

Preface

The latest advances in the high-performance computing (HPC) hardware, such as increased capabilities of a single NUMA node or heterogeneous architectures combining traditional CPU nodes with accelerators, have significantly raised the level of principally available compute performance. At the same time, the growing hardware capabilities of modern supercomputing architectures have caused an increasing complexity of the parallel application development technology. While a number of new programming paradigms, e.g., task-based parallelization and data-driven programming frameworks, have been introduced to fully exploit the available compute resources, very little has been done in terms of tools for performance optimization and debugging for new programming models nor for the latest generation of hardware.

Despite numerous efforts to improve and simplify application development, there is still a lot of manual tuning work required in order to take full advantage of modern HPC architectures. The process of identifying and eliminating performance issues, ranging from simple memory leaks to inefficient design of communication patterns, is very difficult, unless special tools are used. The HPC tools for debugging, performance analysis, and optimization of parallel applications make a major contribution to development of the robust and efficient parallel software.

In order to enable a technology exchange and cross-fertilization in the optimization techniques and development approaches across the HPC tools' developers, the Center for Information Services and High Performance Computing of the University of Dresden (ZIH-TUD)¹ and the High-Performance Computing Center Stuttgart (HLRS)² jointly organize the International Parallel Tools Workshop. The workshop is an annual event, which addresses challenges in parallel software performance assurance and discusses novel trends in HPC tools development.

The workshop has two major goals. The first is serving as discussion forum for tool developers on the latest advances in performance analysis techniques and

¹http://tu-dresden.de/die_tu_dresden/zentrale_einrichtungen/zih/

²<http://www.hlrs.de/>

software technologies for them. Approaches of eliminating typical performance issues in complex application scenarios by coupling techniques used in different tools were of a special interest for the last workshop's edition. The second goal is to offer the users of parallel tools a unique opportunity to gain a consolidated outlook on state-of-the-art HPC tools. The workshop has proved successful among the application providers, who get an opportunity to have a discussion with the other developers sharing similar performance issues or establish new contacts with tools' developers. On the other hand, the users' feedback helps tools' developers define obstacles to newly raising performance issues and identify engineering or research approaches to overcome them.

This book comprises a continuation of a successful series of publications that started in 2007. It contains contributed papers presented at the 6th International Parallel Tools Workshop,³ held 25–26 September 2012 in Stuttgart, Germany. The workshop's audience represent leading scientific and industrial organizations worldwide. The presentations covered different aspects of the software optimization, ranging from parallel debugging to complex performance data visualization technology. More than ten different tools were addressed in workshop presentations or hands-on tutorials.

Along with the newest features of the well-known tools, such as Vampir (a performance analysis framework for a wide range of parallel applications) or DDT (a debugging framework with a big set of extensive analysis features), the book introduces new tools which were presented for the first time in the Parallel Tools series, e.g., Temanejo (a debugging environment for StarSs) or MemPin (an automatic memory detection tool for MPI applications). The book's material is organized in four sections: Debugging, Automatic Error Detection, Performance Analysis and Optimization, and Performance Data Visualization.

We believe that the presented material offers a comprehensive outlook on the mainstream application analysis and optimization technology in the high-performance computing domain for both categories of readers – parallel tools' developers and developers of parallel applications.

Stuttgart, Germany
February 2013

Alexey Cheptsov
Steffen Brinkmann
José Gracia
Michael M. Resch
Wolfgang E. Nagel

³<http://toolsworkshop.hlr.de/2012/>

Tools for High Performance Computing 2012

Cheptsov, A.; Brinkmann, S.; Gracia, J.; Resch, M.;
Nagel, W.E. (Eds.)

2013, XI, 162 p. 70 illus. in color., Hardcover

ISBN: 978-3-642-37348-0