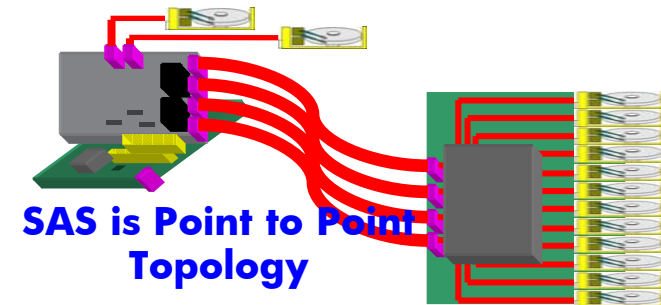# Serial Attached SCSI (SAS):
Value Proposition

Industry Standard Servers, HP
August 7, 2006

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
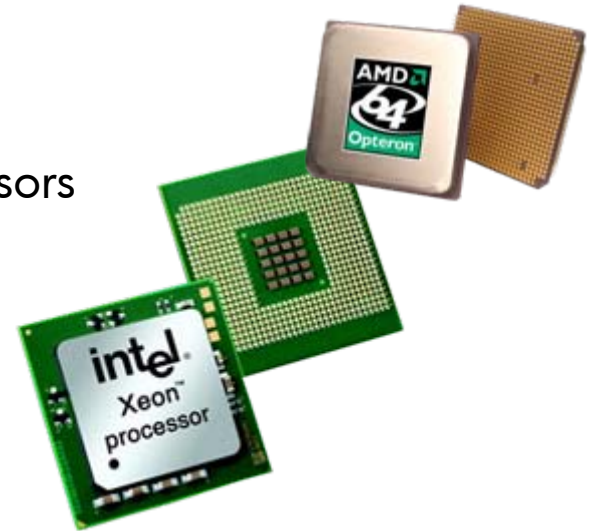 - Command Set from pSCSI reduces SW stack porting

SAS is Point to Point Topology

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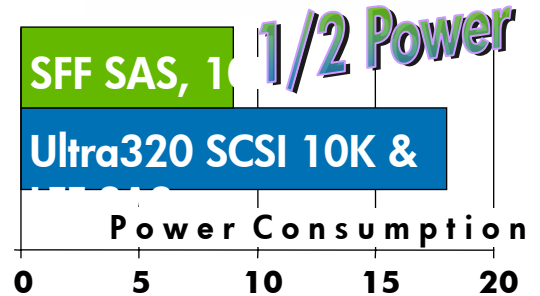### 70% smaller package and half the power draw of 3.5" U320 SCSI

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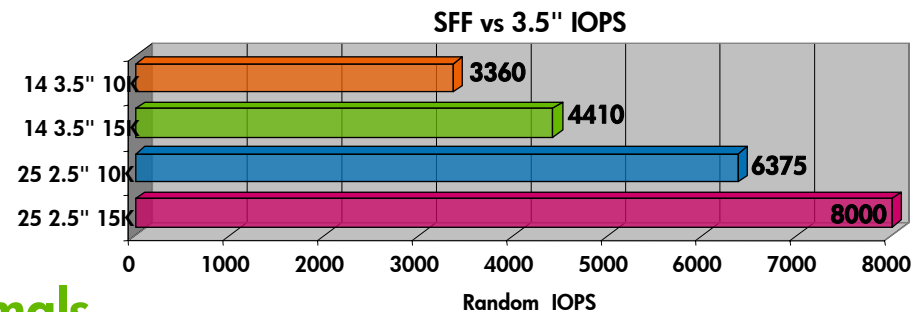
Better performance
- Serial point-to-point connections
- SAS10K rpm, 3Gb/s transfer rates
- SATA5400 rpm, 1.5Gb/s transfer rates
- More drives per platform = better performance

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

1/2 Power

SFF SAS, 1...

