GB drives 1U w/ RAID 0 = 300GB usable storage	 DL360 w/300GB drives 1U w/ RAID 0 = 300GB usable storage	 6 Bay in DL360 (1U w/RAID 5 = 730GB Usable) 8 Bay in DL380 16 Bays in ML370



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



- The performance to move ultra dense dual socket systems into the core of data center applications and virtualization
- Smart Array with RAID 5 & 6... more usable storage and higher reliability RAID
- Twice the usable storage in ProLiant DL360 than other 1U servers with large form factor drives
- Full feature high availability and redundancy with enterprise management and server security

A new paradigm for compute density



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



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

DL360

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



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

DL380

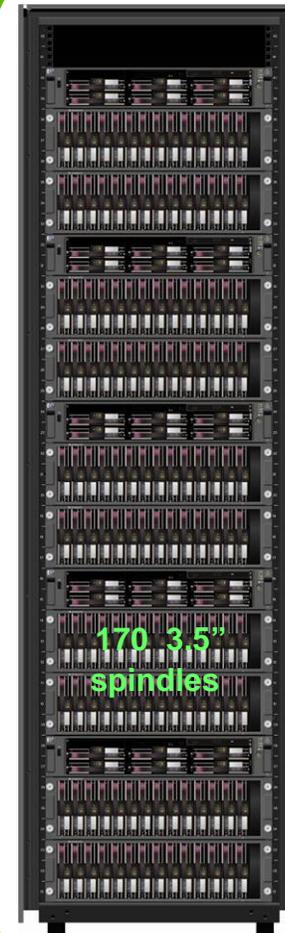
146GB SFF SAS Drives Available September 2006

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
 - ½ 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

42U

HP pSCSI



HP SAS SFF



U: unit rack height
1U = 1.75"

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

Drive usage summary

	SATA	SAS
Drive Strengths	Capacity	Reliability
	Lowest cost per GB	Best price for performance
Applications	Reference data Sensitivity to Environmental Vibration	Transactional data Performance for Rigorous Environments
	Non-mission critical applications (near-line storage, data tubs)	Mission critical applications (on-line transactions, banking)
	Entry level servers and bulk storage	Main stream servers and storage
Reliability	Desktop class architecture	Enterprise class architecture
	8 to 10 hours, 5 days a week 50% Duty Cycle	24x7x365 100% duty cycle
Warranty	1-year warranty	3-year warranty

SAS SFF vs U320 Drives

	U320 pSCSI Drives	SAS SFF Drives
Investment Protection	Yes, through universal carrier	Yes through universal carrier and Physical to Proliant management
IOPS Performance	240 IOPS/Drive on 10k 315 IOPS/Drive on 15k	255 IOPS/Drive on 10k 320 IOPS/Drive on 15k
Capacities	36GB to 300GB available	36 & 72GB currently with 146GB in September 2006
Form Factor	3.5" form factor, which limits #drives in servers	2.5" Form Factor, which increases #drives in servers
Rotational Speed	10k and 15k currently available	Currently 10k with 15k in January 2007
List Price Structure	Flattened price on 10k and fewer reductions on 15k	Aggressive price reductions to achieve parity with U320
Raid 5 & 6 Capability	Only on 2U DL servers with 4 drives or more	Now on 1U DL 360Server
Mixing SATA & SAS	No	Yes, in a SAS carrier

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. <div data-bbox="702 1053 1254 1139" data-label="Image">  </div> <p data-bbox="788 1148 1169 1186">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



Questions & Answers

www.hp.com/go/serial

