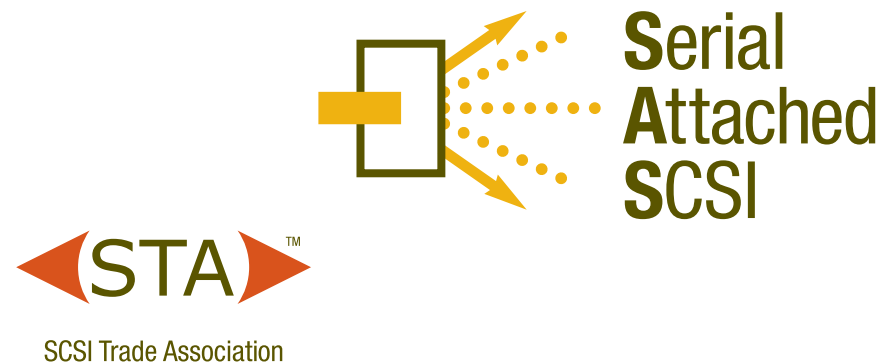


A SCSI Storage I/O Solution  
for the Twenty First Century

# A SCSI Storage I/O Solution for the Twenty First Century



This page intentionally blank!

## What is Serial Technology?

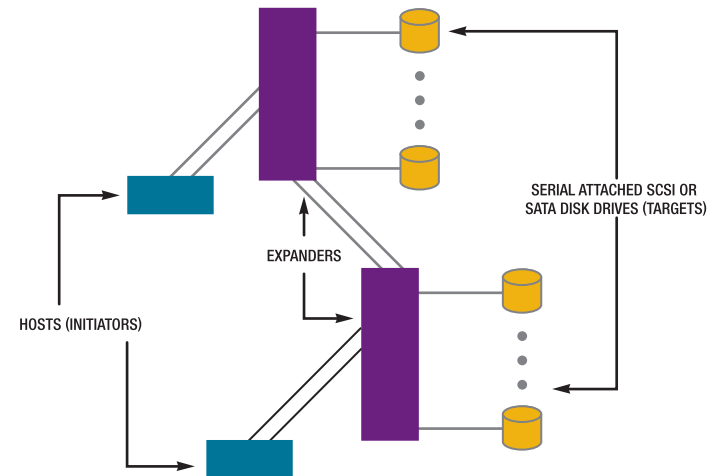
Data travels in time and space between system components—the server and PC, the PC and connected devices, and within the software. Data that is transferred serially moves one bit at a time in linear succession through a fast single path. In contrast, data transferred in parallel mode consists of many data bits moving together simultaneously on a shared pathway.

The primary differentiator between serial and parallel architectures is the clock. In serial technology the clock is embedded in the data. This results in data constantly moving through the system from one point to another using the bandwidth to the fullest extent. A parallel architecture clock moves data at a measured pace, resulting in intermittent periods of inactivity. Data using parallel paths is akin to a vast army marching under the command of one general—it simply can't move as fast. The benefits of serial technology are well understood and are now being used for the most advanced desktop and enterprise applications including USB, 1394, Ethernet and Fibre Channel.

## Advantages of Serial Technology

The advantages of serial technology include scalability to meet end-users needs, more predictable and reliable signaling and smaller form factors. These advantages translate

FIG. 1: SERIAL ATTACHED SCSI SYSTEM DIAGRAM



towards dense server and storage configurations while thinner cabling eases the airflow and cooling characteristics of these smaller systems.

Because serial technologies require fewer signals to be routed, backplane, connector and cable design is simplified. Last, the point-to-point nature of serial interfaces increases system reliability and scalability. In a point-to-point network, each device receives a dedicated connection to the host resulting in an environment where a failed device is unlikely to affect a neighboring device. The isolation of devices in a point-to-point network increases scalability because each device has access to dedicated bandwidth, whereas in a parallel configuration the bandwidth is shared.

