A Scalable Prescriptive Parallel Debugging Model

Debugging is a critical step in the development of any parallel program. However, the traditional interactive debugging model, where users manually step through code and inspect their application, does not scale well even for current supercomputers due to its centralized nature. While lightweight debugging models, which have been proposed as an alternative, scale well, they can currently only debug a subset of bug classes. We therefore propose a new model, which we call prescriptive debugging, to fill this gap between these two approaches. This user-guided model allows programmers to express and test their debugging intuition in a way that helps to reduce the error space. Based on this debugging model we introduce a prototype implementation embodying this model, the DySectAPI, allowing programmers to construct probe trees for automatic, event-driven debugging at scale. In this paper we introduce the concepts behind DySectAPI and, using both experimental results and analytical modelling, we show that the DySectAPI implementation can run with a low overhead on current systems. We achieve a logarithmic scaling of the prototype and show predictions that even for a large system the overhead of the prescriptive debugging model will be small.