

**TEST CENTER EXCLUSIVES**  
EMC's Virtual Storage Platform  
and Data Domain's Backup p26

**Learning From Real-Life  
Security Disasters** p36

**JON UDELL**  
When Geeks Tell  
Good Stories p34



# InfoWorld

May 16, 2005 ■ Issue 20

GET TECHNOLOGY RIGHT®



*Seagate's  
2.5-inch  
Savvio SAS  
hard disk*

**THE  
NEXT  
SMALL  
THING**

Coming to a rack near you:  
Serial attached SCSI and  
2.5-inch enterprise drives.  
Faster, more flexible storage  
is just a spin away p44

 [INFOWORLD.COM](http://infoworld.com)

 **CLICK HERE**

For a Free Subscription

Serial-attached SCSI delivers more flexible storage options for the enterprise, while new 2.5-inch models promise better performance and reduced power needs

**T**HAT OLD STANDBY STORAGE standard, SCSI, is about to get a makeover. Two technology shifts, occurring in parallel and arriving this year, will change the kinds of disk drives enterprises use up and down their storage systems.

One transformation several years in the making is the move to a new interface — SAS (serial attached SCSI) — which provides faster, more flexible, and more reliable connections to drives. The new spec also permits the same drive enclosure to support SAS devices and lower-cost SATA drives.

At the same time, in part due to the advent of the smaller SAS interface, 2.5-inch enterprise-class drives will start to replace tried-and-true 3.5-inch models. In the long haul this will mean that datacenters will accommodate more storage without eating up more floor space. Smaller drives will also reduce power

usage, speed data access, and increase the overall capacity of drive arrays.

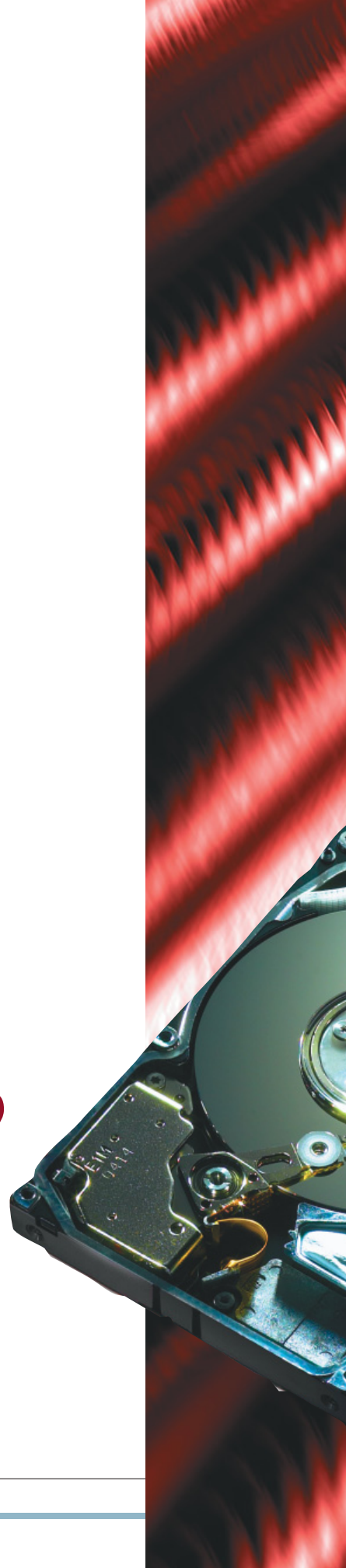
At first the changes will be invisible, with new servers coming midyear with internal SAS drives instead of the traditional parallel SCSI ones. Lower-end drive arrays will start using SAS drives as well toward the end of the year. “SAS is now being qualified by the major OEMs,” notes John Monroe, an analyst at Gartner. By 2008 to 2010 (estimates vary), all SCSI drives will be SAS drives.