FIG. 2: SERIAL ATTACHED SCSI DEVELOPMENT AND INDUSTRY ADOPTION TIMELINE

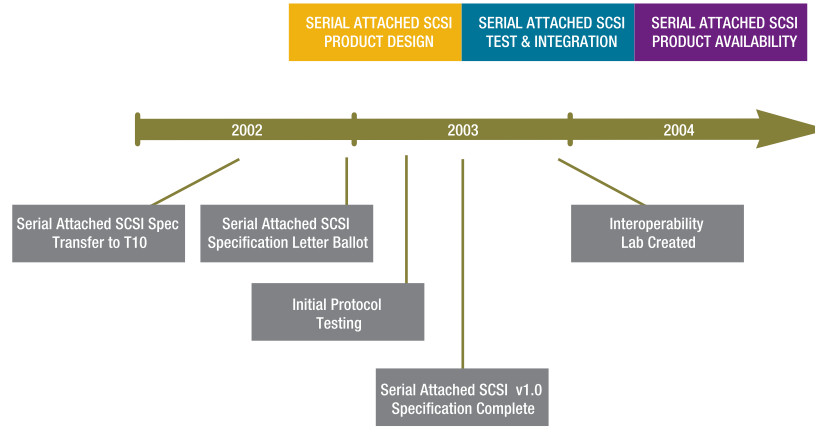
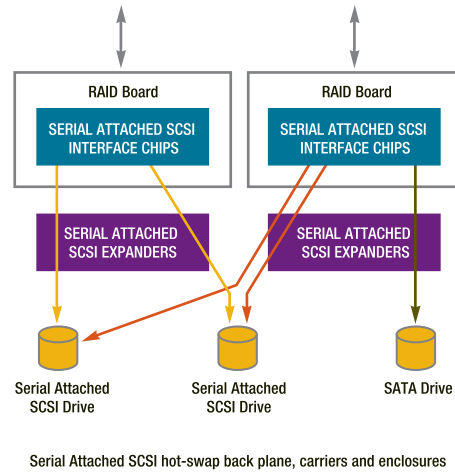


FIG. 3: HOST SYSTEM CONNECTION



## What is Serial Attached SCSI?

Serial Attached SCSI is the logical technical evolution that satisfies the future requirements of the enterprise data center. It integrates two established technologies—SCSI and serial, combining the proven utility and reliability of the SCSI protocol with the performance advantages of serial architecture. The result is scalable I/O, which can move data at the speed of three gigabits per second per path, across multiple, low-cost full duplex paths. (*see Figure 1*)

### FEATURES OF SERIAL ATTACHED SCSI:

- Supports the features of traditional SCSI including software and middleware
- Leverages volume economies of the Serial ATA (SATA) physical interface
- Defines a cost-effective switching architecture, connecting multiple drives to multiple ports for scalable I/O performance

### PLUS:

- Improved performance and reliability features
- A second data port on the disk drive to support redundant data path configurations
- Serial point-to-point interface with simplified cabling and fault isolation
- Scalable to large configurations with high performance
- Growth roadmap for multiple future generations
- Customers have the option of high-performance, dual-ported Serial Attached SCSI drives and/or lower-cost, high-capacity SATA drives in a single enclosure
- Scalable outside the box to a bounded level, supporting both Serial Attached SCSI and SATA disk drives

## Origin of Serial Attached SCSI

Serial Attached SCSI emerged through the effort of leading storage vendors and suppliers who were challenged with addressing the storage interconnect requirements of future enterprise environments. The initiative was announced to the industry in the late fall of 2001. By January 2002, the SCSI Trade Association adopted the emerging technology and prepared to present it to the T10 committee of the InterNational Committee for Technology Standardization (INCITS). In May 2002, the T10 committee voted to accept the project and has continued its development and preparation for standardization. Serial Attached SCSI specification completion and issuance of the letter ballot occurred in November 2002. (*see Figure 2*)

## Technology Background of Serial Attached SCSI

In defining Serial Attached SCSI, the initial developers determined that end users would benefit most by retaining the attributes that SCSI historically provided to the storage industry. The serial transport contained in Fibre Channel (which uses the SCSI protocol), was added along with a second data port for path redundancy. They then looked for ways to further improve the new technology to meet future enterprise

Recognizing that end users have differing requirements, the development team determined that adding SATA to take advantage of desktop economies of scale would be beneficial. Adding SATA technology would give end users choices in storage system configuration not available in the past, along with improved ease of use, an upgrade path and a reasonable purchase price where cost per gigabyte is a concern.

