

***ARCHITECTURAL AND METHODOLOGICAL CONCERNS FOR
INDUSTRIAL REAL-TIME APPLICATIONS:
AN HARDWARE/SOFTWARE CO-DESIGN APPROACH****

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- Abstract -

Control, monitoring and supervision of industrial processes are increasingly demanding a great investment in technological solutions each time more embedded and with real-time capabilities, especially devoted to the interconnect of shop-floor equipment with operational information systems (for production, quality and maintenance management), in an intelligent way. The main goal of industrial control-based information systems consists of the management of the information that flows in the factory plants between the lower and the upper CIM levels. The design and open implementation of this new kind of information systems demand that some methodological and architectural issues be carefully treated.

In what concerns the specification aspects, it is imperious to assure the following issues: (1) at the language level, to deal with exceptions, to model data-paths/plants in a reactive way and to support multiple-view operational meta-models; (2) at the complexity control level, to support graphical and hierarchical formalisms and middle-out approaches; (3) at the continuity of models level, to integrate co-related refined representations within the successive design stages for forward and backward navigation.

In what concerns the design aspects, it is critical to adequately deal with the following problems: (1) at the technological constriction level, to decouple the traditional one-all-going project approach into 3 feed-forward quasi-independent project levels (target architecture design, functional module design, final solution design), each one with a different design flow; (2) at the virtual modelling level, to integrate CASE and CAE design tools by using stubbing techniques; (3) at the module reutilization level, to adopt a component-based development path throughout the 3 project levels.

All these issues are being taken into account to define a system-level hardware/software co-design approach to the development of industrial real-time applications, which allows the implementation of industrial control-based information systems. The relevance of the co-design-based development resides in the fact that with the three-level project decoupling it is easier to benefit from the speed-up that results from the using of reconfigurable processing architectures in the implementation of critical and real-time requirements. This methodology demands the use of homogeneous, neutral-object-oriented and executable specifications, the adoption of the operational approach and the spiral process model to support an architectural-pattern-based inward-level microprocess design flow.

* This work has been partially funded by the Portuguese Science & Technology Foundation project PRAXIS/P/EEI/10155/1998, *Reconfigurable Embedded Systems: Development Methodologies for Real-Time Applications*.