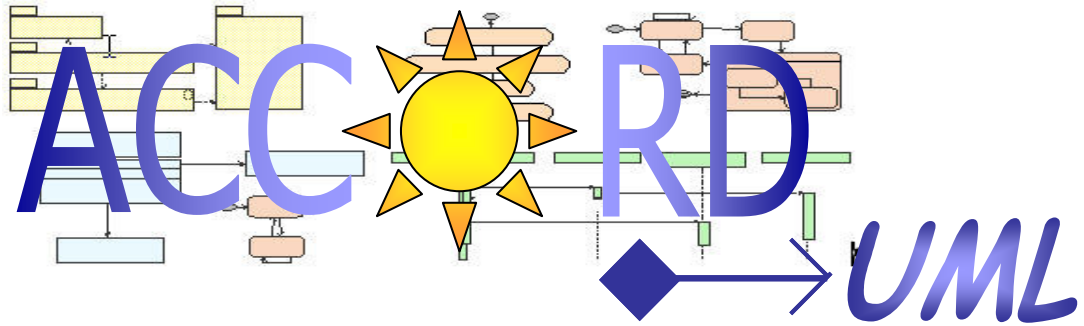


Methodology

François Terrier, Sébastien Gérard

DRT-LIST/DTSI/SOL/LLSP, CEA/Saclay,
F-91191 Gif sur Yvette Cedex France
Phone: +33 1 69 08 62 59 ; Fax: +33 1 69 08 83 95
Francois.Terrier@cea.fr ; Sebastien.Gerard@cea.fr

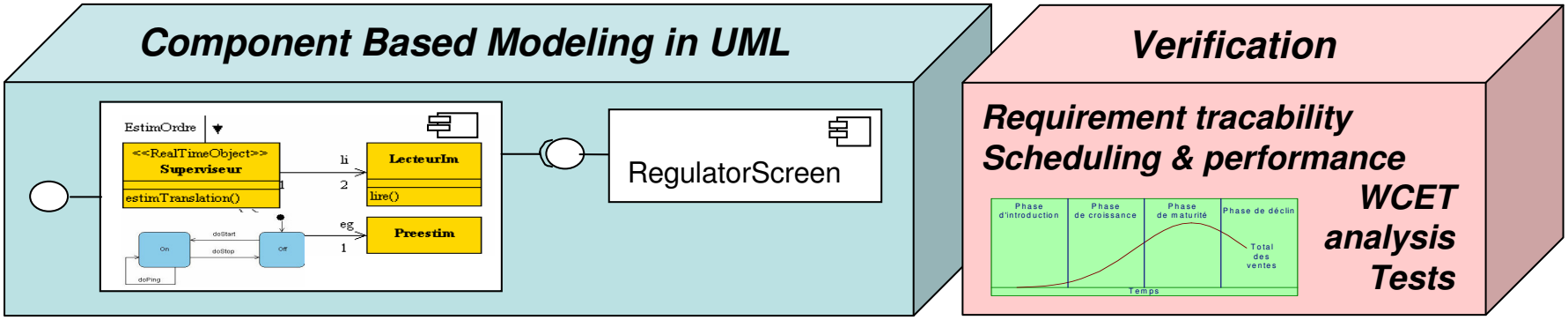
ACCORD/UML Methodology

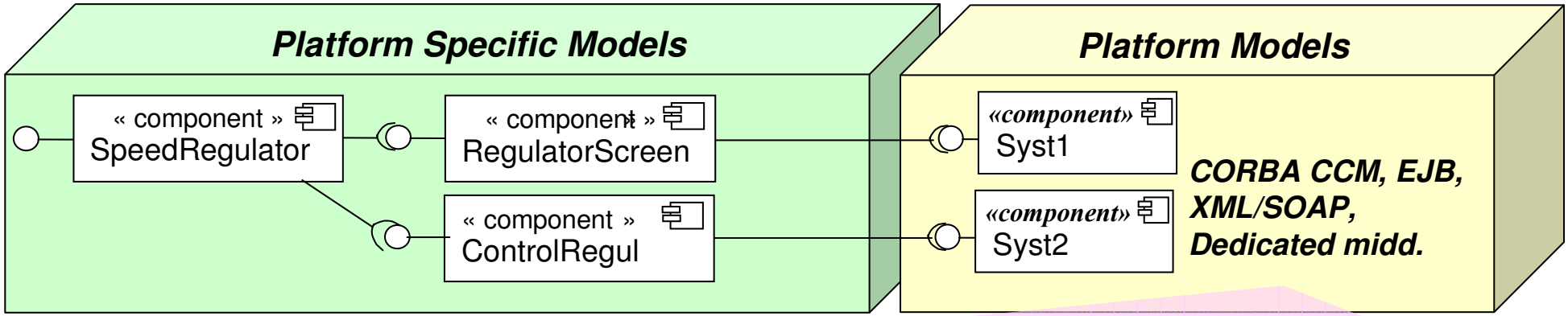
➔ Results of 10 years of OO researches for ERT-Systems
- \+ collaborations with PSA, Thales, CS SI, MBDA…
- \+ AIT-WOODDES (IST), ACOTRIS (RNTL), EAST-AEE (ITEA)