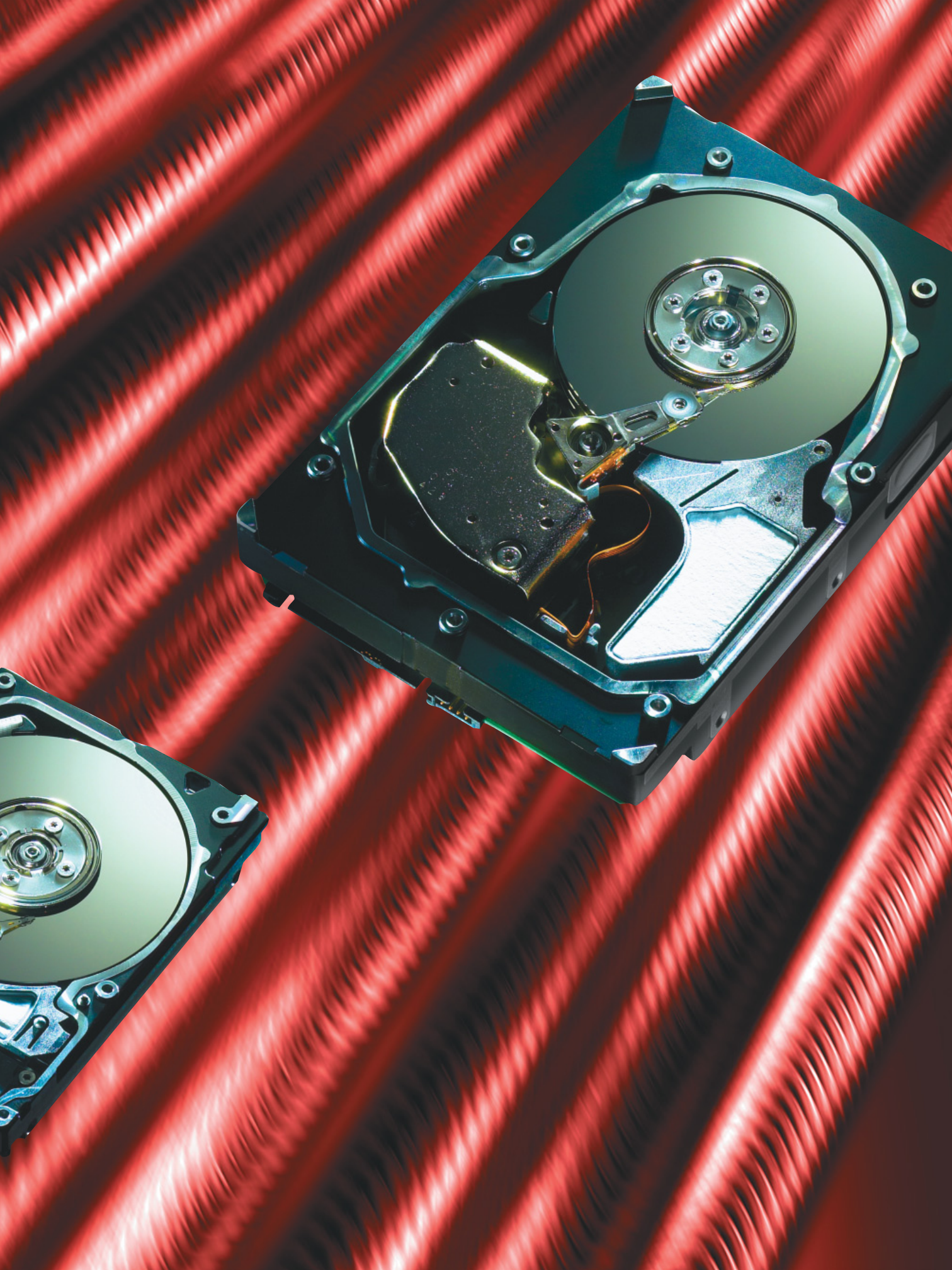
“What IT will see is the continued trend of better capacity and performance at lower prices,” says Greg Hartzog, head of storage infrastructure at consultancy Optimus Solutions.

Although SCSI technology is changing under the hood, enterprises don’t have to worry about reworking their storage infrastructure to prepare for or manage the change. Because the drives use the same command set as previous SCSI

# The New SCSI: *Better, Faster, Smaller*

BY GALEN GRUMAN | PHOTOGRAPHY BY MARK JOHANN





**SAS: SCSI to the Max** Of the four enterprise drive interface technologies, SAS is second only to Fibre Channel in performance, and it supports many more drives.

	SAS	Parallel SCSI	SATA	Fibre Channel
Maximum addressable drives	4,032	15	1	127
Maximum current throughput	3Gbps	3Gbps	1.5Gbps	4Gbps
Maximum planned throughput	12Gbps	3Gbps	1.5Gbps	16Gbps
Maximum cable length	8m (per hop)	12m	1m	10km

SOURCE: SCSI TRADE ASSOCIATION

drives, there's no change needed to the enterprise's storage architecture, as the SCSI command set and external interfaces remain unchanged. Also unchanged are the drives' head assemblies, the parts that store and read the data, notes Jay Krone, director of Clariion product marketing at EMC.

