Year 2 Review
Paris, November 8th and 9th, 2006

Highlight on

UML for RTES:
develop a UML-based proposal
for modelling and analysing of RTES

Activity leader :

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CEA-LIST

Previous Work

- Set up and influence at the OMG a request for proposal (RFP)

  "UML profile for Modeling and Analysing Real Time Embedded systems"

  → realtime/05-02-06 (MARTE RFP)

- Setup an OMG submitter team in order to answer to the RFP

  → Artisan, Carlton University, CEA, IBM, I-Logix, INRIA,
  Looked-Martin, Thales, Tri-Pacific

- Submit the initial proposal in the first year

  → realtime/05-11-01 (MARTE initial submission)

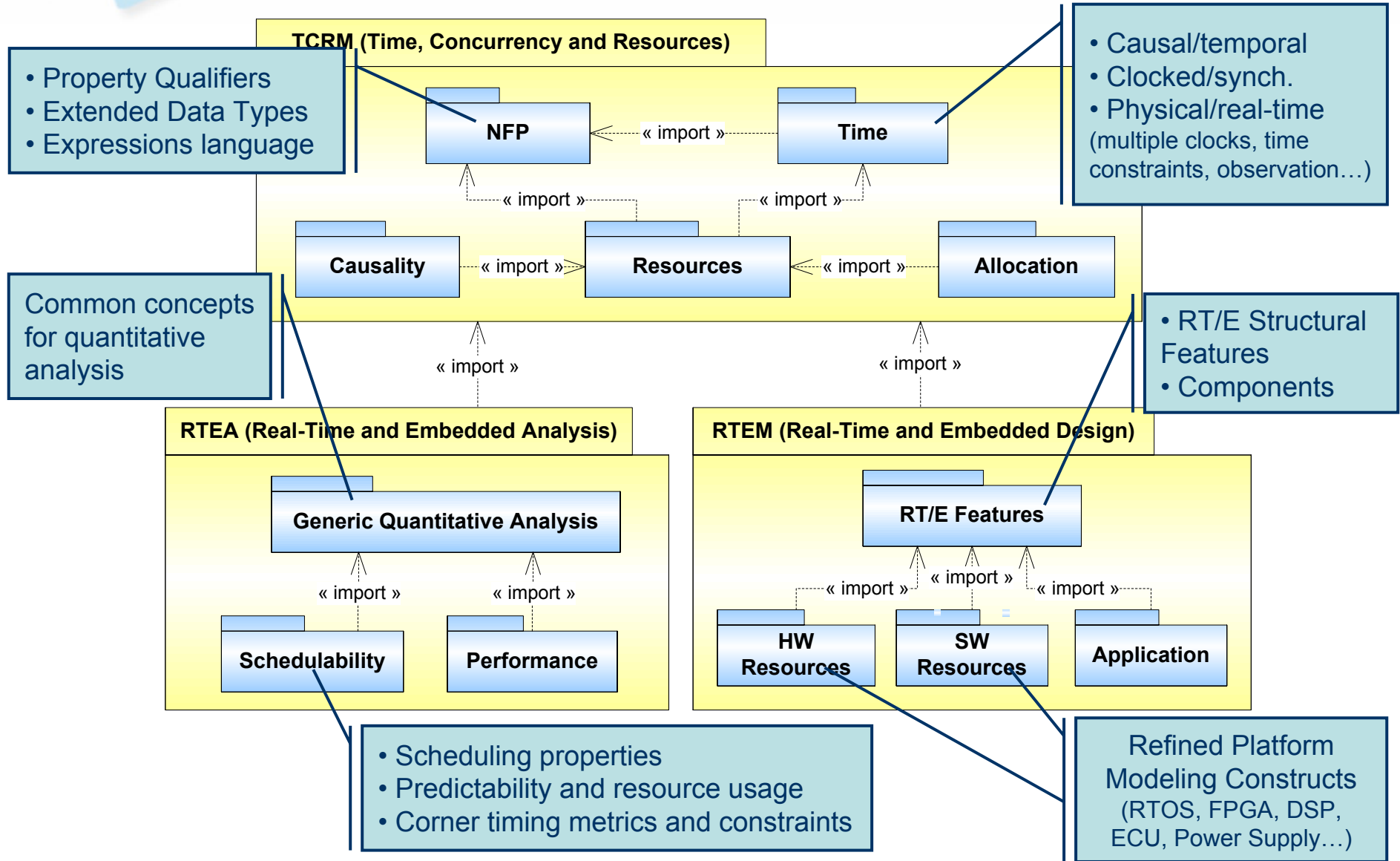# UML Extensions Supporting Real-Time Systems Modeling
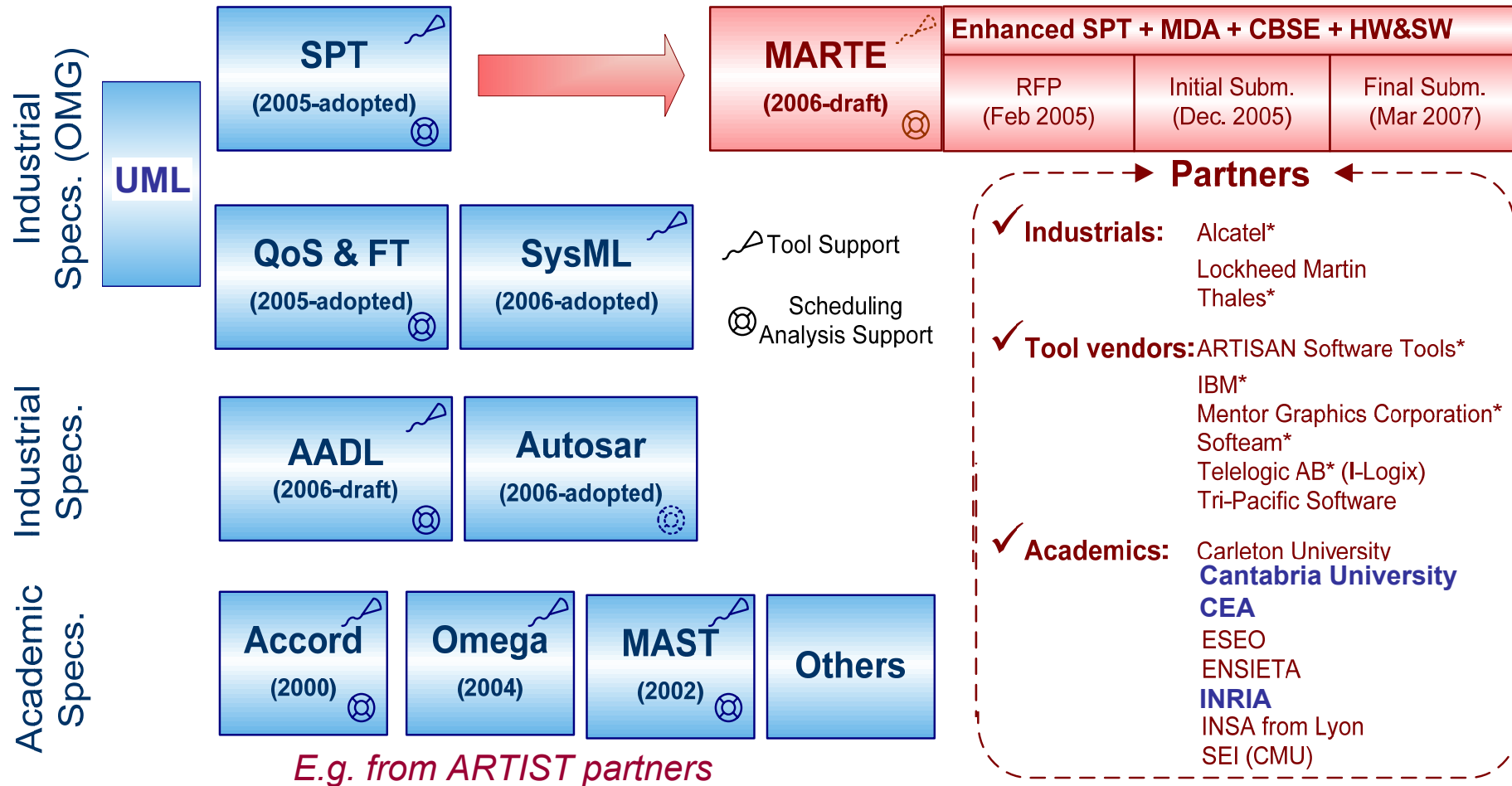
Problem Tackled in Year2

- Special focus on representing { *resources, timing, RT/E qualities of service, communication modes, execution modes* }

- Start experiments of MARTE through realizations of case studies and connections with analysis tools such as schedulability analysis tools

- Create links with other standards (AUTOSAR, AADL)

