

Design of Embedded Distributed Control Systems - AIDA2

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1. Introduction and Status of the AIDA2 Project

In the *AIDA2* project the goals are to provide a modelling framework, a prototype tool-set and an accompanying method to support the design of machine control systems that are increasingly implemented in embedded distributed computer systems. The project is a collaboration between the Mechatronics Division at the Dept. of Machine Design/KTH and SAAB Combitech Software. Siemens-Elementa and SCANIA participate in the project reference group.

The *AIDA2* project is supported by ARTES and the Cooperative Research Project on Mechatronics (CRPM), each providing funding corresponding to approximately one PhD student. Due to difficulties in recruiting PhD students, the start of the project has been delayed. For the autumn of 1999, however, we have two good PhD student candidates, currently involved in their MSc theses work. Thus we expect our ARTES PhD student to begin by January year 2000. In addition, the funding from the Cooperative Research Project on Mechatronics will be used during the autumn 1999 for two *AIDA2*-oriented MSc theses projects.

The original application, *Design of Embedded Distributed Control Systems - DEEDS*, [1], is still fully valid, apart from the fact that the acronym (due to collisions with other projects) has been changed to *AIDA2*. Due to this, the remarks on Scientific merits, industrial relevance and exploitation expectations, and mobility (as requested by ARTES) remain unchanged as in [1] - note that [1] is downloadable from the *AIDA2* www-page, [3].

Recently, a journal paper [2] has been prepared which introduces some modifications to the proposed modeling framework and which relates and compares the *AIDA* framework with representative models with a basis in object-oriented analysis and design (UML real-time extensions), structured analysis and design (DARTS/DA), and real-time scheduling research. We hope that this journal paper, together with the following summary of the plans for the future based on the original application, jointly provide a basis for constructive feedback.

2. Approach in the AIDA2 Project

The approach according to the original application [1] is based on

- **industrial interactions** through
 - *a survey of industrial experiences and requirements*. An inventory of the experiences of industrial designers (primarily from Combitech Software) with respect to the goals and design issues of *AIDA2* will be carried out.
 - *mobility* of PhD students to industry as part of the survey and case study work.
 - *the reference group*
 - *the case studies*. Due to the interest of the industrial partners it may be possible to evaluate draft deliverables in real developments.
- **coordination with related research** through
 - *contacts with international research groups* (see [1]),
 - *the reference group* with respect to other Swedish research activities. Invitations will be extended when the project starts.
- **a combination of theoretical and practical work** through
 - *continued development and evaluation of the modeling framework* where case studies are an important part. Specifically, the applicability of RT-UML along the lines of the investigation [2], that clearly indicates a complementarity of the *AIDA* and UML models, will be evaluated. A key requirement in the framework development is to provide appropriate abstraction levels. Apart from high level models, there is a need to provide detailed models for the system parts that essentially influence the critical timing properties. Another important point is that of providing suitable views, models and links between these.
 - *evaluation of the 'technology' for the tool-set and other existing modeling techniques*. The following tools will be studied: the DOME environment by Honeywell research for creating customized software engineering tools, the Ptolemy toolset from Berkeley, the Matlab/Simulink and RT-UML tools and their extensibility mechanisms.
 - *development of a limited set of analysis functions* for the tool-set. It is expected that some 'analysis modules' are identified for reuse from other research projects and some for design within the project. *AIDA2* is not primarily dealing with the development of algorithms for example scheduling analysis. Instead the idea regarding analysis is to exploit and utilize the available body of theory. This may entail adaption and some theoretical extensions. Cooperation with other research projects and institutions is also important here, and already exists through related projects such as DICOSMOS2, [4].
 - *rapid prototyping of a prototype tool-set and a method*. The industrial partners of the project have emphasized the need to develop the method providing design guidelines for distributed real-time control systems.

3. References, publications and link to the AIDA2 www-page [3]

- [1] Törngren Martin (1998). *Design of Embedded Distributed Control Systems*, Research Proposal to ARTES 3rd call for proposals: 9811-2 (ARTES no).
- [2] Törngren Martin and Redell Ola (1999). A Modelling Framework to support the design and analysis of distributed real-time control systems. Invited Paper. To appear in the *Journal of Microprocessors and Microsystems*, Elsevier, special issue based on selected papers from the Mechatronics 98 proceedings.
- [3] <http://www.damek.kth.se/~martin/aida.html> (*AIDA2* www-page)
- [4] <http://www.damek.kth.se/~mis/dicosmos/index.html> (DICOSMOS2 www-page)