"There's not much that IT has to do," adds Franco Castaldini, enterprise storage product manager at Seagate Technologies. "They don't have to rip out their middleware or their storage management."

Older parallel SCSI drives are incompatible with SAS, so enterprises will have both sorts of SCSI devices in their DAS and SANs until the older devices are retired years from now. But that just means maintaining two types of replacement drives in case of failures and perhaps rearranging arrays to minimize having multiple cabinets, some of each type, in the same location, EMC's Krone says.

### A Smaller, More Flexible Interface

The move to SAS dramatically changes the connection between a drive and the backplane — whether the drive connector on a server's motherboard or the host bus adapter within a drive array cabinet. The new connection is almost identical to the now-familiar SATA connector, and that's intentional. SAS controllers work with both SAS and SATA drives because the cables are both physically and electrically the same. This will allow vendors to use the same power supplies, cases, and backplanes in all their products, reducing manufacturing costs and thus lowering prices to the enterprise, Optimus' Hartzog says.

"We'll have very high volumes [of SAS drives] because they will be used

in both servers and arrays, so they'll be cheaper," says Craig Butler, disk storage product marketing manager at IBM.

In addition to the reduction in manufacturing costs that standardizing the enclosures brings, the dual support for SAS and SATA drives by the SAS interface means enterprises can mix both types of drives in the same enclosure. That could help consolidate storage in one physical structure while supporting the typical functional split between the drives: using SAS for high-performance, high-transaction applications and SATA for low-performance, long-read appli-

cations such as archiving and streaming media.

But mixing the two drives together could cause problems if the drive enclosures aren't designed for it, notes Harry Mason, president of

the SCSI Trade Association and director of industry marketing at chip-set maker LSI Logic. Due to their distinct disk rotations, SAS and SATA drives vibrate differently, causing the cabinet to shake. If they don't want the box walking across the floor, storage administrators who want to mix the two drive types in the same cabinet must ensure that the enclosure vendor has designed the cabinet to quell such vibrations.

In addition, some interfaces will be dual-use, whereas others will not. To prevent someone from plugging in an SAS drive to a SATA-only connector, appli-

## High-End Backup for Less

SCSI IS USED IN TAPE DRIVES, NOT JUST DISK DRIVES, BUT THERE'S BEEN LITTLE public attention paid to how SAS would be deployed in tape libraries. Seagate's Franco Castaldini notes that no tape vendors have yet attended the SCSI Trade Association's "plugfests," where vendors test SAS products, for example.

Optimus Solutions consultant Greg Hartzog believes that SAS could be a great benefit to tape libraries because of the increased cable length and the smaller, more flexible cable size. He says his customers like the idea of external but direct attached tape libraries for departmental and other local backup. LSI Logic's Harry Mason agrees, saying that tape libraries have not fit well in most enterprises outside of FC (Fibre Channel) connections because tape libraries don't typically connect to a backplane as disk drives do but instead connect via cables.

But FC tape-drive adapters cost about \$1,000, Hartzog notes, making IT think twice before deploying them. "SAS tape should easily compete on price," he says.

Mason says he's seen "a lot of interest from the tape providers in SAS designs." One reason is that the SCSI protocols have "always been a fairly good portal to the robotics of the tape drive," says Kevin Schoonover, director of engineering at distributor Arrow Enterprise Storage. With its SCSI basis and better cabling option, tape providers can now consider SAS instead of the pricier FC, gaining the benefits of a cabled connection without having to migrate to a different command set, Schoonover says. — G.G.

the SAS cables have a plastic bump that prevents them from being inserted into anything but an SAS connector. SATA cables fit in both SATA and SAS connectors.

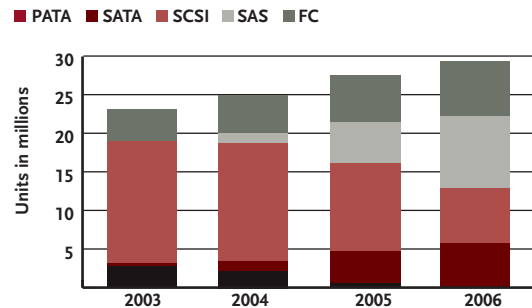
According to IBM's Butler, the SAS interface's support for both SATA and SAS drives "will make it easier to do tiered storage." A common interface means that enterprises can easily configure some drives for backup and archiving using SATA drives and others for transactional access using SAS drives, all with the same array cabinets and racks. The common interface will also make it cheaper for vendors to offer "cost-effective products up and down the line," he says, encouraging the use of tiered storage.

