Report on the visit of Jeremy Siek, SICSA Distinguished Fellow

Jeremy Siek visited Scotland from May 29 to August 1, 2010. He was hosted by Philip Wadler at the University of Edinburgh, in the Laboratory for Foundations in Computer Science. Siek also made one-day visits to meet with Paul Cockshott at the University of Glasgow and Kevin Hammond at the University of St. Andrews. In addition, Siek attended the Scottish Programming Languages Seminar at St. Andrews. Siek gave the following talks at these Universities.

- *General Purpose Languages Should be Metalanguages*. University of Edinburgh, June 1, 2010.

- *Build to Order Linear Algebra Kernels*. University of Glasgow, June 8, 2010.

- *Monads for Relations*. Scottish Programming Languages Seminar, University of St. Andrews, June 16 2010.

In the visit to Glasgow, Siek met with Cockshott and his group of students working on a vectorizing compiler. Siek shared with them the results of several of his experiments regarding the optimization of numerical linear algebra subroutines using loop fusion. Cockshott went over the approach used in his compiler to perform vectorization. Based on this visit, Siek will be integrating vectorization into his linear algebra compiler back at the University of Colorado.

In the visit to St. Andrews, Siek met with Kevin Hammond and Edwin Brady. They discussed how metalanguages should provide clean abstraction boundaries for domain-specific languages (DSLs). In particular, they focused on how to provide support for DSLs to give better error messages. Siek and Brady made some progress on improving the error messages in a prototype metalanguage that Brady is working on. They developed a technique for attaching error messages to type-equality constraints in the datatype of the abstract-syntax for the DSL.

During the two months at the University of Edinburgh, Siek collaborated with Philip Wadler on the programming language metatheory for integrating casts, the dynamic type, and parametric polymorphism. The main result of Jeremy's visit was a technical breakthrough on a problem that Philip Wadler had been working on with three other collaborators for more than two years. This resulted in a paper submitted to POPL, the premier conference in the research area.