Building Real-Time Embedded Systems with MetaH and UML

Ed Colbert and Bruce Lewis

Building evolvable, embedded, time-critical systems with MetaH and UML. This tutorial will look at how to develop embedded, time-critical system that can evolve as requirements or technology changes, using MetaH and the Unified Modeling language (UML). MetaH is an architectural design language, with a supporting toolset, for specifying, analyzing, and integrating computer control systems. MetaH is designed for the specification of real-time, fault-tolerant, securely partitioned, dynamically reconfigurable multi-processor system architectures. We will look at the integration of MetaH and UML, the Object Management Group’s standard language for object-oriented software development.

MetaH was developed to meet the requirements of aircraft and missile avionics and flight control; but can be used in other embedded, time-critical applications, such as robotics, where a highly integrated, rapidly evolvable approach is need. Developers use MetaH to specify the code modules that form the application, the execution behavior of the application, the target hardware and software environment, and the allocation of the application to the hardware. The specification is then analyzed to determine whether the system is schedulable, reliable, and safe. The MetaH tools can generate the integrated code for the application components, an executive, and "architectural glue", all customized for the target hardware environment.

The Society of Automotive Engineers (SAE) is developing a standard Avionics Architecture Language using MetaH as a base. We will show an integration of UML and MetaH that will be proposed to SAE as the standard.

Prerequisites
Participants should have familiarity with UML and a general understanding of embedded time-critical systems and software development methods. Language expertise is not required. Project managers, systems engineers and software engineers should find the tutorial valuable.

Expected benefit
Architecture Description Languages are a new development in Software Engineering. MetaH is an ADL that supports time critical, high assurance systems. It significantly eases integration while providing early analysis of key system attributes like schedulability and fault management. Participants will gain an understanding of what is an ADL; what is MetaH; how it is used to specify a system's architecture and behavior; how MetaH accelerates the system development and evolution process; how to apply the it in developing real-time, high assurance system; and how MetaH can be integrated with UML.

Ed Colbert has been teaching object-oriented methods, software engineering, and the Ada programming language since 1982, and since 1986 consulting as well. He created the Object-Oriented Software Development method ("OOSD"), which supports analysis and design for implementation in languages such as Ada, C++, and SmallTalk. NASA Langley Research Center recently used OOSD for a Software Engineering Process. OOSD was chosen partly for its strength in real-time software development. Clients of his Absolute Software company include Computer Science Corporation, TRW, Lockheed Martin, Aonix, Information Management Associates, KPMG Peat Marwick, and Honeywell.

Bruce Lewis is a computer engineer responsible for the experimental development, assessment and transition of new software engineering technology. He has worked with DARPA over the last 7 years on architecture based software development and re-engineering technology. He is the DARPA technical agent for the development of the MetaH technology and is the Chairman of the SAE task group developing a standard Avionics Architecture Description Language. He is co-moderator for architecture on the International Real-Time Systems Symposium website.