Static Selective Instrumentation for Parallel Programs Verification

Global informations

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Abstract

High Performance Computing (HPC) plays an important role in many fields like health, materials science, security or environment. The current supercomputer hardware trends lead to more complex HPC applications (heterogeneity in hardware and combinations of parallel programming models) that pose programmability challenges. As indicated by a recent US DOE report, progress to Exascale stresses the requirement for convenient and scalable debugging methods to help developers ; despite all recent advances this still remains a manual complex task.

The PARallel COntrol flow Anomaly CHecker[1,2,3] (PARCOACH) aims at helping developers in their debugging phase. It combines static and dynamic analyses to detect misuse of collectives (i.e., collective operations mismatch in MPI) in parallel applications. First, an interprocedural static analysis studies the control and data flow of a program to find potential deadlocks. During this step, a program is tagged as statically correct (no possible deadlock) or not verifiable. For statically not verifiable programs, all collectives and exit statements are instrumented with Check Collective (CC) functions, starting from the first collectives that may deadlock in the program. This instrumentation prevents programs from deadlocking at runtime.

The goal of this internship is to improve the selective instrumentation of PARCOACH. We will first focus on MPI applications and collective communications. The work will then be extended to other parallel programming languages.

References

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