Design Tools Session

Genetic Algorithm Framework for Dynamic Data Type Optimization and Memory Assignment

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Abstract

Most modern applications in the fields of telecommunications and multimedia involve complex data structures called dynamic data structures (DDTs), which are dynamically allocated and de-allocated, in order to attain maximum flexibility at run-time. Much of the added dynamism in the behavior of an embedded application is reflected in the DDTs, which are responsible of storing dynamic data. All dynamic data accesses that occur within and towards these DDTs should be optimized, in order to allow execution of modern embedded software by the targeted MPSoC. The efficient realization of such complex applications in modern MPSoC platforms demands the designer to choose the DDTs that best fit the applications' needs as well as where these data are to be stored in the memory hierarchy. In this work we present a tool that performs two tasks, namely a) DDT optimization and b) heap data management of embedded applications in an automated way, alleviating the designer's effort. For a specific application, information about the DDT properties (footprint, memory accesses, etc.) as well as the underlying architecture is needed for effective DDT optimization and assignment to take place. This information, collectively addressed as metadata, is extracted from a two step procedure. The first step involves using a profiling library into a given application in order to find out the DDT and the instances associated with each one. The second step is the actual analysis of the previous DDTs in order to extract the aforementioned metadata. This procedure is common for both optimizations. The differentiator between them is a genetic algorithm that performs the design space exploration, converging fast to a satisfactory solution. The tool performs the DDT optimization and the actual data assignment using different versions of a genetic algorithm. Metrics like delay and energy are taken into account in order to define the suitability of a solution (respecting application and platform constraints).