



INFORMATION TECHNOLOGY FOR EUROPEAN ADVANCEMENT

## MARTES – Boosting productivity in embedded systems development

ITEA 2 Symposium 2008 – Rotterdam, the Netherlands  
Klaus Kronlöf, Nokia Research Center



### Outline

- Rationale
  - Challenges
  - Drivers
  - Market
- Approach
  - Target scope
  - Model based thinking
- Outcomes
  - Modelling method
  - Design process
  - Tool interoperability
  - Validation case studies
- Conclusions

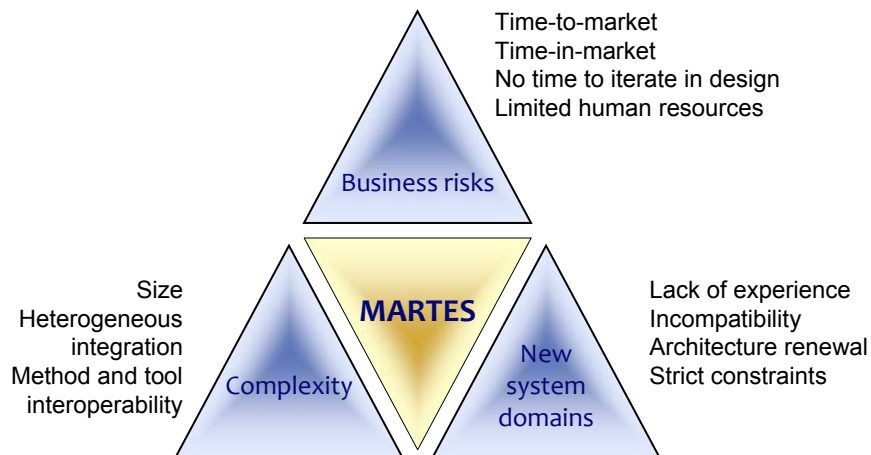


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Project Presentation  
MARTES



## Product development challenges

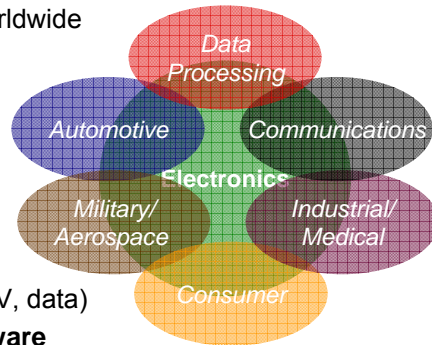


## Driven by systems companies and tool providers

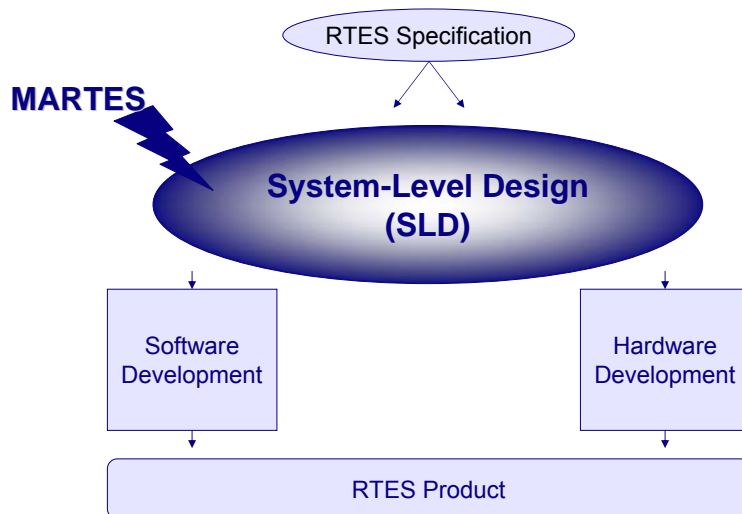
- Embedded systems companies seek
  - renewal of their methodology and supporting tools for efficient development of embedded systems products targeting increasingly diverse markets
  - better means for the analysis and early verification of design architecture
  - capability to maintain and advance their leading position of European embedded systems companies
- Tool providers seek
  - creation of a large market for systems-level design tools through consistent, widely accepted methodology and tool interoperability
  - leveraging the widespread acceptance of UML and model-driven architecture (MDA) as a basis for an industry-standard, embedded-systems design methodology
  - opening up a market for a new category of UML-based tools – and, through tool interoperability, increasing the market for many existing tools

