

MAP-i Doctoral Program in Computer Science

Thesis Proposal

Title:

Multi-Threaded Tabling for Logic Programming

Brief Description:

Logic Programming (LP) languages, such as Prolog, provide a high-level, declarative approach to programming. Despite the power, flexibility and good performance that Prolog has achieved, the past years have seen wide efforts at increasing its declarativeness, expressiveness and efficiency. One proposal that has gained popularity is the use of tabling. In a nutshell, tabling consists of storing intermediate answers for subgoals so that they can be reused when a repeated subgoal appears. It can be shown that tabling based models are able to avoid looping, have better termination properties, and often significantly reduce the search space for logic programs. Currently, tabling is widely available in systems like XSB Prolog, Yap Prolog, B-Prolog, ALS-Prolog, Mercury and more recently Ciao Prolog.

The main goal of this work is to study how tabling technology can be extended to support multi-threading. In particular, we are interested in extending the tabling engine of Yap Prolog to support multi-threaded evaluation of tabled logic programs. In a multi-threaded tabling system, tables may be either private or shared between threads. While thread-private tables are relatively easy to implement, all other cases imply sharing a dynamic data structure between threads, with all the associated issues of locking, synchronization, and potential deadlock cases. Thus, despite the availability of both threads and tabling in Prolog compilers such as XSB, Yap, and recently Ciao, the implementation of these two features such that they work together seamlessly implies complex ties to one another and to the underlying Prolog engine.

In the current Yap version, tabling and threads are incompatible features. Work is planned to provide robust integration of these two key features. Together with the expected increase on the number of cores per processor, we can foresee a powerful programming environment for taking full advantage of concurrency and parallelism in Prolog systems supporting tabled evaluation.

Pre-requisites:

Preference will be given to candidates with solid formation in C programming, parallel programming and concurrency, and in the theoretical and practical concepts of programming languages design and implementation.

Grants:

The proposed research work can be supported by a research fellowship in the context of the research project `STAMPA - *Sophisticated TAbling Mechanisms for Prolog and their Applications*' (<http://www.dcc.fc.up.pt/stampa>).

Advisor:

Ricardo Rocha

Departamento de Ciência de Computadores

Faculdade de Ciências da Universidade do Porto

Rua do Campo Alegre, 1021/1055, 4169-007 - Porto

Phone: (+351) 220 402 926

Fax: (+351) 220 402 950

E-mail: ricroc@dcc.fc.up.pt

Web: <http://www.dcc.fc.up.pt/~ricroc>

Research Unit:

Center for Research in Advanced Computing Systems (CRACS)

Web: <http://cracs.fc.up.pt>