- **Difficulty: Dissemination issue due to privacy rule of work at OMG**
  → only available document is the initial submission only members of ProMarte consortium can access the full information of the proposal

  → dissemination done through summer schools *(MDE for DRES, ARTIST2 summer school)*, workshops *(MARTES at Models)*, publications…

→ Very strong involvement of ARTIST2 partners:
CEA-List (lead), INRIA (DaRT, ESPRESSO and AOSTE), Univ of Cantabria, & associated THALES (TRT, DAE, TCF and TSS)…

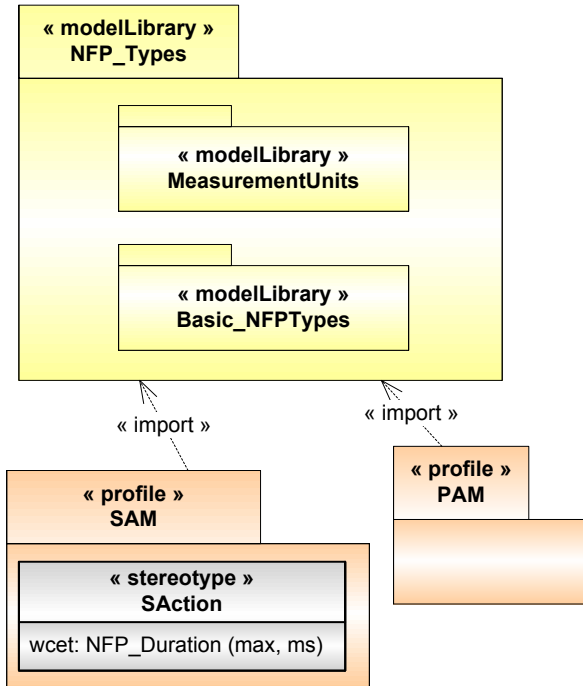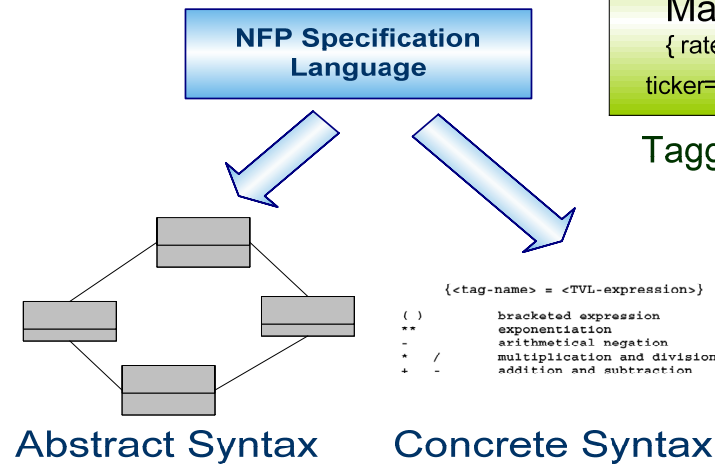✔ *funding projects: CARROLL (Thales/CEA/INRIA), Usine Logicielle of System@tic, RNTL OpenEmbeDD*

TCRM (Time, Concurrency and Resources)

- Property Qualifiers
- Extended Data Types
- Expressions language

- Causal/temporal
- Clocked/synch.
- Physical/real-time
(multiple clocks, time constraints, observation…)

NFP «import» Time

«import» «import»

Causality «import» Resources «import» Allocation

Common concepts for quantitative analysis

- RT/E Structural Features
- Components

«import» «import»

RTEA (Real-Time and Embedded Analysis)

RTEM (Real-Time and Embedded Design)

Generic Quantitative Analysis

RT/E Features

«import» «import»

«import» «import» «import»

Schedulability | Performance

HW Resources | SW Resources | Application

- Scheduling properties
- Predictability and resource usage
- Corner timing metrics and constraints

Refined Platform Modeling Constructs (RTOS, FPGA, DSP, ECU, Power Supply…)

1) Declaration of NFPs

« modelLibrary »
NFP_Types

« modelLibrary »
MeasurementUnits

« modelLibrary »
Basic_NFPTypes

« import »   « import »

