

Preface

As Moore's law is losing steam, one already sees the phenomenon of clock frequency reduction caused by the excessive power dissipation in general purpose processors. At the same time, embedded systems are getting more heterogeneous, characterized by a high diversity of computational models coexisting in a single device. Therefore, as innovative technologies that will completely or partially replace silicon are arising, new architectural alternatives are necessary.

Although reconfigurable computing has already shown to be a potential solution when it comes to accelerate specific code with a small power budget, significant speedups are achieved just in very dedicated dataflow oriented software, failing to capture the reality of nowadays complex heterogeneous systems. Moreover, one important characteristic of any new architecture is that it should be able to execute legacy code, since there has already been a large amount of investment into writing software for different applications. The wide spread usage of reconfigurable devices is still withheld by the need of special tools and compilers, which clearly preclude reuse of legacy code and its portability.

The authors have written this book with the aforementioned limitations in mind. Therefore, this book, which is divided in seven chapters, starts presenting the main challenges computer architectures are facing these days. Then, a detailed study on the usage of reconfigurable systems, their main principles, characteristics, potential and classifications is done. A separate chapter is dedicated to present several case studies, with a critical analysis on their main advantages and drawbacks, and the benchmarks used for their evaluation. This analysis will demonstrate that such architectures need to attack a diverse range of applications with very different behaviors, besides supporting code compatibility, that is, the need for no modification in the source or binary codes. This proves that more must be done to bring reconfigurable computing to be used as main stream computing: dynamic optimization techniques. Therefore, binary Translation and different types of reuse, with several examples, are evaluated. Finally, works that combine both reconfigurable systems and dynamic techniques are discussed, and a quantitative analysis of one of these examples is presented. The book ends with some directions that could inspire new fields of research.

The main purpose of this book is to introduce reconfigurable systems and dynamic optimization techniques to the readers, using several examples, so it can be a source of reference whenever the reader needs. The authors hope you enjoy it, as they have enjoyed making the research that resulted in this book.

Porto Alegre

*Antonio Carlos Schneider Beck Fl.
Luigi Carro*

Dynamic Reconfigurable Architectures and Transparent
Optimization Techniques

Automatic Acceleration of Software Execution

Beck Fl., A.C.S.; Carro, L.

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