JAVA, VHDL-AMS, ADA or C for System Level Specifications?

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Abstract:

This technical panel discussion compares and discusses the suitability of new and established languages for creating executable specifications of heterogeneous embedded systems. The comparison is made by champions of the languages JAVA, VHDL-AMS, ADA and C based on a common example, a portal crane. In particular the panel focuses on issues like modeling efficiency in different domains, execution performance and reusability.

Today complex integrated control systems are in use in many application domains. Their specification requires an executable model of the entire system to be validated against timing, safety and functional requirements. Due to the integration of sensors and actors into the control system, time and value continuous signals need to be modeled together with the time and value discrete digital part of the controller. Additionally in many cases an environment model is needed to describe the physical behavior of the application's external world, e.g. in terms of differential equations.

In industry today languages like C are in use for specifications of control systems. Additionally MatLab and MatrixX are used for certain aspects, however, not for the full design flow. In safety critical applications additionally ADA comes into play. Recently JAVA gets a lot of attention in particular for small applications, e.g. SmartCards. At the same time due to its mixed-mode capabilities, VHDL-AMS gains interest, while a long term vision is to standardize a new methodology and set of languages for system level modeling (SLDL) which covers all aspects of heterogeneous system level design.

The objective of the panel is to discuss currently available and used languages with respect to their suitability to model this kind of heterogeneous systems. The discussion is structured around a common case study, a portal crane. Each of the languages is presented by a champion. The case study has been specified independently from the champions and includes a time and continuous environmental model in terms of a set of differential equations, a time discrete specification of the control FSM, concurrent behavior and exception handling. It thus includes the main features of typical industrial applications. For the sake of better understanding, however, it does not reveal issues related to complexity. The languages under consideration are compared with respect to the modeling effort needed to capture an executable specification, the simulation performance and the reusability of the specification, e.g. in an evolutionary design methodology.

It is the intention of the contributors to this session to stimulate the language discussion with the languages mentioned and to initiate an ongoing discussion process with additional and upcoming languages. We hope to establish the case study as a reference and benchmark for system level languages.