« profile »
SAM

« profile »
PAM

« stereotype »
SAction
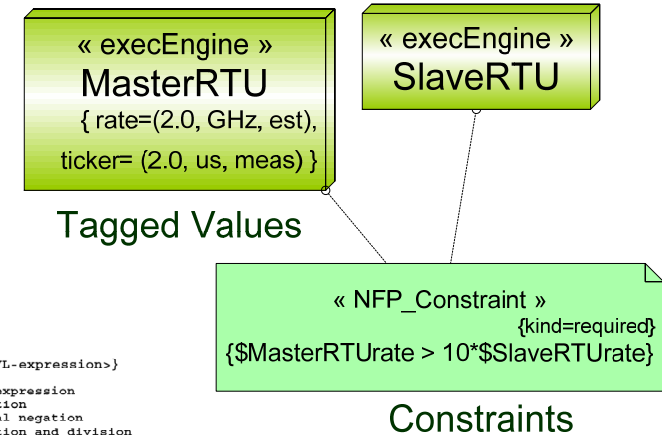
wcet: NFP_Duration (max, ms)

- To define, qualify and organize NFPs

- It defines the structure of NFP specifications: value, measurement units, statistical nature of measures...

2) Value Specification

NFP Specification Language

```
{<tag-name> = <TVL-expression>}

( )    bracketed expression
**     exponentiation
-      arithmetical negation
*  /   multiplication and division
+  -   addition and subtraction
```

Abstract Syntax   Concrete Syntax

- A complete language for NFP value specification: abstract & concrete syntaxes.

- Exact notation for values: extended Literals, Intervals, Tuples, Variables, Complex and Time Expressions.

3) Annotation Mechanism

« execEngine »
MasterRTU
{ rate=(2.0, GHz, est),
ticker= (2.0, us, meas) }

« execEngine »
SlaveRTU

Tagged Values

« NFP_Constraint »
{kind=required}
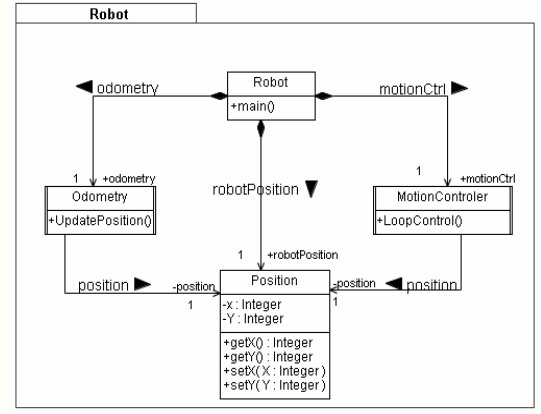{$MasterRTUrate > 10*$SlaveRTUrate}

Constraints

1. Tagged values: profile mechanism.

2. Constraints: OCL-like language.

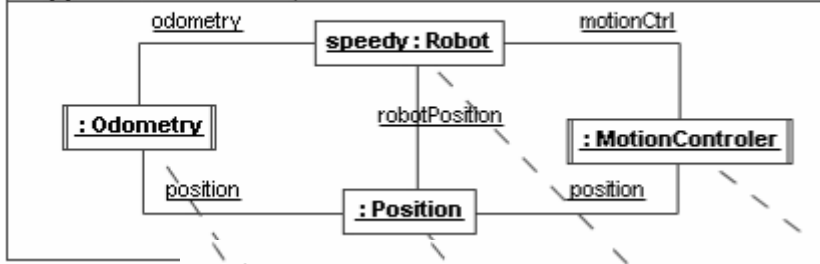3. Direct use in UML models by applying MARTE NFP Types to Properties of Classifiers.

Application Model

→ **Free specification &**
Open Source API of a simulator
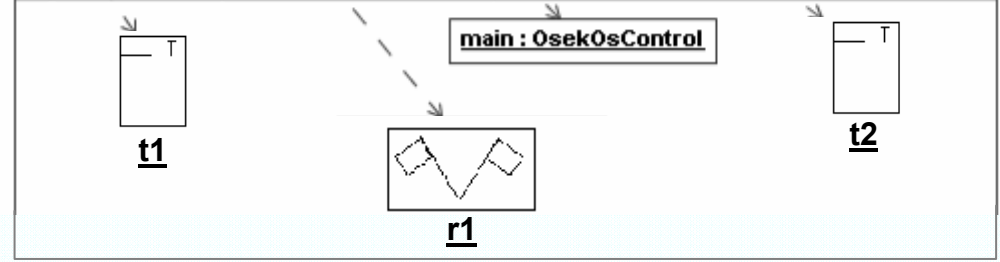
Execution Resources Model
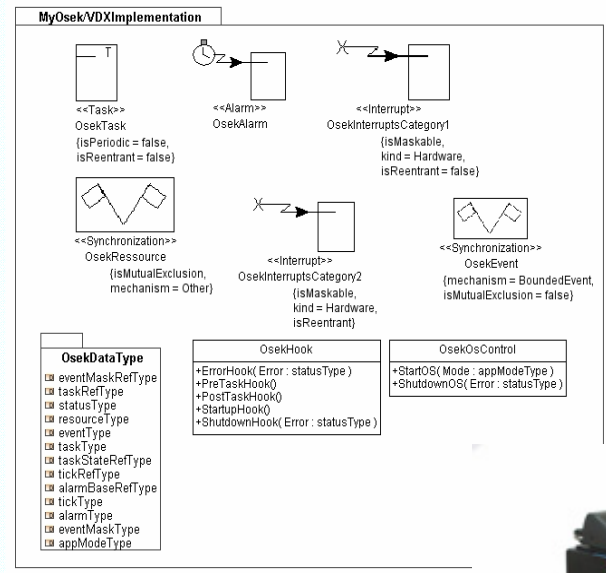
The Pionner2dx robot

