

Semantic-Driven Parallelization of Loops Operating on User-Defined Containers

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Abstract

We describe ROSE, a C++ infrastructure for source-to-source translation, that provides an interface for programmers to easily write their own translators for optimizing user-defined high-level abstractions. Utilizing the semantics of these high-level abstractions, we demonstrate the automatic parallelization of loops that iterate over user-defined containers that have interfaces similar to the lists, vectors and sets in the Standard Template Library (STL). The parallelization is realized in two phases. First, we insert OpenMP directives into a serial program, driven by the recognition of the high-level abstractions, containers, that are thread-safe. Then, we translate the OpenMP directives into library routines that explicitly create and manage parallelism. By providing an interface for the programmer to classify the semantics of their abstractions, we are able to automatically parallelize operations on containers, such as linked-lists, without resorting to complex loop dependence analysis techniques. Our approach is consistent with general goals within telescoping languages.