Ultra320 SCSI 10K &

P o w e r C o n s u m p t i o n

| 0 | 5 | 10 | 15 | 20 |

SFF vs 3.5" IOPS

14 3.5" 10K	3360
14 3.5" 15K	4410
25 2.5" 10K	6375
25 2.5" 15K	8000

| 0 | 1000 | 2000 | 3000 | 4000 | 5000 | 6000 | 7000 | 8000 |

Random IOPS

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

U: unit rack height
1U = 1.75"

HP pSCSI   **HP SAS SFF**

42U

170 3.5" spindles

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

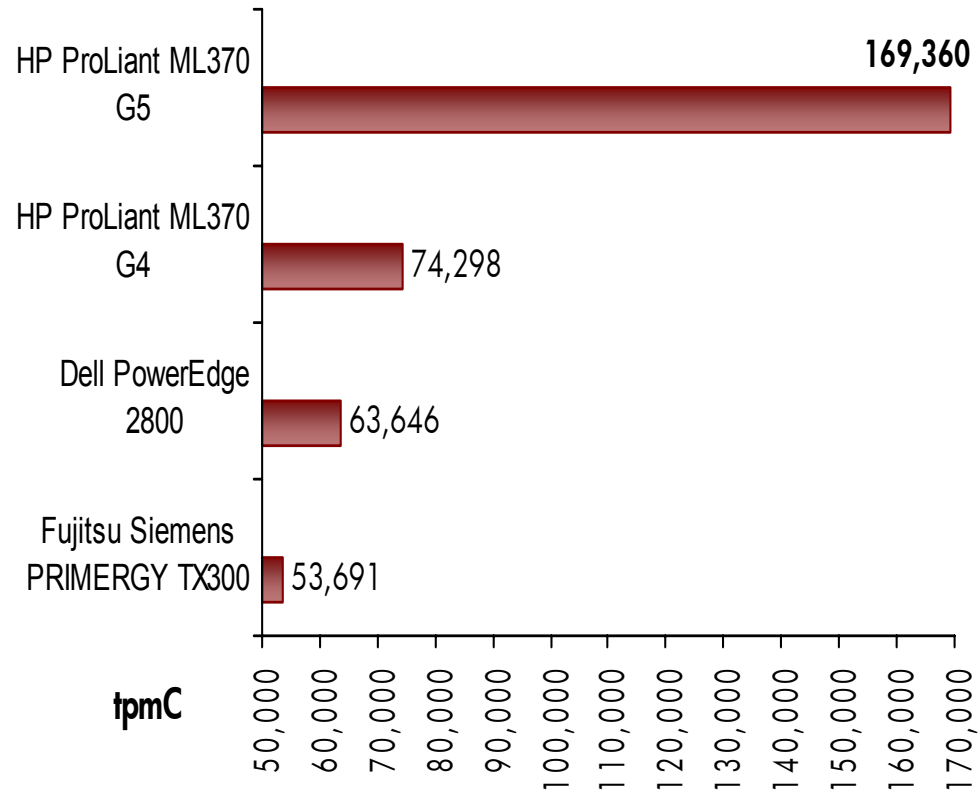# HP ProLiant ML370 G5 SAS is #1 2P x86 server on TPC-C benchmark

The HP ProLiant ML370 G5 has achieved the following results on the TPC-C benchmark:

- **#1 2P x86 result**
- **#1 2P Microsoft SQL Server result**
- ***More than double the scalability compared to G4***

HP ProLiant ML370 G4 #1 2P x86 Performance

Server	tpmC
HP ProLiant ML370 G5	169,360
HP ProLiant ML370 G4	74,298
Dell PowerEdge 2800	63,646
Fujitsu Siemens PRIMERGY TX300	53,691

tpmC (axis: 50,000 – 170,000)

•In the TPC-C benchmark, Spec. Rev. 5.7, the server achieved 169,360 tpmC @ $2.93 USD/tpmC. This result is the first achieved in the industry with all SAS drives. Also contributing to the blazing performance were seven of the **new** HP Smart Array P800 SAS controllers, one HP Smart Array P600/512 MB controller, and 50 HP MSA 60 StorageWorks Enclosures.

SFF its about Spindles, performance and lower costs

Large Form Factor

Small 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

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

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 paridigm 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
• 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.	• Deployed ProLiant DL385 servers with small 2.5" SAS drives. • Moved away from parallel SCSI shared bus technology to Serial Attached SCSI (SAS) architecture. **ProLiant DL385 SFF SAS**	• 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

http://customer.corp.hp.com/admin/materials/107237_Advance%20SWD20050526c.pdf

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

For more information please contact
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