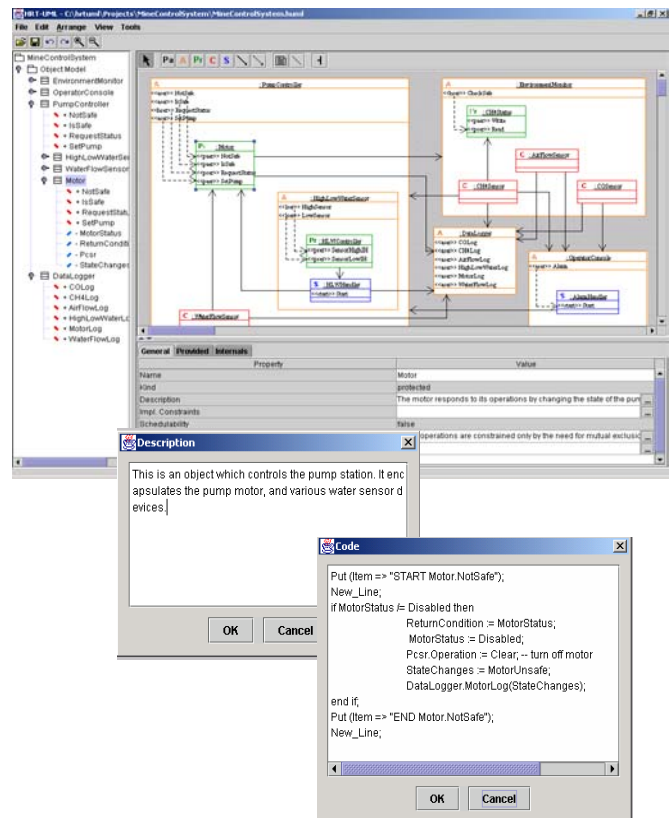


HRT-UML

The Hard Real-Time Unified Modeling Language (HRT-UML) method, and the support toolset, aims at providing a comprehensive solution to the modeling of hard real-time and dependable systems, and their early verification, according to rigorous techniques based on formal theories.

HRT-UML allows you:

- to design the system taking into account **functional** and **timing** requirements
- to **verify** the design, according to rigorous techniques
 - ❖ **schedulability** analysis and simulation
 - ❖ formal **model-checking**
 - ❖ **quantitative evaluation** of RAMS properties
 - ❖ **combined simulation** of control aspects
- to generate **consistent code**
 - ❖ Ada 95
 - ❖ Ada 95 compliant with Ravenscar Profile
 - ❖ C for standard OSEK/VDX RTOSs



HRT-UML Design Principles

The focus of an HRT design is not the definition of classes but rather the *set of objects* that compose the system and their interconnections. Interacting objects are organized in a structure according to the following principles:

- **Object Modeling Prevalence**
- **Multiple Static Instances**
- **Hierarchical Decomposition**
- **User-Provider Relationships**

HRT-UML enables

- the easy decomposition of the software architecture into design objects having internal parts that communicate with each other and with the outside environment,
- the explicit recognition of the typical activities of real-time systems such as cyclic and sporadic threads, protected resources
- the association of timing and dependability properties to objects, so as to enable schedulability and dependability analysis.

Extending UML for HRT and dependability support

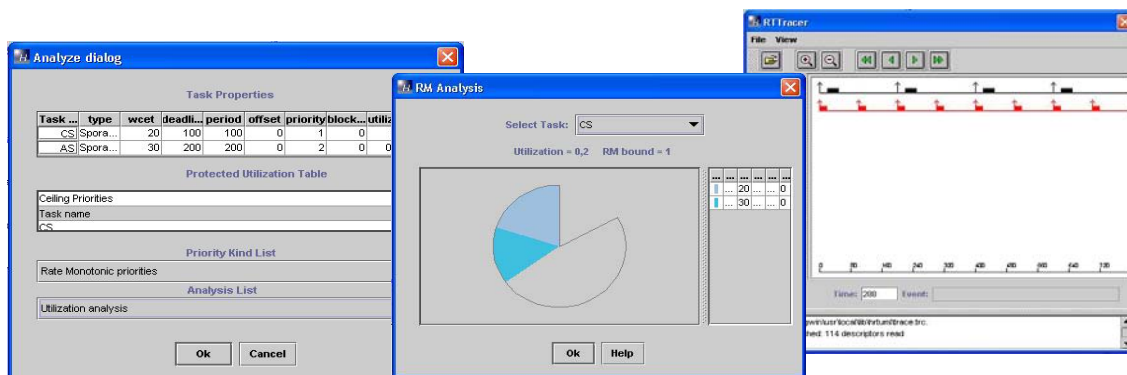
The experience shows that the design of Hard Real-Time systems needs methodologies suitable for the modeling and analysis of aspects related to time, schedulability, performance, and RAMS (Reliability, Availability, Maintainability, Safety).

In the context of the European Aerospace community a reference for the modeling of hard real time systems was the Hard Real-Time-HOOD (HRT-HOOD) method, recommended by the European Space Agency (ESA) for the development of on-board systems. On the other hand in recent years the Unified Modeling Language (UML) has been gaining a very large acceptance in a wide range of domains, all over the world, becoming a de-facto international standard.

HRT-UML defines a customized version of UML to express and improve the HRT-HOOD methodology. The resulting design method, and the support toolset, permits static scheduling analysis of the system and also caters for automated generation of consistent code.

A relevant aspect of HRT-UML is the integration of design activities with selected methods for the development of dependable systems. The approach is to assist the designer by offering an appropriate design methodology, and a support toolset, that integrates dependability validation techniques based on formal verification of system behavioral properties by model-checking, modeling of dependability aspects and well established techniques for quantitative assessment of system dependability attributes, automatic translations from the design to the mathematical models and the analysis tools that are most appropriate for the different kinds of validation, the SPIN model-checker and the Möbius behavior modeling tool.

Support is offered by HRT-UML also for the development of systems with control aspects, by integrating major lifecycle activities such as functional control design made with Simulink, with software/hardw



A comprehensive one-day course is available to provide an introduction to all of the major features of the HRT-UML method and support toolset.

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