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Communications

## Case Study: ATTO Technology, Inc.

### iSCSI-Based Storage at Wire Speed

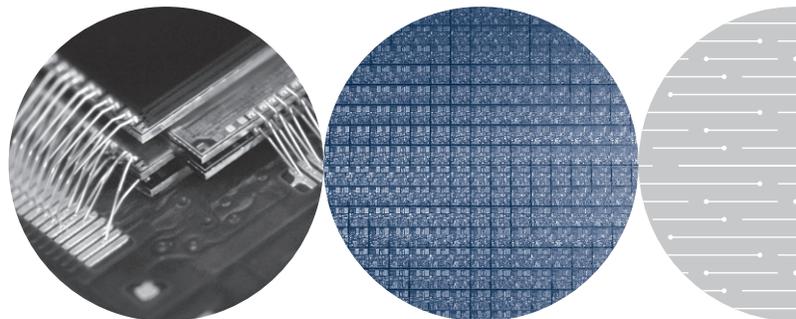
#### Summary

For SAN system OEMs, the notion that iSCSI-based storage solutions can match the performance of Fibre Channel may seem far-fetched. After all, the iSCSI protocol requires ten times the processing power of Fibre Channel to process commands. And many industry observers don't expect iSCSI to perform until the 10GbE version of the spec is published in late 2004. At just 1GbE, delivering Fibre Channel equivalent performance requires some pretty fancy engineering – and an enormous amount of development time and resources.

Or maybe not. ATTO Technology has developed a bridge that delivers 99.5 percent of wire speed performance – regardless of the operating

parameters. The ATTO iPBridge\* 2500C/R/D Gigabit Ethernet-to-SCSI bridge connects both iSCSI and NDMP applications, enabling OEMs and customers to affordably connect SCSI-based devices to Ethernet/IP networks.

The Intel® 80200 processor with Intel XScale® technology combined with two Intel® PRO Gigabit Ethernet controllers and a proprietary Bus Memory Acceleration Control (BMAC) engine helped ATTO generate the necessary performance. This case study looks “under the hood” of the ATTO bridge to learn about the true potential of the iSCSI protocol.



## Background: iSCSI Finds Its Niche

Widespread proliferation of data has made Storage Area Networks (SANs) essential. Compared to servers or direct attached storage options, SANs offer simplified administration and backup strategies, making them attractive solutions. To support the high-speed data transmission demanded by users, SANs are typically based on Fibre Channel technology.

And therein lies the trouble. Fibre Channel can be complicated and costly to implement, beyond the resources of most small-medium sized organizations. In addition, Fibre Channel-based SANs do not easily map into IP-based Wide Area Networks (WANs), meaning that most SANs end up as islands. While isolated storage is better than no storage, there is a growing need for SAN-to-SAN connectivity for improved data access.

The emerging iSCSI standard was developed so that existing Ethernet/IP networks can be used to deliver low-cost SANs, enabling businesses to quickly and easily add SAN functionality without having to deploy a whole new network. By allowing SCSI-based block-level storage to be remotely accessed over IP networks, the iSCSI protocol also facilitates integration of existing storage devices with Fibre Channel networks.

But the iSCSI protocol has its limitations as well. For example, it takes ten times the compute power to process an iSCSI command as it does for Fibre Channel. Many OEMs believe that “speed gap” cannot be overcome and have defined its niche at the low end of the storage segment.

## The Challenge: Can iSCSI Match Fibre Channel?

Or maybe iSCSI has a lot more potential than its architecture might imply.

A long-time leader in data delivery solutions, ATTO Technology recognized that the iSCSI protocol opened up a whole new segment in the storage market. For example, iSCSI could be used to cost-effectively add SAN functionality to an abundance of existing Ethernet/IP networks. It could also be used to help installed SANs make better use of their existing systems by eliminating the “island” effect.

ATTO engineers calculated that a bridge would be the most efficient means to deliver Gigabit Ethernet-to-SCSI connectivity for both new and existing systems. Saving OEMs development time and money, minimizing the need for additional infrastructure, and reducing management overhead, a bridge would enable organizations to transform SCSI storage devices into network-enabled addressable devices – without converting to Fibre Channel.

But even with a bridge, ATTO still had that “speed gap” to deal with. It’s true; an iSCSI bridge could offer tremendous benefits within the performance limitations of the protocol. But ATTO engineers were determined to do better. They came up with a bridge design that could achieve wire speed performance – on par with Fibre Channel – regardless of the defined operating parameters.

