Séminaire Informatique Haute Performance @ Campus Teratec

Séminaire n°28 du Jeudi 17 Septembre 2015, 10h, Amphi du TGCC.

Static/Dynamic Analyses for Validation and Improvement of Multi-models HPC Applications

Jeudi 17 Septembre 2015, Emmanuelle Saillard, Doctorante au CEA, nous présentera ses travaux lors d'une répétition de sa soutenance de thèse.

Voici le résumé de cette présentation qui aura lieu dans l'Amphi du TGCC à 10h.

Static/Dynamic Analyses for Validation and Improvement of Multi-models HPC Applications.

Supercomputing plays an important role in several innovative fields, speeding up prototyping or validating scientific theories. However, supercomputers are evolving rapidly with now millions of processing units, posing the questions of their programmability. Despite the emergence of more widespread and functional parallel programming models, developing correct and effective parallel applications still remains a complex task. Although debugging solutions have emerged to address this issue, they often come with restrictions. However programming model evolutions stress the requirement for a convenient validation tool able to handle hybrid applications. Indeed as current scientific applications mainly rely on the Message Passing Interface (MPI) parallel programming model, new hardwares designed for Exascale with higher node-level parallelism clearly advocate for an MPI+X solutions with X a thread-based model such as OpenMP. But integrating two different programming models inside the same application can be error-prone leading to complex bugs - mostly detected unfortunately at runtime. In an MPI+X program not only the correctness of MPI should be ensured but also its interactions with the multi-threaded model, for example identical MPI collective operations cannot be performed by multiple non-synchronized threads.

This thesis aims at developing a combination of static and dynamic analysis to enable a scalable verification of hybrid HPC applications. The first pass statically verifies the thread level required by an MPI+OpenMP application and outlines execution paths leading to potential deadlocks. Thanks to this analysis, the code is selectively instrumented, displaying an error and synchronously interrupting all processes if the actual scheduling leads to a deadlock situation. Our method has been implemented as a plugin in the GCC compiler to avoid compiler recompilation.

Emmanuelle Saillard obtained a M.Sc. in Computer Science in 2012 from the University of Versailles. She is in a PhD program at CEA DAM, in collaboration with the University of Bordeaux 1, since september 2012. She worked on "Static/Dynamic Analyses for Validation and Improvement of Multi-models HPC Applications". Her interests are building analysis to detect as soon as possible incorrect patterns in parallel programs.