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Facing the Multicore-Challenge

Aspects of New Paradigms and Technologies in Parallel Computing
Preface

The proceedings at hand are the outcome of the conference for young scientists titled *Facing the Multicore-Challenge* held at the Heidelberger Akademie der Wissenschaften, March 17–19, 2010. The conference focused on topics related to the impact of multicore and coprocessor technologies in science and for large-scale applications in an interdisciplinary environment. The conference was funded by the Heidelberger Akademie der Wissenschaften and placed emphasis on the support and advancement of young scientists.

The aim of the conference was to bring together leading experts as well as motivated young researchers in order to discuss, recent developments, the present status of the field, and its future prospects the exchange of ideas, in a pleasant atmosphere that stimulates. It was the designated goal to address current issues including mathematical modeling, design of parallel algorithms, aspects of microprocessor architecture, parallel programming languages, compilers, hardware-aware computing, heterogeneous platforms, emerging architectures, tools, performance tuning, and requirements for large-scale applications. This broad range of issues is reflected by the present conference proceedings. The results of the presented research papers clearly show the potential of emerging technologies in the area of multicore and manycore processors that are paving the way towards personal supercomputing. However, many issues related to parallel programming environments, development of portable and future-proof concepts, and the design of scalable and manycore-ready algorithms still need to be addressed in future research. Some of these points are the subject of the presented papers.

These proceedings include diverse and interdisciplinary research work. An assessment of parallel programming environments like the RapidMind platform and the perspective of GPGPU computing in large data centers is presented. The proceedings further address issues of hardware architecture by exploring way-adaptable caches. The management of parallel units is considered in papers on thread affinities and on thread creation. Application aspects on modern processor technologies are investigated for the Cell Broadband Engine by means of the G-means application for data mining and a numerical study on 3D multigrid methods. A complex fluid dynamic application modeled by the lattice Boltzmann equations is considered on multi- and manycore processors like the multicore CPUs, GPUs, and Cell. The potential of FPGA and GPU technology is outlined for a sorting problem. Application studies on GPUs include image segmentation and parallel volume rendering. Furthermore, fault tolerance of pipeline workflows is the subject of presented research work.

The conference organizers and editors would like to thank the Heidelberger Akademie der Wissenschaften for giving us the opportunity to organize this conference at this inspiring venue. Without the funding of the Heidelberger
Akademie der Wissenschaften and the comprehensive support for this fruitful event this conference would not have been possible. In particular, we would like to thank all the friendly people at the Heidelberger Akademie der Wissenschaften for making this conference happen. Last but not least, thank you very much to all the contributors submitting exciting, novel work and providing multi-facetted input to the discussions.

March 2010

Rainer Keller
David Kramer
Jan-Philipp Weiss

Preface from the Heidelberg Academy of Sciences and Humanities

The focus of this publication is: How are innovative computer systems going to have a crucial impact on all branches of science and technology? Multicore systems are opening up new perspectives to cope with challenges which seemed to have been out of range to be mastered up to now. However, they are also posing new challenges in adapting all domains, ranging from mathematical modeling, numerical methods and algorithms to software and hardware design and development. The contributions presented in this volume offer a survey on the state of the art, the concepts and perspectives for future developments. They are an outcome of an inspiring conference conceived and organized by the editors within the junior scientist program of Heidelberg Academy for Sciences and Humanities. The Academy is happy to promote junior scientists getting involved in innovative research and daring to break new ground. Springer deserves high recognition for handling the publication efficiently and thus helping to face the multicore challenges.

Willi Jäger

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