UCHPC 2012: Fifth Workshop on UnConventional High Performance Computing

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Foreword

As the word "UnConventional" in the title suggests, the workshop focuses on hardware and platforms for HPC, which were not intended for HPC in the first place. Reasons could be raw computing power, good performance per watt, or low cost in general. To address this unconventional hardware, often, new programming approaches and paradigms are required to make best use of it. Thus, a second focus of the workshop – for the first time with UCHPC 2012 – is on innovative new programming models for unconventional hardware and how to best combine its computing power with more conventional systems. To this end, UCHPC tries to capture solutions for HPC which are unconventional today but could become conventional and significant tomorrow. While GPGPU still is on topic, especially when integrating the GPUs with multi-cores, other examples for "unconventional" hardware are embedded, low-power processors, upcoming many-core architectures combined with FPGAs or DSPs. Thus, interesting devices for research in unconventional HPC are not only standard server or desktop systems, but also relatively cheap devices due to being mass market products, such as smartphones, netbooks, tablets and small NAS servers. Especially smartphones seem to become more performance hungry every day. Only imagination sets the limits for use of such devices for HPC. The goal of the workshop is to present latest research in how hardware and software (yet) unconventional for HPC is or can be used to reach goals such as best performance per watt. UCHPC also covers corresponding programming models, compiler techniques, and tools.

It is now the 5th time the UCHPC workshop took place, and it is the 3rd time it is co-located with Euro-Par (in 2010, 2011, and 2012). Before that, it was held in 2008 in conjunction with the *International Conference on Computational Science and Its Applications 2008* and in 2009 with the *ACM International Conference on Computing Frontiers 2009*. While the focus of the workshop on the one hand is fixed, it is — on the other hand — a moving target: unconventional for HPC in the beginning was the usage of hardware for game consoles, and especially GPUs. While these still are a hot topic, and get new features for better programmability in every new generation, they rapidly get conventional. This example shows that UCHPC by its main theme needs to regularly re-target

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to new research areas with new ideas for HPC. This can be difficult to achieve. While this year, we only have three papers in this post-workshop proceedings volume, they are high quality and we are confident for the future.

From eight submissions, the organizers were able to accept five. Due to a late withdrawal, we finally had four interesting paper talks in the workshop. The reason for only three papers in these proceedings is that one of the papers, while presenting an innovative idea, had to be accepted conditionally on resubmission of an improved paper, which unfortunately did not meet our expectations.

In addition to the paper talks, we were proud to present speakers for two invited talks, making up for a very exciting half-day program. The first session started with the invited talk from Jens Breitbart. It was titled "Programming Models for Next Generation HPC Systems", representing our additional UCHPC focus on yet unconventional programming models. The main idea of a new PGAS model presented by Jens is to work with memory which only can be written once. This allows to ignore consistency problems with non-coherent shared memory, and hence usage of simpler, power efficient hardware. The session went on with two paper talks. The second session had the same structure, starting with an invited talk by Hartwig Anzt on "Is UCHPC the Solution to the Power Challenge?" He proposed the use of new, power-aware methods not only on the hardware, but also on the software side. As example, he showed that it is possible to relax synchronization requirements in iterative numerical algorithms. Although convergence may be slower, the higher throughput — synchronization on GPUs is expensive — may allow for much faster iterations and thus still faster total run time.

These post-workshop proceedings include the final versions of the presented UCHPC papers which were accepted for publication. They take the feedback from reviewers and workshop audience into account. The organizers want to thank the authors of the papers. Without them, the workshop would not have been able to come up with the interesting topics for discussion. But also, we sincerely thank the EuroPar organization for providing the opportunity to arrange the workshop in conjunction with the Euro-Par 2012 conference, and would like to thank them for a very nice environment. As in the last years, we especially appreciate the hard work of the members of our International Program Committee. They did a perfect job at reviewing the submissions. Last but not least, we thank the — again — large number of attendees this year. They contributed to a lively half-day, and we hope that they found something of interest in the workshop. Based on the positive feedback, the organizers and the steering committee plan to continue the UCHPC workshop in conjunction with EuroPar 2013.