To achieve the highest system flexibility they decided that Serial Attached SCSI would have an enhanced physical layer that was compatible with SATA, so SATA and Serial Attached SCSI disk drives could be used in the same system. As a result, Serial Attached SCSI systems will be populated with either type of disk drive or both.

*(see Figure 3)*

## *Why does the Storage Industry Need Serial Attached SCSI?*

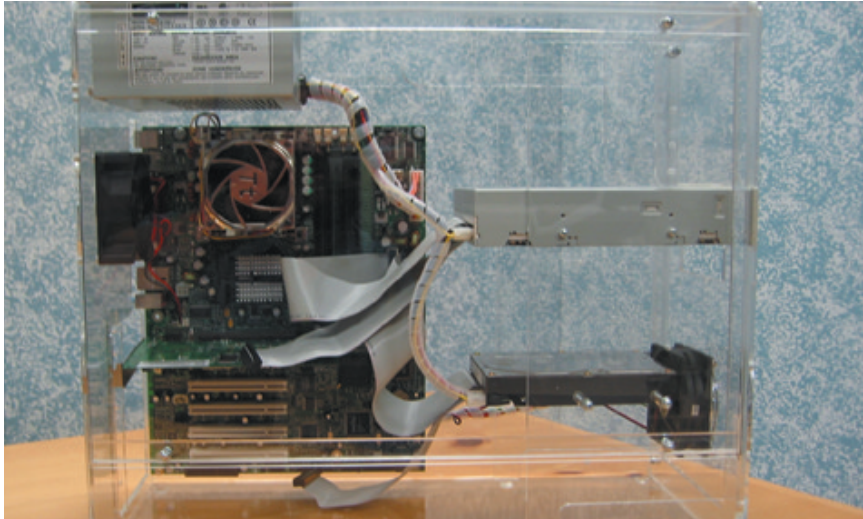
With enterprise storage requirements escalating and becoming more complex, factors such as larger capacity, density, security, scalability and accessibility are more critical than ever. Enterprise data centers must be online all of the time, fulfill requests from numerous users simultaneously, allow for constant growth and expansion and be maintained while in operation. More affordable than Fibre Channel and more robust and

reliable than SATA, Serial Attached SCSI will have the capability of fulfilling these requirements as well as providing the necessary performance and scalability to move data at gigabit speeds—speeds that meet or exceed current storage I/O performance found in ATA, SATA, SCSI or Fibre Channel systems.

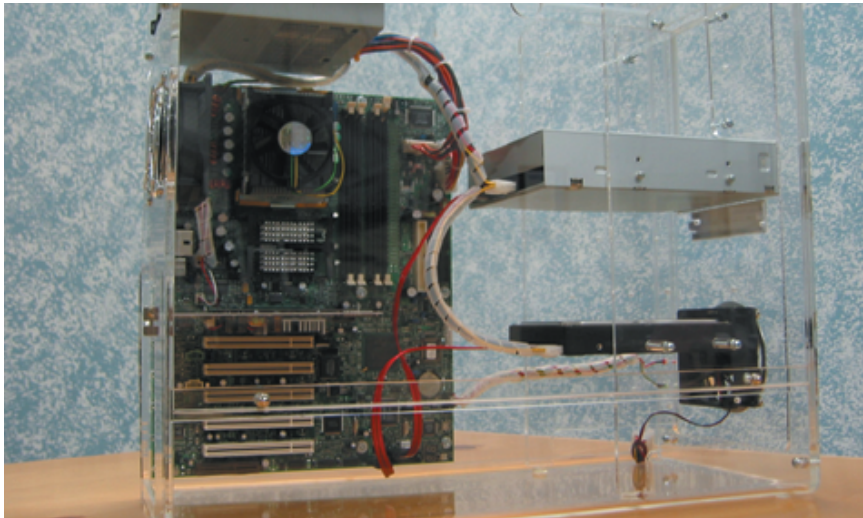
Of concern are the limits of current parallel transmission line architectures and the physical size of the connectors. SCSI cables and connectors are too large to fit easily into cabinets. They significantly increase the size and cost of storage equipment plus they require more data center real estate. Serial Attached SCSI has the features and characteristics to present a smaller thermal footprint and to fit into smaller cabinets. Future enterprise storage components must be miniaturized to the extent possible to keep ownership costs at a reasonable level while maximizing the output of data center real estate.