A less obvious benefit from SAS is that SCSI goes from being a parallel technology to a serial one. Current SCSI interfaces allow a maximum of 15 drives per cable, but the cables don't have the bandwidth to simultaneously support that many drives in real-world environments. The move to SAS increases the addressable number of connections per port — without using expanders — to 4,032, compared with 127 for FC (Fibre Channel).

Because the connection to each drive is serial, there is no bandwidth sharing to prevent storage systems from using all those connections. SAS's serial nature also means that a failure of one drive cannot affect other drives. (The possibility of failure is one reason that SCSI has been such a highly reliable technology: The parallel architecture increased the impact of any one drive's failure.) In the past, the parallel approach was used because more data could be moved

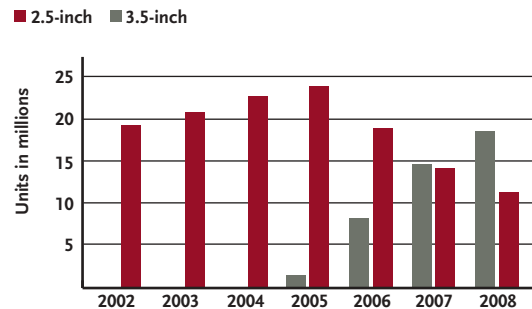
## Spike in SAS Demand?

Seagate projects that by the end of next year, more SAS drives will be sold into enterprises than any other drive type.



## Rise of the Shrinking Drive

By 2008, Seagate expects to sell more 2.5-inch SCSI, Fibre Channel and SAS drives to enterprises than 3.5-inch models.



simultaneously per connection. But today's serial technology — and the controllers to manage all the individual connections — have progressed to the point where serial is the preferred approach, as exemplified by FireWire, USB, FC, and Ethernet connections.

SAS also promises to break SCSI's performance barrier, with a current transfer rate of 3Gbps. "You can't drive parallel [technology] to any greater transfer rates. We're at the end of the bucket," Gartner's Monroe says. Initial SAS devices will also run at 300Mbps, and transfer rates should double to 6Gbps by 2008 and to 12Gbps by 2010, according to the SCSI Trade Association.

SAS also adds support for dual ports, which provide two connections to one drive for fail-over reliability, as well as for redundant RAID controllers — just as FC does.

The result of the greater device support and the faster transfer speeds will be larger clusters of drives in arrays with very high storage capacities and high performance. That should help SAS displace FC in all but the highest-performance storage tier, where FC's higher cost will be worth the better performance, IBM's Butler says.

SAS also has a use in near-line storage, according to LSI Logic's Mason. IT can aggregate several SAS devices — arrays or external drives — via direct SAS-to-SAS connections without having to put in a local SAN or share that network with other traffic, he says. Mason expects some enterprises to use SAS to create these near-line storage loops as an adjunct to, rather than replacement for, SANs. Similarly, IBM's Butler expects SAS to be used

for two-node external storage clusters.

Still, vendors expect SAS to make its first mark in servers, which now rely on SCSI drives because of their high performance and reliability. SAS extends that performance and reliability while allowing vendors to use the same chip sets and connectors for their servers as they do for their PCs, reducing costs. The drives will become standard on servers by 2006, IBM's Butler notes. But because many enterprises have recently replaced their servers, SAS-based servers won't be deployed in large numbers until "the next refresh," Gartner's Monroe says.

### Minidrives: Two Transition Paths

Servers will also take advantage of the second SCSI trend: the move to smaller, enterprise-class drives. The 2.5-inch drives take less power and generate less

## Coming to a Server Near You Most major storage vendors are now working on SAS devices. The following eight vendors account for 75 percent of the enterprise storage market.

heat, and their performance — access and seek times — is better than that of 3.5-inch drives because there is less distance for the drive heads to travel. That makes them perfect for transaction-intensive applications.

The small size provides another advantage. According to LSI Logic's Mason, 2.5-inch SAS drives mean blade servers will be capable of using reliable, high-performance SCSI technology rather than the 2.5-inch ATA drives — designed for notebooks — they've had to use in the past.

