

Preface

Sustained simulation performance is a widely ignored issue in high-performance computing. Typically the focus is on peak performance and on Linpack results. Rarely we do see a discussion about real-world applications and their performance on large-scale systems.

This book presents the results of the 14th Teraflop Workshop which was hosted by the High Performance Computing Center Stuttgart/Höchstleistungsrechenzentrum Stuttgart (HLRS) in December 2011 as well as the contributions of the 15th workshop in this series. In order to adapt the title of the workshop series to the changing technology in high-performance computing the workshop was renamed to “Workshop on Sustained Simulation Performance.” It was held in March 2012 at the Tohoku University in Sendai, Japan.

This book contains contributions focused on the issue of sustainable performance on large-scale systems. This includes issues of exaflop computing as one important part. The three other parts are focusing on real-world applications and their performance on state-of-the-art HPC architectures. These contributions together give an overview of the level of performance that is available for the scientific community today.

The workshop series is based on a project that was initiated in 2004. The Teraflop Workbench Project was founded initially as a collaboration between the High Performance Computing Center Stuttgart (HLRS) and NEC Deutschland GmbH (NEC HPCE) to support users to achieve their research goals using high performance computing.

Since then a series of workshops have put their focus on sustainable performance. These workshops have become a meeting platform for scientists, application developers, international experts, and hardware designers to discuss the current state and future directions of supercomputing with the aim of achieving the highest sustained application performance.

Work in the Teraflop Workbench project gives us insight into the applications and requirements for current and future HPC systems. We observe the emergence of multi-scale and multi-physics applications, the increase in interdisciplinary tasks, and the growing tendency to use today’s stand-alone application codes as modules

in prospective, more complex coupled simulations. At the same time, we notice the current lack of support for those applications. Our goal is to offer an environment that allows users to concentrate on their area of expertise without spending too much time on computer science itself.

The first stage of the Teraflop Workbench project (2004–2008) concentrated on user's applications and their optimization for the 72-node NEC SX-8 installation at HLRS. During this stage, numerous individual codes, developed and maintained by researchers or commercial organizations, have been analyzed and optimized. Several of the codes have shown the ability to outreach the TFlop/s threshold of sustained performance. This created the possibility for new science and a deeper understanding of the underlying physics.

The second stage of the Teraflop Workbench project (2008–2012) focuses on current and future trends of hardware and software developments. We observe a strong tendency towards heterogeneous environments at the hardware level. At the same time, applications become increasingly heterogeneous by including multi-physics or multi-scale effects. The goal of the current studies of the Teraflop Workbench is to gain insight into the developments of both components. The overall target is to help scientists to run their applications in the most efficient and most convenient way on the hardware best suited for their purposes.

We would like to thank all the contributors of this book and the Teraflop Workbench project. We thank especially Prof. Hiroaki Kobayashi for the close collaboration over the past years and are looking forward to intensifying our cooperation in the future.

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