Ancient Math System Delivers Breakthrough in Digital Signal Processing

The Athena Group achieves advances in digital signal processing (DSP)

The speed and flexibility of Athena's residue number system-driven function block designs resulted in the design and production of computer chips that are reusable, scalable, more compact, and yet operate on less power than traditional computer chips.

The Challenge—In 1997, The Athena Group foresaw major advances in digital signal processing (DSP) using an ancient yet innovative information calculation system called residue number system (RNS). Athena envisioned a dramatic tenfold increase in information and data processing speeds over conventional mathematical functions. Such improvements were critical to the semiconductor industry due to demands for increased chip functionality. But because RNS processing technology was unproven on a large scale, Athena, a small company, was unable to attract or generate from within the necessary funding to support this high-risk research. In March 1997, Athena won an ATP cost-shared award and in November 1997 began work on this project.

The Outcome—At the conclusion of the project in October 2000, Athena had successfully developed semiconductor chip function blocks using RNS algorithms. These function blocks demonstrated tenfold increases in processing speed and operated on two-thirds the area of conventional DSP processors while producing a 50 percent reduction in unit manufacturing cost. These newly designed function blocks were also scalable and reusable, achieving greater end-user applicability due to this versatility. In addition to achieving the original project goals, Athena discovered an unexpected but highly significant benefit: their newly designed function blocks operated on significantly less power than conventional function blocks. In some designs, the reduction in power was as high as tenfold. Processing systems that require less power also extend the lives of the battery and the electronic device.

In 2000, Athena licensed the technology to Philips Semiconductors, which used the new technology in digital cameras and electronic platform applications.

In February 2002, Athena entered the information security domain by signing a licensing agreement with U.S.-based Hifn, a leading network security company.

Based on its ATP-supported, RNS-driven technology, Athena developed a line of cryptographic accelerators, which they called "TeraFire."[1] The TeraFire accelerator line enables secure session communications across the Internet and via wireless devices.

By 2006, Athena licensed its DSP information processing and TeraFire security information product designs to numerous customers including Philips, Hifn, LSI Logic, and Cryptek with application ranging from e-commerce to digital cameras.

The Athena Group exceeded expectations in DSP technology development and subsequently identified valuable commercial applications for the technology.

Partnering Organization:	The Athena Group, Gainesville, FL
Project Duration:	10/1/1997 – 9/30/2000
Project Cost:	$1.9M ATP cost-share; $0.4M industry cost-share
Project Brief:	http://jazz.nist.gov/atpcf/prjbriefs/prjbrief.cfm?ProjectNumber=97-01-0222
Project Status Report:	http://statusreports.atp.nist.gov/reports/97-01-0222.htm Research conducted September 2006

[1]TeraFire is a registered trademark of The Athena Group.