"We know we'll put 2.5-inch drives in a server or blade where there's less physical capacity," IBM's Butler agrees.

For drive arrays, Optimus' Hartzog expects midtier arrays to adopt 2.5-inch SAS drives first. Most midtier arrays hold 14 drives in a 19-inch rack, he notes, but could hold 30 drives if they switch to the 2.5-inch size. "You can add more spindles," Hartzog says.

"SAS will really capitalize on the move to 2.5-inch and outstrip the other technologies," LSI Logic's Mason says. "The small form factor is a fairly big deal."

STORAGE VENDOR	PLANS
<b>Adaptec</b>	Currently shipping several SAS controller chips and cards
<b>Fujitsu Computer Products</b>	Has begun shipping to OEMs the MAV series of 2.5-inch SAS drives
<b>Hewlett-Packard</b>	Will add SAS in the next year to all its products in the HP BladeSystem, Integrity, ProLiant, and StorageWorks lines
<b>Hitachi</b>	Expects to ship SAS drives to OEMs later this year
<b>IBM</b>	IBM's xSeries 366 Server uses Adaptec SAS cards to provide SAS connectivity
<b>Maxtor</b>	Says it will ship SAS drives to OEMs later this year
<b>Seagate Technologies</b>	Has begun shipping to OEMs the SAS-enabled Cheetah 15K.4 and Savvio 10K.1 drives
<b>Vitesse</b>	Offers the NexSAS line of expanders

SOURCE: GARTNER

Although 2.5-inch SAS drives help vendors deliver smaller drive arrays or increase the total capacity in the same cabinet space, Seagate's Castaldini says the 3.5-inch drive will remain in use for many years. That's because SATA drives don't have an enterprise-class 2.5-inch version, so to gain the benefit of mix-and-match enclosures, vendors will stick with the drives of the same size. Another reason is that the price of 2.5-inch SATA drives won't be as low as for 3.5-inch versions on a per-gigabyte basis for some time. "It's not clear what

the cost per gigabyte is compared to 3.5-inch drives," IBM's Butler says, noting they will need to achieve price parity to gain broad adoption.

Nonetheless, change in the normally staid world of hard drives is in the air. Despite regular predictions of its demise, the hard drive has soldiered on, with storage density enhancements exceeding the transistor density increases postulated by Moore's Law. Soon the enterprise SCSI drive will take another leap forward — this time in convenience, reliability, and lower cost of operation. ☛

## Where Does iSCSI Fit In?

JUST AS STORAGE VENDORS START TO SELL SAS AND 2.5-INCH drives, they're also pitching iSCSI. But iSCSI isn't really a form of SCSI, nor does it have any real relationship with the SCSI technology evolution.

iSCSI is actually an external interface to connect storage systems, similar to FC (Fibre Channel) or Infiniband. An iSCSI connection uses the Ethernet as the data transport and packages the storage management commands for delivery via TCP/IP. But an iSCSI connection works equally with ATA, SCSI, and FC storage systems. (FC is both an external connection technology and a specific drive technology, but similar to iSCSI, it connects any type of drive system.)

That means enterprises should evaluate the merits of iSCSI — essentially a cheaper SAN connection method with slower

performance — separately from those of SAS and 2.5-inch drives. "The primary advantage is lower cost of connectivity," says Jay Krone, director of Clariion product marketing at EMC.

"There's a school of thinking in the low-end server market that iSCSI would be a cheaper way to do [direct-attached] storage," says Harry Mason, director of industry marketing at LSI Logic. But Mason's not convinced. "SAS took all the wind out of iSCSI's sails in that kind of implementation because it gives all the predictability and bandwidth without having to build a new environment." Mason, citing offerings from companies such as LeftHand Networks and EqualLogic, does see iSCSI as an appropriate SAN alternative for low-performance environments such as small businesses and for linking isolated SANs. — G.G.

NEW SUBSCRIBERS ONLY!

Apply online at: <http://subscribe.infoworld.com>

Priority Code: **MT4PDF**

Form: 18

I WISH TO RECEIVE A FREE SUBSCRIPTION TO **InfoWorld**

1. Yes  0. No

SIGNATURE \_\_\_\_\_ DATE \_\_\_\_\_

## A MAILING ADDRESS

Publisher reserves the right to limit the number of complimentary subscriptions. Free subscriptions available in the U.S. (including APO and FPO) and Canada.

