

Parallel Program = Operator + Schedule + Parallel Data Structure

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Abstract. Multicore and manycore processors are now ubiquitous, but parallel programming remains as difficult as it was 30-40 years ago. In this talk, I will argue that these problems arise largely from the computation-centric abstractions that we currently use to think about parallelism. In their place, I will propose a novel data-centric foundation for parallel programming called the operator formulation in which algorithms are described in terms of unitary actions on data structures. This data-centric view of parallel algorithms shows that a generalized form of data-parallelism called amorphous data-parallelism is ubiquitous even in complex, irregular graph applications such as mesh generation and partitioning algorithms, graph analytics, and machine learning applications. Binding time considerations provide a unification of parallelization techniques ranging from static parallelization to speculative parallelization. We have built a system called Galois, based on these ideas, for exploiting amorphous data-parallelism on multicores and GPUs. I will present experimental results from our group as well as from other groups that are using the Galois system.

Biography

Keshav Pingali is a Professor in the Department of Computer Science at the University of Texas at Austin, and he holds the W.A."Tex" Moncrief Chair of Computing in the Institute for Computational Engineering and Sciences (ICES) at UT Austin. He was on the faculty of the Department of Computer Science at Cornell University from 1986 to 2006, where he held the India Chair of Computer Science. Pingali's research has focused on programming languages and compiler technology for program understanding, restructuring, and optimization. His group is known for its contributions to memory-hierarchy optimization; some of these have been patented and are in use in industry compilers. His current research is focused on programming languages and tools for multicore processors. Pingali is a Fellow of the ACM, IEEE and AAAS, and a Distinguished Alumnus of IIT Kanpur, India. He was the co-Editor-in-chief of the ACM Transactions on Programming Languages and Systems, and currently serves on the editorial boards of the International Journal of Parallel Programming and Distributed Computing. He also served on the NSF CISE Advisory Committee (2009-2012).