Editorial: Special Issue on Computing Frontiers

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Technology is experiencing revolutions in memory devices and systems, networks, electronic device production, machine learning, data analytics, cloud computing, techniques to improve power and energy efficiency, systems portability/wearability, to name but a few areas. New application domains that affect everyday life are emerging, especially in the era of highly interconnected and collaborative cyber-physical systems. Boundaries between the state-of-the-art and revolutionary innovation constitute the frontiers that mark the advances of science, engineering, and information technology. Early research that envisions future technologies provides the bases that allow novel materials, devices, and systems to become mainstream. Collaborative efforts among researchers with different expertise and backgrounds enables revolutionary scientific breakthroughs that lead to innovative solutions over a wide spectrum of computer systems, from embedded and hand-held/wearable devices to supercomputers and data centres.

In this wide context, we have assembled a collection of articles that cover a variety of topics: from programming frameworks for parallel architectures, to novel applications and computing platforms, to more traditional architectural themes.

“StreamDrive: A Dynamic Dataflow Framework For Clustered Embedded Architectures” proposes a dataflow programming framework for clustered embedded multicore architectures. The proposed framework allows the development of dynamic dataflow applications starting from sequential reference C code and the seamless handling of heterogeneous and application-specific processing elements.

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“Static Compiler Analyses for Application-specific Optimization of Task-parallel Runtime Systems” proposes compiler techniques to determine program features – such as the structure of task spawning, the granularity of individual tasks, the memory and stack size required per task - that affect the optimal settings for a task-parallel execution environment.

“GPU-based Iterative Medical CT Image Reconstructions” proposes the GPU parallelization of the algebraic reconstruction technique, a computationally expensive image reconstruction algorithm for computed tomography.

“Extending the Lifetime of Nano-Blimps via Dynamic Motor Control” presents a nano-sized blimp platform, consisting of a helium balloon and a rotorcraft, enabling nano-size unmanned aerial vehicles with low power requirements.

“Finding Maximum Cliques on the D-Wave Quantum Annealer” assesses the performance of the D-Wave 2X (DW) quantum annealer for an important NP-hard problem: finding a maximum clique in a graph.

Finally, “Maximizing Limited Resources: A Limit-based Study and Taxonomy of Out-of-order Commit” revisits non-speculative and speculative out-of-order commit with the aim to demonstrate the potential for selective, speculative out-of-order commit using an oracle implementation without speculative rollback costs.

These articles are extended versions of selected papers published in the Proceedings of the ACM International Conference on Computing Frontiers 2017. Each article has received at least two additional reviews to ensure that the authors have added at least 30% original material over the conference version of their paper and have addressed the feedback provided by the conference reviewers. In addition, the journal reviews have raised additional issues that have allowed further improving the quality of the articles and their technical material.

We hope that the community will find this special issue to be a useful and interesting collection of articles.

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