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Online Tuning of Stream Programs

Abstract

This talk introduces an autonomic mechanism for online tuning of stream programs.

A stream program is a parallel program consisting of a number of filters that are interconnected in a flow graph. A given stream program is compiled to an online tunable form that exhibits tuning parameters. Tuning parameters are variables that influence a program's performance, but not its results. Examples of tuning parameters are the degree of parallelism, the degrees of replication and fusion of filters, or the choice of alternative implementations of kernels. During program execution, we use application heartbeats to monitor performance. Heartbeats are events emitted at certain points in the program; the faster the heartbeat, the better the performance. An automatic optimizer uses heartbeat rates for making informed decisions on how to adjust tuning parameters to maximize performance.

We evaluated the approach with five benchmarks on three different multicore platforms. Performance improvements range between 50% and 100% of the overall tuning potential, with negligible overhead.

The approach could also be used for optimizing energy consumption or for choosing among heterogeneous cores.

Biosketch

Walter F. Tichy has been professor of Software Engineering at the Karlsruhe Institute of Technology (formerly University Karlsruhe), Germany, since 1986, and was dean of the faculty of computer science from 2002 to 2004. Previously, he was senior scientist at Carnegie Group, Inc., in Pittsburgh, Pennsylvania and served six years on the faculty of Computer Science at Purdue University in West Lafayette, Indiana. His primary research interests are software engineering and parallelism. He is currently directing research on a variety of topics, including empirical software engineering, software architecture, and programming languages and tools for multi/manycore computers. He has consulted widely for industry. He earned an M.S. and a PhD in Computer Science from Carnegie Mellon University in 1976 and 1980, resp. He is director at the Forschungszentrum Informatik, a technology transfer institute in Karlsruhe. He is co-founder of ParTec, a company specializing in cluster computing. He has helped organize numerous conferences and workshops; among others, he was program co-chair for the 25th International Conference on Software Engineering (2003). He received the Intel Award for the Advancement of Parallel Computing in 2009 and was named ACM Distinguished Scientist in 2010. Dr. Tichy is a member of ACM, GI, and the IEEE Computer Society.