NAME \_\_\_\_\_

TITLE \_\_\_\_\_

COMPANY NAME \_\_\_\_\_

DIVISION / DEPT / MAIL STOP \_\_\_\_\_

MAILING ADDRESS \_\_\_\_\_

CITY / STATE / ZIP / POSTAL CODE \_\_\_\_\_

Is the above address a home address?  1. Yes  0. No

BUSINESS PHONE (INCLUDING AREA CODE) \_\_\_\_\_ FAX NO. (INCLUDING AREA CODE) \_\_\_\_\_

E-MAIL ADDRESS \_\_\_\_\_

## B SPECIAL REQUEST:

You may receive a renewal reminder via e-mail. May we send other information about **InfoWorld** products or services via e-mail?  1. Yes  0. No

Reader feedback is important to us. May a member of our editorial team contact you?  1. Yes  0. No

## 1 WHAT IS YOUR ORGANIZATION'S PRIMARY BUSINESS ACTIVITY AT THIS LOCATION? (PLEASE CHECK ONE ONLY):

### General Business Industries

- 01. Defense Contractor / Aerospace
- 02. Retail
- 03. Wholesale / Distribution (non-computer)
- 04. Pharmaceutical / Medical / Dental / Healthcare
- 05. Financial Services / Banking
- 06. Insurance / Real Estate / Legal
- 07. Transportation / Utilities
- 08. Media (print / electronic)
- 09. Communication Carriers (telecomm, data comm., TV / cable)
- 10. Construction / Architecture / Engineering
- 11. Manufacturing & Process Industries (other than computer-related)
- 12. Research / Development

### Technology Providers

- 13. Managed Service Provider / Business Service Provider
- 14. Technology Service Provider (ISP / ASP / MSP, etc.)
- 15. Computer / Network Consultant
- 16. Systems or Network Integrator
- 17. VAR / VAD
- 18. Technology Manufacturer (hardware, software, peripherals, etc.)
- 19. Technology - Related Retailer / Wholesaler / Distributor

### Government / Education

- 20. Government: federal (including military)
- 21. Government: state or local
- 22. Education
- 98. Other \_\_\_\_\_ (Please specify)

## 2 WHAT IS YOUR PRIMARY JOB TITLE? (PLEASE CHECK ONLY ONE):

### IT / Technology Professionals

- 01. Chief Technology Officer (CTO)
- 02. Chief Information Officer (CIO)
- 03. Chief Security Officer (CSO)
- 04. Vice President (including SVP, EVP, etc.)
- 05. Director
- 06. Manager / Supervisor
- 07. Engineer
- 08. Systems Analyst / Programmer / Architect
- 09. Consultant / Integrator
- 10. Developer
- 11. IT Staff
- 12. Other IT Professional \_\_\_\_\_ (Please specify)

### Corporate / Business Management

- 13. CEO, COO, President, Owner
- 14. CFO, Controller, Treasurer
- 15. Vice President (including SVP, EVP, etc.)
- 16. Director
- 17. Manager / Supervisor
- 18. Other Business Management Title \_\_\_\_\_ (Please specify)
- 98. Other Title \_\_\_\_\_ (Please specify)

## 3 PLEASE INDICATE YOUR JOB FUNCTION(S)? (PLEASE CHECK ALL THAT APPLY):

### IT / Technology Functions

- 01. Executive
- 02. Department Management - IT
- 03. Research and Development Management
- 04. Systems / Network Management
- 05. Management of Enterprise Applications (CRM, ERP, SCM, etc.)
- 06. Applications Development
- 07. Consultant / Integrator
- 08. Other IT Department Management \_\_\_\_\_ (Please describe)
- 09. Other IT - Staff \_\_\_\_\_ (Please describe)

### Corporate / Business Functions

- 10. Executive
- 11. Department Management - Business
- 12. Financial / Accounting Management
- 13. Research and Development Management
- 14. Sales / Marketing Management
- 15. Other Department Management
- 16. Other Department Staff \_\_\_\_\_ (Please describe)
- 98. Other \_\_\_\_\_ (Please describe)

## 4 HOW MANY PEOPLE ARE EMPLOYED AT THIS ORGANIZATION, INCLUDING ALL OF ITS BRANCHES, DIVISIONS AND SUBSIDIARIES? (PLEASE CHECK ONE ONLY):

- 01. 20,000 or more
- 02. 10,000 - 19,999
- 03. 5,000 - 9,999
- 04. 1,000 - 4,999
- 05. 500 - 999
- 06. 100 - 499
- 07. 50 - 99
- 08. Less than 49

