Design Tools Session

High-Level Performance Estimation Using Simulators At Multiple Abstraction Levels

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Abstract

Design Space Exploration (DSE) of an application running on a Multi-Processor System-on-Chip (MPSoC) platform is a challenging task. In order to tackle this DSE challenge, fast high-level simulators (running at multiple abstraction levels) are used to provide static and dynamic evaluation of the system-level performance metrics (e.g. execution time, energy consumption). These simulators are coupled with advanced DSE tools to generate Pareto set of optimum system configurations for a specified application running on a specified MPSoC platform. This generated Pareto set is used by a Run-Time Manager to optimize platform resource usage during the application run.

DSE for an application requires a large number of application runs. There is a trade-off between accuracy of the simulation results and the time taken for simulating application. Using simulators at multiple abstraction levels allows the application developer to make this trade-off (between simulation accuracy and simulation time). DSE is done with a large set of application runs using faster higher-level simulators (e.g.IMEC-HLsim [1] and MULTICUBE-SCoPE [2]). The DSE end results (Pareto set of optimum operating points for the application) are verified using more accurate platform simulators (e.g. cycle-accurate simulators built using CoWare Virtual Platform tool [3]). To enable seamless integration of DSE results across multiple simulators, a generic XML interface between DSE tools and simulators is defined [4]. This XML interface defines the format of system-level performance metrics used as an input-output by each simulator. Further, the XML interface specifies the design space that can be explored by the DSE tools at all the abstraction levels.

To maintain interoperability of the application code across multiple abstraction levels, a Run-Time Library (RTLib) API is defined to specify platform-dependent part (e.g. thread spawning, communication, synchronization) of the application. This RTLib API enables to run the same application code across multiple simulators by using RTLib implementation available at the desired simulator abstraction level.

In the framework of EU-MULTICUBE project [4], this methodology of coupling DSE tools with multiple high-level simulators is applied for the performance estimation of MPEG4 encoder application running on an MPSoC platform. Initial experiments in using this methodology show promising gains in both: the time spent for obtaining Pareto set of operation points and the design space coverage during exploration.

References:

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[2] J. Castillo, V. Fernández, H. Posadas, D. Quijano, E. Villar: “SystemC Platform Modeling for Behavioral Simulation and Performance Estimation of Embedded Systems”, in the book “Behavioral Modeling for Embedded Systems and Technologies: Applications for Design and Implementation”. IGI International ed (to be published).
[3] CoWare Virtual Platform tools http://www.coware.com
[4] The EU-MULTICUBE project http://www.multicube.eu