



A Methodology for Profiling and Partitioning Stream Programs on Many-core Architectures

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Abstract

Maximizing the data throughput is a very common implementation objective for several streaming applications. Such task is particularly challenging for implementations based on many-core and multi-core target platforms because, in general, it implies tackling several NP-complete combinatorial problems. Moreover, an efficient design space exploration requires an accurate evaluation on the basis of dataflow program execution profiling. The focus of the paper is on the methodology challenges for obtaining accurate profiling measures. Experimental results validate a many-core platform built by an array of Transport Triggered Architecture processors for exploring the partitioning search space based on the execution trace analysis.

Keywords: TTA, execution trace graph, dataflow, partitioning, profiling

1 Introduction

A natural method to handle applications characterized by high computational complexity is to implement parallel programs on high performance machines. Traditional approaches with concurrency evolving directly from sequential programs present several drawbacks. For instance, there is no guarantee that the resulting programs would end in exactly the same way as the starting sequential program. The threads behaviour cannot be properly profiled nor simulated by appropriate test vectors and the risk of unpredicted race conditions is always present. Furthermore, threads depend on the platform making any changes a troublesome interference in the design [11]. Programming paradigm used by the dataflow computational model presents an interesting alternative. Apart from some attractive features such as platform independence and explicit exposition of parallelism it provides several design space analysis opportunities [9].

In spite of many features that make dataflow programs efficient and analyzable, the designer usually has to deal with the problem of transferring those features onto a specific architecture. At this stage several narrowing factors occur that are relative to the number of available units, constraints on power consumptions or architectural obstacles to track the application execution. There are several ways of dataflow design evaluation among which the throughput is particularly important, as it contributes to the improvement of other design factors [8]. One method of

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