## 5 OVER THE COURSE OF ONE YEAR, DO YOU BUY, SPECIFY, RECOMMEND, OR APPROVE THE PURCHASE OF THE FOLLOWING PRODUCTS OR SERVICES WORTH:

\* CONSULTANTS: PLEASE INCLUDE WHAT YOU RECOMMEND FOR YOUR CLIENTS AS WELL AS WHAT YOU BUY FOR YOUR OWN BUSINESS, IF APPLICABLE. IF YOU CANNOT DISTINGUISH BETWEEN THIS AND OTHER LOCATIONS, PUT RESPONSE IN THE FIRST COLUMN.

- |                                  |                                |                            |
|----------------------------------|--------------------------------|----------------------------|
| 01. \$100 million or more        | 06. \$5,000,000 to \$9,999,999 | 11. \$100,000 to \$399,999 |
| 02. \$50,000,000 to \$99,999,999 | 07. \$2,500,000 to \$4,999,999 | 12. \$50,000 to \$99,999   |
| 03. \$30,000,000 to \$49,999,999 | 08. \$1,000,000 to \$2,499,999 | 13. Less than \$49,999     |
| 04. \$20,000,000 to \$29,999,999 | 09. \$600,000 to \$999,999     | 14. None                   |
| 05. \$10,000,000 to \$19,999,999 | 10. \$400,000 to \$599,999     |                            |

Product category	For this location: (write code in box)	For other locations: (write code in box)
Large systems	<input type="text"/>	<input type="text"/>
Client computers	<input type="text"/>	<input type="text"/>
Networking / Telecom (including servers)	<input type="text"/>	<input type="text"/>
Internet / Intranet / Extranet	<input type="text"/>	<input type="text"/>
Security	<input type="text"/>	<input type="text"/>
Storage	<input type="text"/>	<input type="text"/>
Peripheral equipment	<input type="text"/>	<input type="text"/>
Software	<input type="text"/>	<input type="text"/>
Service / Support	<input type="text"/>	<input type="text"/>

Please answer the questions on the following page. 

**6 PLEASE TELL US YOUR INVOLVEMENT WITH YOUR COMPANY'S STRATEGIC TECHNOLOGY INITIATIVES (PLEASE CHECK ALL THAT APPLY):**

- 01. Integrate Technology with company goals
- 02. Define Architecture
- 03. Choose Technology Platforms
- 04. Develop Technology Integration Strategy
- 05. Test, pilot, implement emerging technologies
- 06. Scalability Planning
- 07. Build, Run Web Services
- 08. Internet / Network Infrastructure
- 09. Customer Relationship Management
- 10. External Partnership Management
- 11. Budgeting
- 12. Recruitment & Retention
- 13. Other \_\_\_\_\_ (Please describe)
- 99. None of the above

**9 ARE YOU INVOLVED IN BUYING, SPECIFYING, RECOMMENDING OR APPROVING THE FOLLOWING TECHNOLOGY SERVICES? (PLEASE CHECK ALL THAT APPLY):**

- 01. Technology Services
- 02. Systems / Application Integration
- 03. E-Business / Internet / Intranet / Extranet
- 04. Application Development
- 05. Application Hosting (ASP)
- 06. Web Hosting
- 07. Web Development
- 08. Security
- 09. Storage
- 10. Content Delivery Networks
- 11. Disaster Recovery / Business Continuity
- 12. Outsourcing
- 13. Utility Computing Services
- 14. Telecommunications
- 15. Call Center / IT Services
- 16. Consulting
- 17. Other Technology Services

**7 ARE YOU INVOLVED IN BUYING, SPECIFYING, RECOMMENDING OR APPROVING THE FOLLOWING SOFTWARE? (PLEASE CHECK ALL THAT APPLY):**