## Real-Time Embedded Systems Application Domains

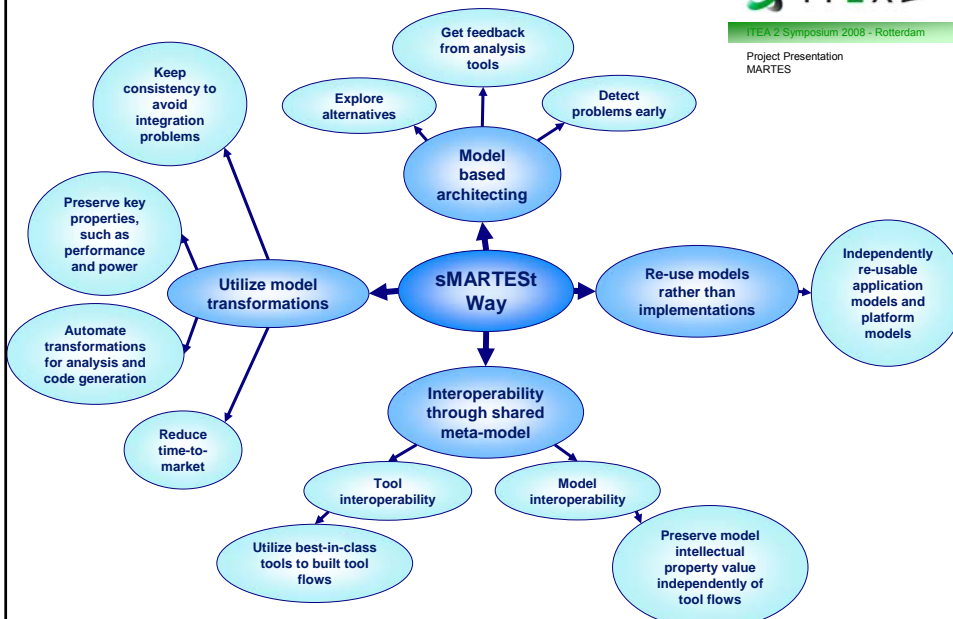
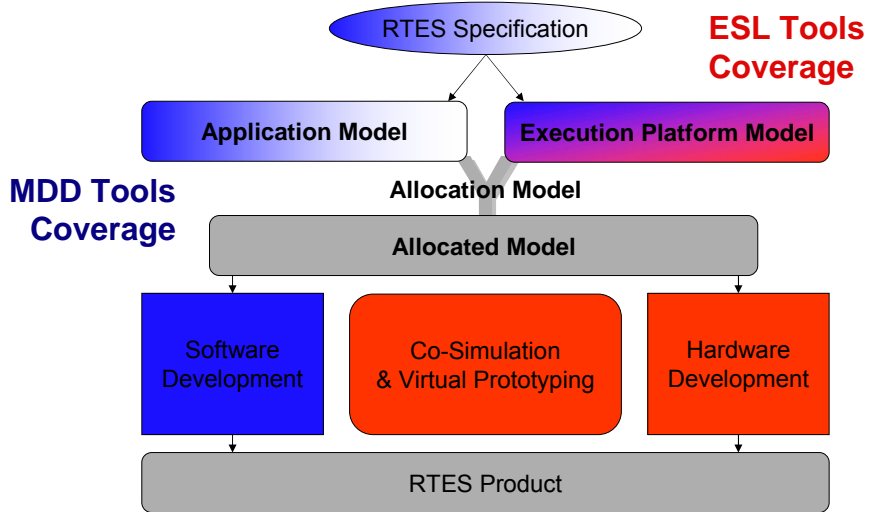
- RTES are ubiquitous in all industries
- RTES are pervasive in everyday/one lives
- Huge market
  - More than **\$1,500B in sales** worldwide
- Fast changing and competitive
- Driven by:
  - Technological progress
  - Demand for novelty
- Major trends:
  - **Explosion of content**
  - **Digital convergence** (voice, A/V, data)
  - **Functionality defined by software**