Links with other standards: *not only UML...*

- Consolidate and disseminate an ADL for automotive:

ΛTESST → *IST project with ARTIST2 partners: CEA, KTH + associated Volvo Tech (lead), DaimlerChrysler, and Siemens VDO,TUB, ETAS + Carmeq, Volvo Car, Delphi/Mecel)*

→ Based on EAST-ADL & aligned on AUTOSAR through its meta-model

→ *Each standard is seen through its meta-model*

- A modeler supporting the language
and build by specialization of an
Open Source UML modeler
and profile builder build on
technical standards
(Eclipse, EMF, GMF...)

Papyrus

EAST-ADL Profile

UML2 MetaM

Autosar MM

EMF

eclipse

Information Society
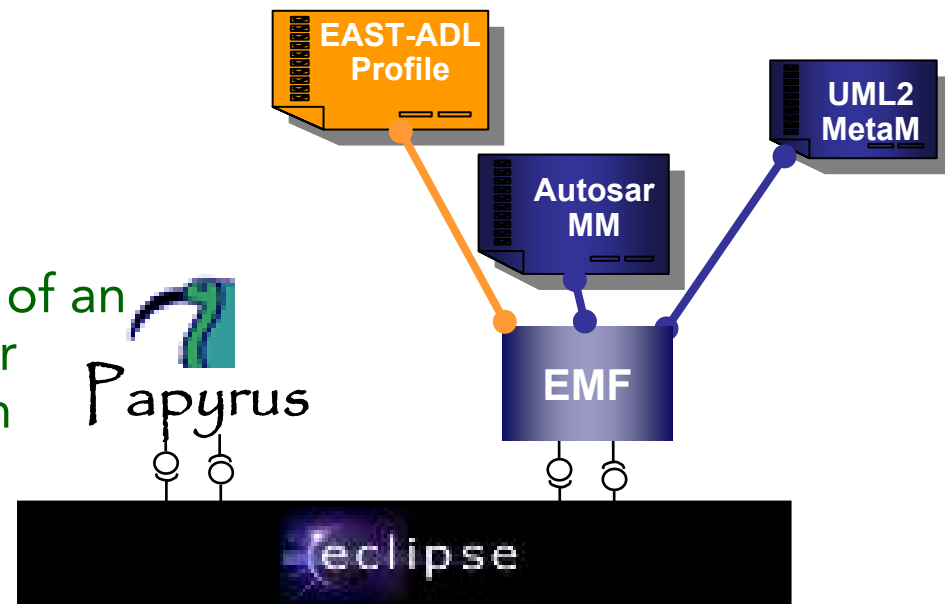
Future Work and Evolution

- Next OMG standardization next stages:

  - Revised Version (the future OMG standard):   March 2007

  - Final Version (consolidation/debug of the standard):   February 2008

    - Formally the document is accessible to external reviewers

    - Policy of ProMarte consortium will be to make it public and disseminate ➔ ARTIST2 Partners contribution will consolidate the standard and its adoption

  - Disseminate and link with other standards

    - Provide an Open Source solution to use MARTE and extend it

      - Implementation of the profile, tutorials, guidelines…
      - UML modeler + specialisation for MARTE + profile editor ("Papyrus")

    - Create convergence with automotive domain:

      - AUTOSAR + Time conform to MARTE ➔ through an incoming project ITEA-TIMMO
      - EAST-ADL conform to MARTE

    - Create link with execution platform standards (Autosar, CCM, Fractal/Think…)

      - Build common component model for platforms and modelling formalisms