Experiencing the UML profile for MARTE in the generation of schedulability analysis models for MAST

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Key reasoning

• Use of the UML profile for MARTE standard for representing modular systems in such a way that the analysis models follow the compositional plasticity of the design constructs → HLAM + UML

• Link the semantics of the high level application modeling constructs in MARTE with the analysis models necessary to assess the timing properties of the system → HLAM

Design Rules

• Have a tool that allows to analyze SAM models with MAST → marte2mast tool
MARTE Overview

Foundations for RT/E systems modeling and analysis:
- CoreElements
- NFPs
- Time
- Generic resource modeling
- Allocation

Specialization of MARTE foundations for modeling purpose (specification, design...):
- Generic component model
- High-level application modeling
- Software resource modeling
- Hardware resource modeling

Specialization of foundations for annotating model for analysis purpose:
- Generic quantitative analysis
- Schedulability analysis
- Performance analysis
How to read, use, & implement MARTE
(see Section 2)

Extension Units

- NFP Non-Functional Properties Section 8
- Time Enhanced Time Modeling Section 9
- GRM Generic Resource Modeling Section 10
- Alloc Allocation Modeling Section 11
- GCM Generic Component Model Section 12
- HLAM High-Level Application Modeling Section 13
- SRM Software Resource Modeling Section 14.1
- HRM Hardware Resource Modeling Section 14.2
- RTM Real-Time objects Modeling Section 13
- GQAM Generic quantitative Analysis Section 15
- SAM Schedulability Analysis Section 16
- PAM Performance Analysis Section 17
- VSL Value Specification Language Annex B
- CHF Clock Handling Facilities Annex C
- RSM Repetitive Structure Modeling Annex E
- AADL AADL models with UML Section A.2
## Usage & Compliance Cases vs. Extension Units

Table 7.2 - Extension Units that must be supported in each Compliance Case

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Processing schema for model-based analysis

UML2 + Marte

« profile » MARTE

UML2 editor

Annotated model

Results/Diagnostic

Model converter

Results converter

Analysis specific framework

Analysis model

Analysis tool

Analysis results
Decoupling design from analysis

Logical UML Model

MASTE-HLAM Design model

MASTE-SAM Analysis Model

Stereotypes Semantics

Compiler

MAST Model

Symbol Table

Updater

MAST Analysis Results

MAST Analysis Tools
From design to analysis

Design Phase

1. Design Models

2. Specify Parameterized Analysis Context Model

3. Annotate Resources Models (PDM)

4. Determine Desired NFPs of Interest (given and predicted parameters)

5. Analysis File

6. Non-functional values for specific analysis contexts

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Structural Elements of an analysis model
Behavioral Elements of an analysis model
## MARTE modelling elements used

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<th>Behavioral Models</th>
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* Elements used in the extraction tool in current version
Additions to MARTE

The Analysis Context:

• “invoke”: (true or false) defines whether the automatic invocation of the MAST tool shall be done or not.
• recoverResults: (true or false) defines whether the results obtained from MAST in its results file should be inserted back into the UML model or not.
• overwriteResults: (true or false) defines whether the response times annotated in the Steps should be replaced by the new ones or appended with the “mode” of the recently executed conversion for analysis.
• overwriteOutputModel: (true or false) indicates whether the UML output model should be overwritten or a new one need to be created to hold the results from the previous analysis.
• modeID: (string) indicates the name that wants to be used for the “mode” attribute that will identify the values resulting from the analysis to be performed after the execution of the tool. This id is going to be used in the name of the resulting UML model file also. By default a combination of date and time of the tool execution is used as the mode of the analysis context.
See our demo…

….and/or visit our web page

http://mast.unican.es/umlmast/marte2mast

Thanks!