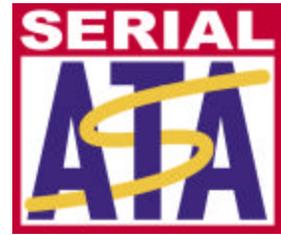# Serial ATA II

Improved Server and Network Storage Features and Performance
2nd Generation Speed

Background of ATA Technology

Since the 1980's, the traditional parallel ATA protocol has been the dominant internal storage device interconnect for desktop and mobile computers due to the technology's simplicity, low implementation cost, and history of frequent throughput enhancements. Recent advances to the ATA specification and drives have resulted in performance and reliability rivaling that of more costly interfaces. As such, current ATA devices are being recognized as a viable solution for entry-level servers and network storage solutions. However, some fundamental limitations of parallel ATA technology limit its growth in this area. The technology has reached a performance barrier due to the critical signal timing requirements, noise coupling, and complex board design inherent in a parallel bus, and thus has a limited future roadmap. Additionally, it will be increasingly difficult to support the traditional 5V TTL signal requirement of parallel ATA in components fabricated with future manufacturing processes. To overcome these barriers, a new approach to the internal storage device interconnect is required.

Serial ATA 1.0 – Overcoming the Limitations of Parallel ATA

To overcome the limitations of the parallel architecture, a paradigm shift in the evolution of the ATA interface was required. Serial ATA 1.0, the next generation internal storage interconnect designed to replace the existing ATA interface, was developed to address this need. With the introduction of this technology, the performance roadmap of ATA has been revitalized, supporting up to 10 years of storage evolution based on historical trends. In addition to performance headroom, the architecture of Serial ATA provides several advantages over parallel storage interconnect technologies:

- Small diameter cables up to 1m in length for improved air flow and routing
- Reduced signal count requiring less routing area on motherboards and backplanes
- Small connector size simplifying physical design requirements of small form factor (2.5") drives
- Low voltage differential signaling enabling use with devices manufactured with next-generation processes

The Serial ATA 1.0 specification was designed to be fully software compatible with existing ATA drivers. Thus replacement of parallel ATA devices with equivalent Serial ATA implementations will be transparent to the OS. Because of this compatibility, Serial ATA is expected to quickly reach a cost structure comparable to that of today's ATA solutions by leveraging the already established high-volume ATA market.

With a similar cost point, improved performance, and increased reliability due to the addition of a CRC error detection mechanism, Serial ATA 1.0 is expected to better meet the needs of the server and network storage segment. However, the technology's full software compatibility with legacy ATA devices requires adherence to the existing ATA specification, which lacks support for advanced features that are desired in some server and network storage applications. To better meet the requirements of the cost-sensitive server and network storage market segment, additions to the specification are needed.

Serial ATA II - Meeting the Demands of a New Market Segment

While Serial ATA 1.0 ensures performance headroom for years to come, the specification lacks features that may be required in some server and network storage configurations. Announced at the Spring 2002 Intel Developers Forum (IDF), the Serial ATA II specification will be a superset of Serial ATA 1.0. This specification will be developed in two phases to meet market demands. Phase 1 improves the use of Serial ATA devices in server and network storage applications. Phase 2 adds additional features for the entry-level and mid-range server segment and provides the 2nd generation speed increase (from 150MBytes/sec supported by Serial ATA 1.0 to 300MBytes/sec) for both server and desktop.

Serial ATA II Phase 1 Overview

The first phase of the Serial ATA II specification is targeted for release in the second half of 2002 to add features to address the needs of the cost-sensitive server and network storage market. Features include:

- Performance improvements such as command queuing, out-of-order execution/delivery, and data scatter/gathering
- Complete enclosure management including fan control, activity indicators, temperature control, new device notification, etc.
- Backplane interconnect solution to extend trace lengths beyond those allowed by Serial ATA 1.0 for use in racks of hot-swappable drives

This technology is expected to be introduced to the market in mid-2003. Though use of these advanced features will require updated drivers and OS support, Serial ATA II host devices will be fully compatible with Serial ATA 1.0 drives.

Serial ATA II Phase 2 Overview

To meet the needs of the entry-level and mid-range server and network storage segments and to allow overhead for increasing hard-drive transfer rates expected by mid-2004, the second phase of the specification's development is planned for released in the second half of 2003. Phase 2 enhancements include:

- Topology support for multiple-initiator networks
- Efficient connectivity to a large number of drives
- 2nd Generation speed increase, targeted at 300MB/sec

Usage of the added features will again require additional software support, but backward compatibility with previous versions of the Serial ATA protocols will be maintained at Serial ATA 1.0 data rates.

Serial ATA and Serial Attached SCSI – Complementary Technologies

Serial ATA is designed to replace parallel ATA as the primary internal storage interconnect for the personal computer. Because of the increased performance, reliability, and feature set in relation to parallel ATA devices and the projected low cost of ownership compared to SCSI implementations, Serial ATA is also expected to be a viable alternative for cost-sensitive entry-level and mid-range server and network storage applications. To maintain a low price point Serial ATA cost/complexity trade-offs were made, and thus some of the advanced features of the SCSI protocol were not implemented. The SCSI interconnect specification has historically been designed to meet the needs of high-end server and network storage segments, and thus the upcoming Serial Attached SCSI technology is expected to complement Serial ATA to provide solutions for the future storage interconnect requirements of all market segments.

Summary

With an early revision of the Serial ATA II Phase 1 specification completed in March 2002, work on the specification development is in full swing. It is expected that the enhancements to Serial ATA technology will meet the needs of cost-sensitive entry-level to mid-range servers and network storage. The 2nd generation speed increase introduced in Phase 2 will also provide room for continuing speed increases in both desktop and server storage devices.

Serial ATA 1.0 development was initiated by APT, Dell, IBM, Intel, Maxtor, and Seagate. Currently there is broad industry support from over 85 companies that have adopted the technology. The 1.0 specification was completed in August 2001; Serial ATA products are expected to market by mid 2002.
The Serial ATA II Working Group is led by APT, Dell, Intel, Maxtor, and Seagate and is currently supported by more than 25 industry leaders. An early version of the Phase 1 specification was completed March 2002.
For more information, see the Serial ATA II Working Group web site at www.serialata.org.