NSF Awards Optimizing Scientific Applications

ATLANTA (June 25, 2006)---College of Computing Associate Professor David A. Bader received a $200,000 award from the National Science Foundation's (NSF) Computing Systems Research program. The Georgia Tech-led project, titled "A Framework for Optimizing Scientific Applications," is in collaboration with professor Viktor Prasanna at the University of Southern California. Bader and Prasanna's Design Optimizer for Scientific Applications (DOSA) framework allows the programmer or compiler writer to explore alternative designs and optimize for speed (or power) at design-time, using its run-time optimizer as an automatic application composition system (ACS). The ACS constructs an efficient application that dynamically adapts to changes in the underlying execution environment based on the kernel model, architecture, system features, available resources, and performance feedback. The application studies are chosen by NSF for their broad impact to traditional and emerging scientific areas such as bioinformatics, computational biology, and medical applications, as well as for national security. Bader's award-winning project especially encourages the participation of women, minorities, and underrepresented groups.

DOSA allows design-time exploration and automatic run-time optimizations using continuous performance optimizations (CPO) so that application programmers and compiler writers are relieved from the challenging task of optimizing the computation in order to achieve high performance. As an illustration of the DOSA framework, one complex, full application is optimized for IBM Cell. The innovative performance optimization techniques for the memory hierarchy use new techniques for reducing I/O complexity, data layout, data remapping, and in-memory processing, while being supported by DOSA--the semi-automatic design framework and dynamic run-time system. DOSA allows rapid, high-level performance estimation and detailed low-level simulation by incorporating high-level performance models into the model-integrated computing framework. The run-time system dynamically improves application performance using the component library, the models, and the run-time optimizer.

In addition, Bader, who works within the College of Computing's Computational Science and Engineeering (CSE) division, recently attended the "Challenges in Biomedicine" workshop sponsored by the Computing Research Association (CRA) and the National Institutes of Health (NIH). He joined researchers and practitioners from the high performance computing and biomedical communities to addresses the challenges and opportunities of collaboration and cooperation.