While ATTO engineers had the option to build a custom ASIC to achieve the design performance objectives, they sought to minimize development time and resources by using an “off-the-shelf” high-performance processor. The goal: 733 MHz of high-speed processing power and a high performance external memory bus. The design also required extra memory for data buffering to maintain the highest system throughput.

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### Barry Debbins

Director of Hardware Engineering, ATTO Technology

## The Solution: Bridging the Speed Gap

Using the Intel 80200 processor based on Intel XScale microarchitecture in combination with a proprietary BMAC engine enabled ATTO to deliver an iSCSI bridge that can run at wire-speed regardless of the operating parameters. To ensure reliable high-speed throughput using low power in a small footprint, ATTO also selected the Intel 82540 and 82546 Gigabit Ethernet controllers with built-in MAC and PHY layers.

The ATTO iPBridge 2500C/R/D is a triple-channel Gigabit Ethernet-to-SCSI bridge offering scalable solutions for both iSCSI and NDMP networks from a single hardware solution. It is available in a board-level product for embedding into OEM storage systems or in a rack mount/desktop enclosure for use with legacy devices.

Because it supports both iSCSI and NDMP networking protocols, the ATTO iPBridge 2500C/R/D bridge is ideal for both NAS and SAN applications. “Using a bridge simplifies the process of adding storage to almost any existing network,” says Ed Tierney, Director of Product Management, ATTO Technology. “While consolidated storage makes sense, the cost and complexity of Fibre Channel may be intimidating. Using a bridge – and the iSCSI or NDMP protocol – almost any network can affordably add storage functionality quickly and easily.”

**“Intel also does a nice job of explaining what’s coming next, so we can keep our products moving forward and stay ahead of our competitors with faster design cycles.”**

### Barry Debbins

Director of Hardware Engineering, ATTO Technology

## Performance On Board

Because ATTO planned to deliver an iSCSI solution that could keep pace with Fibre Channel, the performance capabilities of the chosen components were essential. According to ATTO, there were no other high-speed processing options available, and “Intel had the only ARM\* processor that could run at 733MHz, which was three times faster than anything else we looked at” explains Barry Debbins, Director of Hardware Engineering, ATTO Technology. The Intel XScale microarchitecture enabled ATTO to achieve an eight-fold increase in the external memory and system cache.

The versatility, low-power consumption, and performance enhancements of the XScale-based processor are ideal for such fast, embedded applications. For example, At 733 MHz the Intel 80200 processor dissipates less than 1.3W, making it an extremely power- and temperature-efficient solution. High-performance applications are enhanced with the Intel 80200 processor’s 32KB data and instruction caches. A 2KB mini-data cache is also included to help avoid “thrashing” of the data cache for frequently changing data streams.

The Intel 80200 processor based on Intel XScale microarchitecture is code compatible with the Intel® StrongARM\* SA-110 processor. It is also compliant with ARM\* v.5TE ISA. Users can maximize code density with the 16-bit Thumb\* instruction set. The ARM v.5TE ISA executes either a 32-bit ARM instruction set or the Thumb instruction set.

While performance was essential to the final design, there were other reasons ATTO based its bridge on Intel architecture. “It helps a lot that Intel tends to develop entire product families. This allows us to leverage enhancements in newer products while minimizing development time by re-using code,” explains Mr. Debbins. “Intel also does a nice job of explaining what’s coming next, so we can keep our products moving forward and stay ahead of our competitors with faster design cycles.”

ATTO went with the Intel 82540 GbE controller because it integrates both a MAC and PHY in one package. It is used in the ATTO iPBridge 2500C/R/D as a maintenance port. The Intel 82546 GbE controller offers dual MAC and PHY in a single component thereby replacing up to four separate parts. The Intel 82546 GbE controller offers the added value of presenting a single load to the PCI-X bus at full speed, eliminating the possible need for a separate PCI bridge.

Intel helps simplify the design process by providing reference source code and complete hardware descriptions for both controllers, allowing ATTO to easily develop drivers for the proprietary operating system.

## Conclusion

There's no doubt the iSCSI protocol will bring improved storage capabilities to IP networks of all sizes. The widespread proliferation of data and pervasiveness of Ethernet/IP networks means just one thing: there is plenty of demand for an IP storage solution. And ATTO Technology is leading the industry to deliver SAN functionality to this enormous segment.

If ATTO Technology can deliver wire-speed performance using v1.0 of the 1GbE iSCSI protocol, just imagine what they can do when the 10GbE version is published in another year. While ATTO fully expects that Fibre Channel and iSCSI technology will co-exist for some time, the potential of iSCSI cannot be ignored.

For more information, please visit:

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