The industry will also benefit from the freedom to choose either Serial Attached SCSI or SATA drives or both, depending on storage applications, since they are both operable on the same backplane. Finally, Serial Attached SCSI is the logical evolution that preserves the SCSI advantages while leveraging the SATA electrical and physical connection. *(see Figure 4)*

*FIG. 4: INSIDE PCS CONTRASTING PARALLEL AND SERIAL CONNECTIVITY.*



*Parallel ATA Cabling*



*SATA Cabling*

*The grey parallel cables  
are replaced with  
the thinner red serial cables*

*Photos Courtesy Intel.*

FIG. 5: SERIAL ATTACHED SCSI BACKPLANE ACCEPTS SERIAL ATTACHED SCSI AND SATA DISK DRIVES

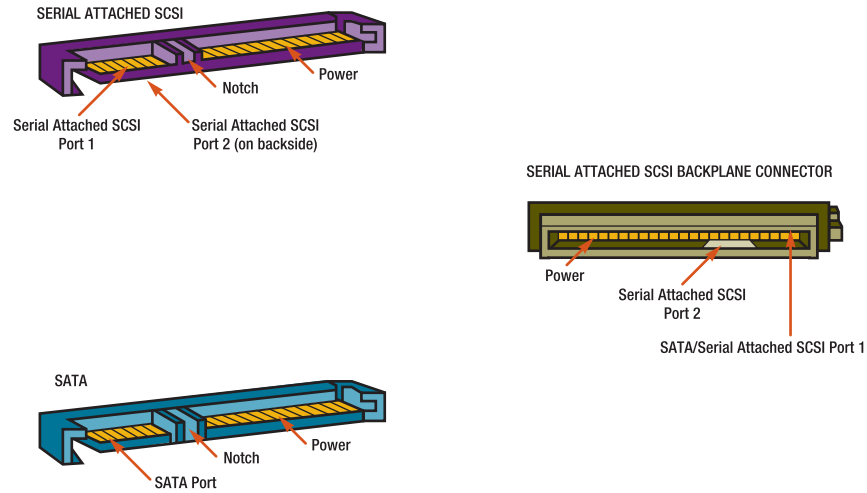
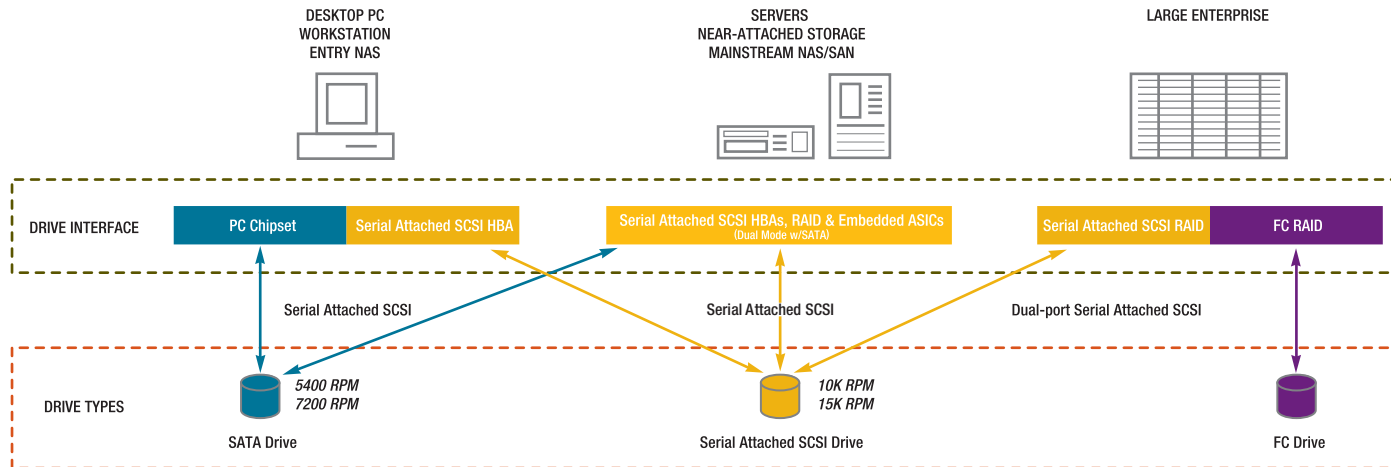


