Mapping and Scheduling Data Stream Applications on MPSoC

M2 internship proposal

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Context

Huawei is a leading global ICT solutions provider.
Through our dedication to customer-centric innovation and strong partnerships, we have established end-to-end capabilities and strengths across the carrier networks, enterprise, consumer, and cloud computing fields. We are committed to creating maximum value for telecom carriers, enterprises and consumers by providing competitive ICT solutions and services. Our products and solutions ranging from processors, servers to mobile phones have been deployed in over 170 countries, serving more than one third of the world's population. The Parallel and Distributed Team develops algorithms and programming tools to support massively parallel, real-time and big-data applications. Next generation smartphone and embedded devices will be massively parallel, raising the interest on intelligent applications that will take advantage of such computing power.

Project

The purpose of this project is to investigate Constraint-based techniques for the design of data stream real-time applications for embedded software. Since [2], the synchronous data flow model has received considerable attention and is used as a formal model of data stream applications [3]. In order to address the next generation of MPSoC that will include dozens of processors, network on chip, cache-coherent clusters and many more features, it is needed to develop new tools and models. Constraint Programming (CP) is a generic yet efficient way of representing knowledge and combinatorial problems. By modeling the mapping and scheduling problem of data stream application on MPSoC using a CP-based approach, we can expect to be able to handle the various difficult constraints and come with a quite realistic model. It will be next needed to provide a validation for this model, based on experimentations with different hardwares like Kalray 256-cores MPSoC with network-on-chip and/or other embedded systems.
An interesting issue would be to be able to reuse the framework of Constraint Programming on Data-Stream [1], another one would be to use machine learning to dynamically switch scheduling decisions according to the stream context.

Student

We are seeking for a top-level Master student with a strong background in Artificial Intelligence including logic and constraint reasoning (SAT and CSP), discrete optimization, game theory, machine learning, graph algorithms, parallel algorithms. In addition, having high C/C++ programming skills

is required, plus a practical programming experience of distributed parallel systems like MPI, BSP, Cuda, OpenCL, OpenMP, and a knowledge of mobile terminals programming (Android, IOS).

Please send by email to the contacts hereafter an archive containing a CV, a motivation letter, all undergraduate and known graduate marks and a detailed description of the courses followed.

Work environment

The work will take place in Huawei FRC (French Research Center) located in Boulogne-Billancourt under the supervision of Prof. A. Lallouet. Huawei FRC provides a challenging international scientific environment, cutting-edge parallel hardware and software, digital library, travel funds, company restaurant and a salary competitive with similar positions in French industry.

Contact

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References

[1] Arnaud Lallouet, Yat Chiu Law, Jimmy Ho-Man Lee, and Charles F. K. Siu. Constraint programming on infinite data streams. In Toby Walsh, editor, *IJCAI 2011, Proceedings of the 22nd International Joint Conference on Artificial Intelligence, Barcelona, Catalonia, Spain, July 16-22, 2011*, pages 597–604. IJCAI/AAAI, 2011.

[2] Edward A. Lee and David G. Messerschmitt. Synchronous data flow. *Proceedings of the IEEE*, 75(9):pp. 1235–1245, September 1987.

[3] Sundararajan Sriram and Shuvra S. Bhattacharyya. *Embedded Multiprocessors: Scheduling and Synchronization*. CRC Press, Inc., Boca Raton, FL, USA, 2nd edition, 2009.