



## PRESS RELEASE

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### **Woven Systems and Chelsio Communications Deliver Scalable High Performance for Computing Clusters at Sandia National Laboratories**

#### **10 Gigabit Ethernet Fabric Solution Sets HPC Performance Benchmark**

**Santa Clara and Sunnyvale, CA – August 7, 2007** – Woven Systems™, Inc., the leading innovator of 10 Gigabit Ethernet (GE) fabric solutions, and Chelsio™ Communications, the leading provider of 10 Gigabit Ethernet Unified Wire solutions, today announced performance test results for the world's largest 10 GE remote direct memory access (RDMA) high performance computing (HPC) cluster built to date. Results from the Sandia National Laboratories 128-node cluster demonstrated twice the average throughput as processors were added and a fraction of the performance variation compared to single data rate (SDR) InfiniBand™.

The benchmark tests were conducted at Sandia using Chelsio's R310E iWARP host bus adapter (HBA) and Woven's EFX 1000 Ethernet Fabric Switch. A test developed by Sandia, was designed to measure the ability to dynamically respond to congestion in the network to deliver the highest levels of throughput and consistent performance.

The combined 10 GE fabric and RDMA solution demonstrated a peak unidirectional bandwidth of 1204 megabytes per second (MB/s), as compared to 960 MB/s for SDR InfiniBand. Moreover, the test results showed that as processors were added, the average throughput for InfiniBand fell to 585 MB/s or 61% of its maximum whereas the 10 GE solution maintained 99% throughput.

“We are pleased to see an industry-standard 10 Gigabit Ethernet interconnect that meets the needs of HPC applications,” said John Naegle, senior engineer with Sandia. “The ability of the Woven 10 GE fabric to dynamically respond to congestion significantly reduced the gap between maximum and average throughput compared to InfiniBand, making this solution very attractive for applications with varying I/O profiles. Additionally, we were very impressed with the sustained performance demonstrated with Chelsio’s 10 GE RDMA implementation.”

“InfiniBand has been the unrivaled solution for building HPC clusters,” noted Joe Skorupa, research vice president, Enterprise Communications Applications and Infrastructure at Gartner, Inc. “As 10 GE vendors deliver on the promise of high throughput, low latency NICs and fabrics, 10 GE will become a viable option for many workloads.”

Woven’s Active Congestion Management feature continuously monitored traffic across Sandia’s 10 GE cluster interconnect. When congestion was detected, the system re-routed traffic to a less congested path without dropping data. For that reason, Sandia experienced more consistent performance for 10 GE as the cluster scaled. Coupled with Chelsio’s iWARP HBAs with support for OS-bypass and the ability to handle out of order packets in the fast path, the solution delivered consistent low-latency and high throughput without the need to manually re-tune. As a result, HPC users can more quickly deploy new applications and more effectively utilize expensive compute resources.

“Sandia’s tests prove that 10 GE can deliver the combination of the performance needed by the HPC community with the ease-of-use of Ethernet,” added Kianoosh Naghshineh, president and CEO of Chelsio Communications. “Chelsio’s unique low latency data-flow processor is particularly suited for iWARP applications, and in conjunction with a low latency 10 GE switch, can deliver all the benefits of today’s high performance cluster fabrics.”

“It is critical that the interconnect fabric can scale and manage the congestion that inevitably occurs as HPC clusters scale,” concluded Harry Quackenboss, president and CEO of Woven Systems. “Active Congestion Management allows HPC users to confidently share a cluster without the need to re-engineer the network for each application, saving time and resources.”

## Sandia's Benchmark Tests

Sandia Cbench HPC benchmark suite is a collection of tests designed to characterize and stress the capabilities of HPC interconnects. In the test designed to highlight congestion effects, high bandwidth traffic is transmitted between pairs of sources and destinations. The test rotates through a series of such pairs to present the fabric with a varying communication pattern. For additional information about the Cbench test suite, refer to <http://cbench-sf.sourceforge.net/>.

The tests compared the performance of SDR InfiniBand and 10 GE HPC cluster interconnects. The 128-node test cluster was configured using Chelsio's R310E iWARP HBA supporting the OpenFabrics 1.2 RDMA stack and Woven's low latency 144-port EFX 1000 Ethernet Fabric Switch.

The test measured I/O bandwidth as the number of nodes increased and traffic patterns varied. As node count increased, the average bandwidth for InfiniBand decreased to 62% of the maximum rate due to congestion in the network. The 10 GE solution maintained average bandwidth at 99% of the maximum rate. This result was due to its ability to respond to congestion by dynamically re-balancing traffic onto alternate paths. While double data rate InfiniBand provides a higher maximum data rate, test performance is expected to exhibit similar scaling characteristics due to congestion as node count increases.

Woven Systems EFX 1000 Ethernet Fabric Switch is a modular 10U switching platform with configurable line cards that can support up to 144 non-blocking 10 GE ports each. Woven's unique switch architecture incorporates patented vSCALE™ packet processing technology to efficiently manage the distribution of traffic through the switch fabric. The Active Congestion Management feature dynamically monitors traffic to detect congestion across a large fabric and automatically redirects traffic onto less congested paths. Utilizing cut-through switching, the EFX 1000 achieves port-to-port latency of 1.5  $\mu$ s through a single switch and 4  $\mu$ s across a 4000-node fabric.

The Chelsio R310E HBA includes on-board hardware that offloads iWARP RDMA processing from its host system, freeing up host CPU cycles for application processing. RDMA, which enables high-speed and low latency, is inherent in the InfiniBand protocol, and the OFED iWARP stack now makes RDMA technology available for 10 GE interconnects. By implementing all the exception paths in hardware, using a built-in fast error recovery mechanism and a single proprietary data-flow processor running at 10 Gbit/s, Chelsio's iWARP adapters contribute significantly to delivering the demonstrated high level of performance at scale.

## **About Woven Systems**

Woven Systems is an innovative network infrastructure provider that offers the industry's first massively scalable Ethernet fabric switching solutions for data centers. Fully compliant with IEEE Ethernet standards, Woven redefines network performance and efficiency with Active Congestion Management for balancing traffic, operational simplicity, and a significantly lower cost of switching. The Woven solutions deliver the performance and scalability of InfiniBand™, the reliability of Fibre Channel and the ease-of-use of Ethernet. For more information, contact Woven Systems at the company's web site [www.wovensystems.com](http://www.wovensystems.com).

## **About Chelsio Communications**

Chelsio Communications is leading the convergence of networking, storage and clustering interconnects with its robust, high-performance and proven unified wire technology. Featuring a highly scalable and programmable architecture, Chelsio is shipping 10-Gigabit Ethernet and multi-port Gigabit Ethernet adapter cards, delivering the low latency and superior throughput required for high-performance computing applications. For more information, visit the company online at [www.chelsio.com](http://www.chelsio.com).

## **About Sandia National Laboratories**

Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin company, for the U.S. Department of Energy's National Nuclear Security Administration. With main facilities in Albuquerque, N.M., and Livermore, Calif., Sandia has major R&D responsibilities in national security, energy and environmental technologies, and economic competitiveness. Learn more at [www.sandia.gov](http://www.sandia.gov).

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