FIG. 6: SERIAL ATTACHED SCSI APPLICATIONS



## Value Proposition and Advantages for the User

Through the integration of SCSI and selected SATA and Fibre Channel features, Serial Attached SCSI is evolving into a storage solution superior and more flexible than any other existing technology. While it will serve any storage environment, its destiny is in mainstream servers and enterprise storage. Serial Attached SCSI's near-and mid-distance connectivity capabilities function equally well. This unprecedented flexibility will be reflected in its installments in DAS systems, in enterprise data centers, with networked SANs and NAS systems. By leveraging a compatible connection scheme, enclosure and infrastructure with SATA, Serial Attached SCSI provides heretofore unavailable choice at less cost to the system integrator and the end customer.

For storage environments requiring high performance and constant data accessibility, Serial Attached SCSI will prove to be the alternative of choice. As the technology evolves, device support will be enhanced, making Serial Attached SCSI even more attractive to the enterprise user, and at a lower cost than Fibre Channel.

## Serial Attached SCSI/SATA Compatibility

By combining industry standards in a universal architecture, Serial Attached SCSI and SATA allow customers unprecedented flexibility in choosing the right class of storage to meet their requirements. Both technologies have similar electrical interfaces, giving users the choice of deploying cost-effective SATA drives for low-cost bulk storage or higher performance SCSI drives for mission-critical applications.

A Serial Attached SCSI backplane is required for either choice of drive for any application such as a server or a networked storage environment. Serial Attached SCSI and SATA disk drives provide complementary benefits that enable a single Serial Attached SCSI enclosure to meet a wide range of cost, capacity, flexibility, scalability, availability and data management requirements. (*see Figure 5*)

# Serial Attached SCSI

## Applications and Configurations

Serial Attached SCSI is easily configurable to enterprise data center applications and readily fulfills the requirements of the following: (*see Figure 6*)

- Enterprise storage environments
- High-end desktop and workstations
- Bounded out-of-box connection schemes
- Internal servers
- SAN (storage attached network)
- NAS (networked attached storage)
- DAS (direct attach storage) with external enclosures
- FAS (fabric attached storage)
- Hot-swap drives with RAID support
- Rack-mount servers with JBOD storage
- Disk-based backup storage
- Graded pools of storage
- Fixed content/nearline

### SERIAL ATTACHED SCSI BROCHURE GLOSSARY

1394: IEEE 1394 standard for multimedia connectivity (also called Firewire)

ATA: AT attachment

DAS: direct attach storage

Ethernet: IEEE 802.3 local area network communication technology

FAS: fabric attach storage

Fibre Channel: a high-bandwidth (100MBytes and up) computer communications protocol

I/O: input/output

JBOD: just a bunch of disks

## Summary

SCSI's historical effect on the enterprise storage industry has been profound. That fact will be especially true of Serial Attached SCSI, as its infrastructure accesses both multiple hosts and multiple paths and it supports a wide range of applications. Its serial point-to-point connection provides the high performance that tomorrow's storage systems require. Serial Attached SCSI's compatibility with SATA drives will give system integrators and end users the unprecedented choice of configuring their storage in ways that are most advantageous to a given application.

Serial Attached SCSI builds on 20+ years of reliable SCSI technology. Its enhancements, quality, reliability and universal compatibility will more than meet the requirements of the enterprise storage market. It will benefit storage management, reduce the risk of storage technology changes or upgrades and increase system interoperability, flexibility and scalability. Finally, it offers high-performance, and reliable solutions that are quickly and easily deployable to the market. Serial Attached SCSI carries SCSI's legacy forward to new generations of storage I/O.

*All trademarks are the property of their respective owners.  
Copyright 2003 by the SCSI Trade Association.  
Serial Attached SCSI Logo Copyright ©2003 STA*

### SCSI Trade Association

<http://www.scsita.org>

Email: [info@scsita.org](mailto:info@scsita.org)

Tel: +1-415-561-6273

Fax: +1-415-561-6120

NAS: network attached storage

PC: personal computer

RAID: redundant array of independent (inexpensive) disks

SAN: storage attached network

SATA: serial ATA

SCSI: small computer systems interface

T10: the INCITS SCSI development committee

USB: universal serial bus

This page intentionally blank!

<http://www.scsita.org>