ABSTRACT

Parallel Graph Algorithms by Blocks

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In today's data-driven world and heterogeneous computing environments, processing large-scale graphs in an architecture agnostic manner is important and pervasive. Traditionally, hand-optimized high-performance computing (HPC) solutions have been studied and used to implement highly efficient and scalable graph algorithms. In recent years, several graph processing and management systems have been proposed. Hand optimized HPC approaches require high expertise and graph processing frameworks suffer from expressibility and performance. Portability is a major concern in both approaches. The main claim of this work is that block-based graph algorithms offer a sweet spot between efficient parallelism and architecture agnostic algorithm design for a wide class of graph problems. We seek to prove this thesis by focusing the work on the three pillars: data/computation partitioning; block-based algorithm design; and performance portability. We will show how we can partition the computation and the data to design efficient block-based algorithms using the triangle counting problem as a use-case. Our algorithm is naturally suitable for task-based execution on shared/distributed-memory systems as well as on heterogeneous architectures. Experimental results indicate that block-based approach increases memory utilization and becomes highly useful even in the sequential case.