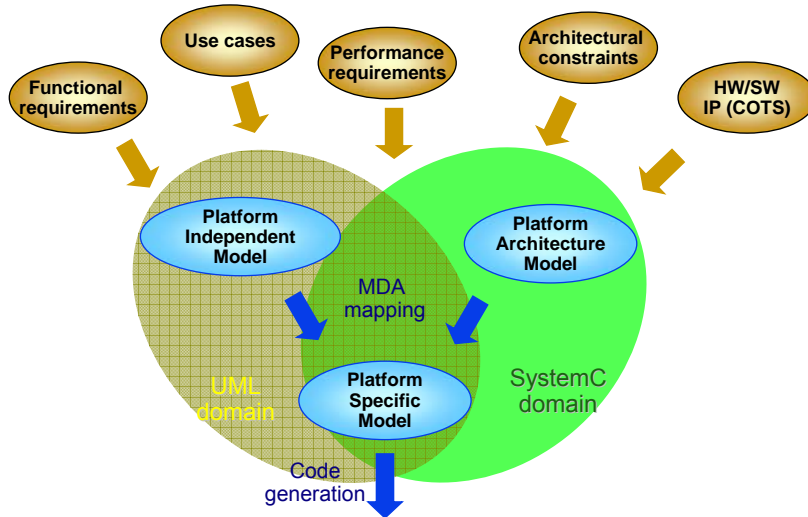
## Targeting The Root Cause of Challenges



# Development Tools Ecosystems

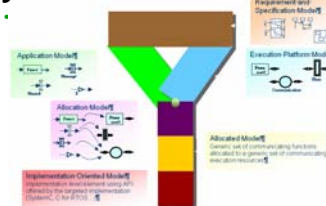


## Model-Based Thinking in MARTES

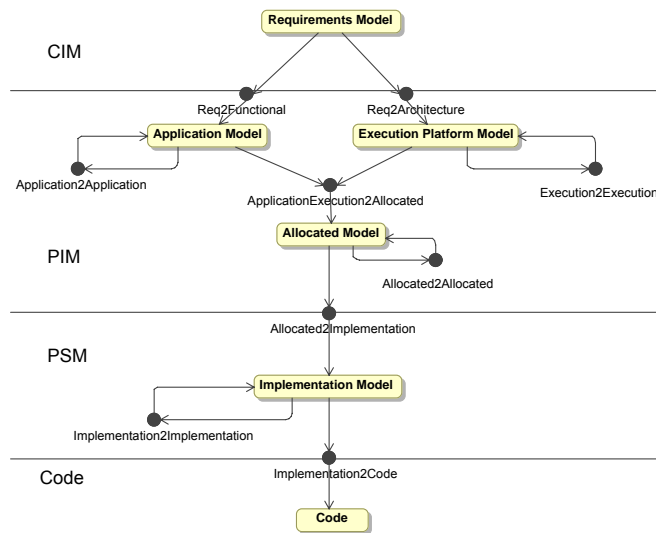


## Models in the MARTES methodology

- Based on a Y chart co-modeling approach
  - Adopt ideas from MDA particularly the separation of application functionality and platform
- MARTES Domain Specific Model
  - used to define the structure and parameters
    - of an application and execution platform as well as their allocation
  - RTES Domain oriented meta-models designed to enhance the support of external domain tools
    - for automatic analyzing, profiling, description of an embedded system
- MARTES UML 2 profile
  - defines a set of stereotypes for extending UML as well as design practices
    - to describe applications, process allocation, and platforms
    - Specification of non-functional requirements
    - Service oriented system modeling