- 01. Enterprise / E-Business Applications
  - 02. Customer Relationship Management (CRM / eCRM)
  - 03. Enterprise Resource Planning (ERP)
  - 04. Supply Chain / Procurement
  - 05. Business Process Management
  - 06. Business Intelligence / Data Mining
  - 07. Knowledge Management
  - 08. Portals
  - 09. Collaborative Applications / Groupware
  - 10. Project Management
  - 11. Financial / Payroll / Billing
  - 12. E-business / E-commerce
  - 13. Database Management Systems (DBMS)
  - 14. Data Warehouse
  - 15. Manufacturing
  - 16. Asset Management / Software Distribution
  - 17. Performance / Application Management
  - 18. Streaming Media
  - 19. Other Enterprise / E-Business Applications
- 20. Integration Software
  - 21. Web Services
  - 22. Web Services Orchestration
  - 23. Application Servers
  - 24. Enterprise Application Integration (EAI) / Middleware
  - 25. Business Process Management
  - 26. Legacy Application Integration Tools
  - 27. Other Integration Software
- 28. Application Development
  - 29. Application Development Tools
  - 30. Application Servers
  - 31. Web services
  - 32. Java / J2EE
  - 33. XML
  - 34. .NET
  - 35. Testing Tools
  - 36. Other Application Development Software

**10 ARE YOU INVOLVED IN BUYING, SPECIFYING, RECOMMENDING OR APPROVING THE FOLLOWING PRODUCTS OR TECHNOLOGIES? (PLEASE CHECK ALL THAT APPLY):**

- 01. Networking
  - 02. LANs (Local Area Networks)
  - 03. WANs (Wide Area Networks)
  - 04. Switches / Routers / Hubs
  - 05. Caching / Load Balancing
  - 06. Grid / Utility Computing
  - 07. E-mail
  - 08. Instant Messaging / Peer-to-Peer
  - 09. Content Delivery Networks
  - 10. Network and Systems Management
  - 11. Traffic Monitoring and Analysis
  - 12. QoS (Quality of Service)
  - 13. VoIP (Voice over IP)
  - 14. Telecommunications
  - 15. IP Telephony
  - 16. Wireless
  - 17. Remote Access
  - 18. Web / Video Conferencing
  - 19. Other Networking
- 20. Storage
  - 21. High-end / Enterprise Class Storage
  - 22. Network Attached Storage (NAS)
  - 23. Storage Area Networks (SANs)
  - 24. Storage Management Software
  - 25. IP Storage
  - 26. Direct Attached Storage (DAS)
  - 27. Storage Blades
  - 28. Storage Backup (Tape, Disk, Optical, RAID)
  - 29. Removable / Portable Storage
  - 30. Disaster Recovery
  - 31. Other Storage
- 32. Security
  - 33. Anti-Virus / Content Filtering
  - 34. Firewall
  - 35. VPN (Virtual Private Network)
  - 36. Identity Management / Authentication
  - 37. Intrusion Detection
  - 38. Encryption
  - 39. Other Security
- 40. Internet / Intranet / Extranet
  - 41. Web Servers
  - 42. Web Development / Authoring Tools
  - 43. Web Performance Management / Monitoring Software
  - 44. Content Management / Document Management
  - 45. Content Delivery Networks
  - 46. Internet Software
  - 47. Other Internet / Intranet / Extranet

**8 ARE YOU INVOLVED IN BUYING, SPECIFYING, RECOMMENDING OR APPROVING THE FOLLOWING HARDWARE? (PLEASE CHECK ALL THAT APPLY):**

- 01. Hardware
  - 02. Mainframes
  - 03. NT / Windows 2000 / .NET Servers
  - 04. Unix Servers
  - 05. Linux Servers
  - 06. Blade Servers
  - 07. PCs / Workstations
  - 08. Notebooks / Laptops
  - 09. PDAs / Handhelds / Pocket PC / Wireless Devices
  - 10. Other Hardware
- 11. Peripherals
  - 12. Laser Printers
  - 13. Inkjet Printers
  - 14. Monitors
  - 15. Flat Panel Displays
  - 16. UPS (Uninterruptible Power Supply)
  - 17. Network Copiers
  - 18. Other Peripherals

**11 WHICH OF THE FOLLOWING OPERATING SYSTEMS ARE IN USE OR PLANNED FOR USE AT THIS LOCATION? (PLEASE CHECK ALL THAT APPLY):**

- 01. Windows XP
- 02. Windows 2000
- 03. Windows NT
- 04. Windows 95/98
- 05. Windows CE
- 06. Mac OS (Macintosh)
- 07. Solaris
- 08. UNIX
- 09. Linux
- 10. MVS, VMS, ESA
- 11. VM
- 12. OS 400
- 13. Netware
- 14. Palm OS
- 15. Other OS

**Return this form to InfoWorld,  
P.O. Box 3511,  
Northbrook, IL 60065-3511 or  
FAX to (847) 291-4816.  
You can also apply ONLINE at <http://subscribe.infoworld.com>**