## Model Transformations in the MARTES Methodology

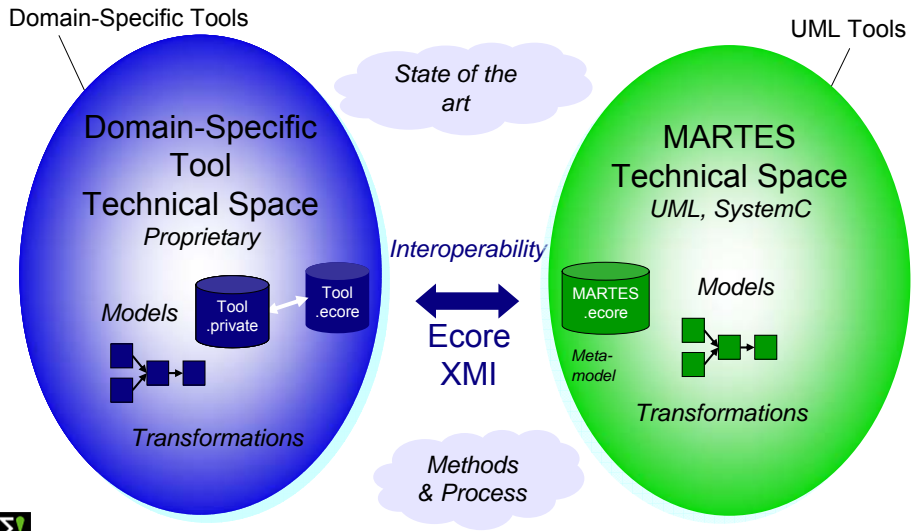


## Model Driven Development Process

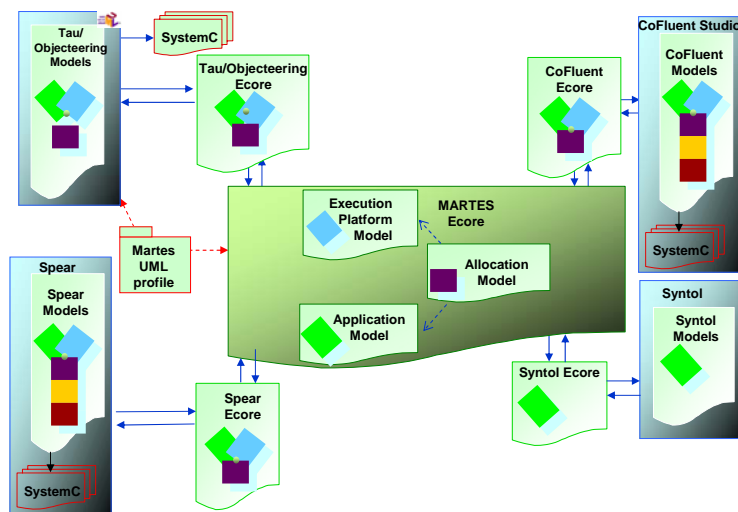
- MARTES common MDD Process Framework described is based on:
  - The basic common Y-Chart MDDE (MDD Environment) process
    - output MDDE that contains an infrastructure part
      - platforms, languages, transformations, etc.
    - a method part
      - guidelines on how to use the infrastructure
  - The specific MDDE refinement process
    - specific version of the MDDE process that guides the partners in creating their own specific instance of the initial Y-Chart MDDE
  - MDD traceability issues
    - as the ability to extract historical information out of a current model
      - Requirements vs. Transformation Traceability
      - Generic/Full vs. Specific Traceability
  - MDD and DO178B standardization issues

**KSY3** Saattaa olla liiankin tekninen  
Systa Kari; 16-9-2008

## Tool Interoperability Approach



## Tool Framework



## Case Studies

- Validate whether the methodology fits to the particular organizations of the partners
- Validate whether tools are valid for the specific environment of each partner, namely:
  - Nokia and Telefónica (mobile communications)
  - Barco (Avionics, safety critical software)
  - GMV (Defense and Aerospace, safety critical software)
  - Thales (communication systems)
  - NXP (process networks)

## Standardisation perspectives

- **Barco** is closely monitoring the evolution within the DO178C standardization committee
  - to ensure that the expected results from the MARTES project remain compliant with future Aviation regulations
- **INRIA, Softeam, Telelogic, Thales** and **Universidad de Cantabria** are contributing to the definition of the OMG UML MARTE profile inside the ProMARTE consortium
  - the contributions are related to the MARTES methodology

## Results and Impact

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### Methodology

- Common approach towards model-based RTES development, documented in public deliverables
- A way to use UML and SystemC for RTES development with specified UML-profile that is fed to OMG standardization
- Strong dissemination activity with 100+ articles, conference papers and other publications

### Tools

- Metamodel-based tool integration, using EMF & Ecore
- New features to commercial tools
- Experiences
- Industrial case studies, encouraging results



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## Conclusions

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- Identifying common approach across industry sectors challenging
  - Different terminology
  - Requirements may seem more different than they actually are
  - Good co-operation spirit helps
  - Industry acceptance of the Y-methodology is one of the most important achievements of MARTES
- Model based approach and focusing on meta-models proved to be useful
  - Good way to accurately define the terminology
  - Good way of achieve semantically solid tool interoperability
- Standardisation crucial for industry wide adoption
  - Many equally good ways to do the same thing – have to agree to choose one
  - The quite big size of MARTES consortium helps to make initial impact e.g. in OMG
  - Big enough market needed to attract the interest of tool providers



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## Project Partners

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**the Netherlands**

NXP  
Powered by Philips

**Sweden**

Telelogica

LUND UNIVERSITY

**France**

THALES

SOFTEAM

Fluent

INRIA

**Spain**

Telefonica

gntv

Universidad Carlos III de Madrid

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