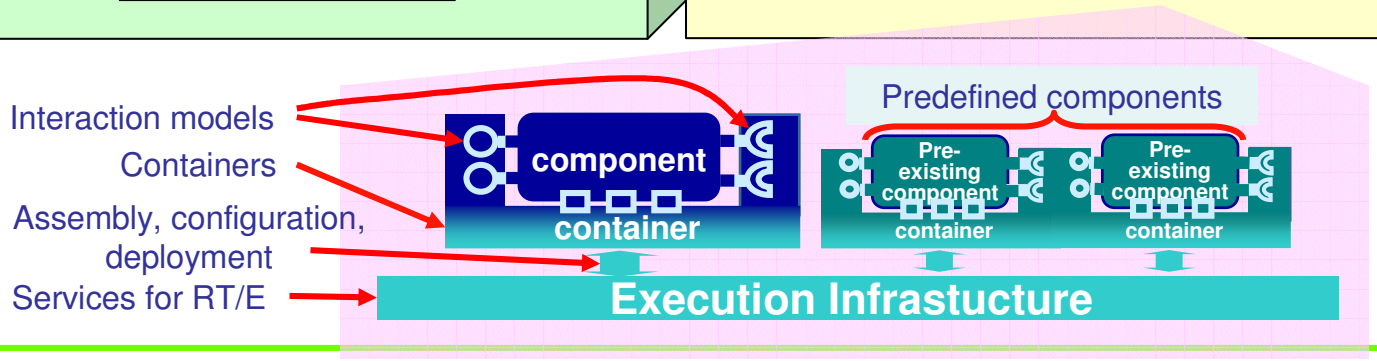
✓ Provides

- → **Modeling methodology:**
  continuous process, separation of functional spec. and implementation constraints or choices
- → **Tools supporting the process and the method**
- → **Model transform., code gen. for rapid prototyping**
- → **Model analysis, test generation**

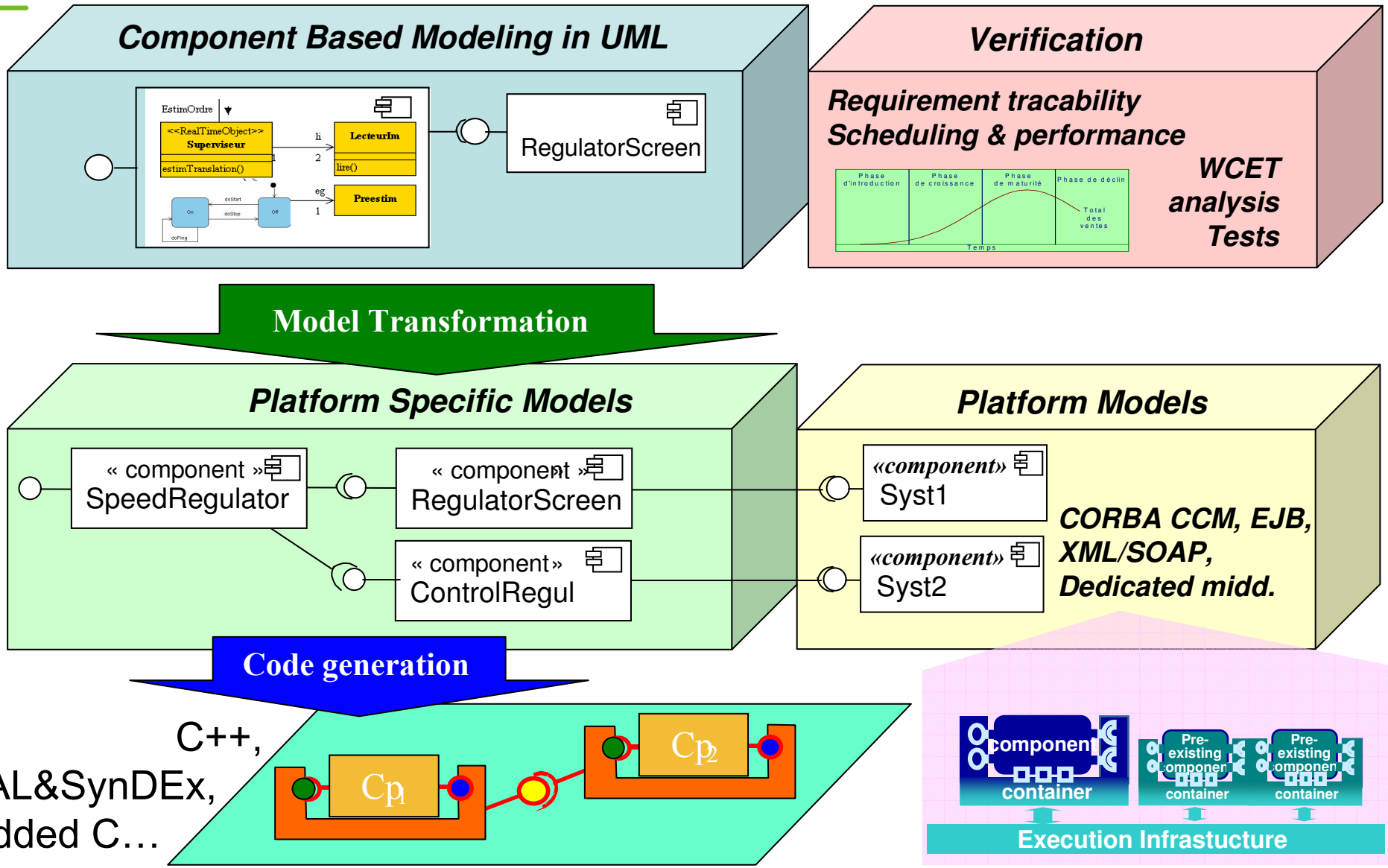
Model Driven Engineering



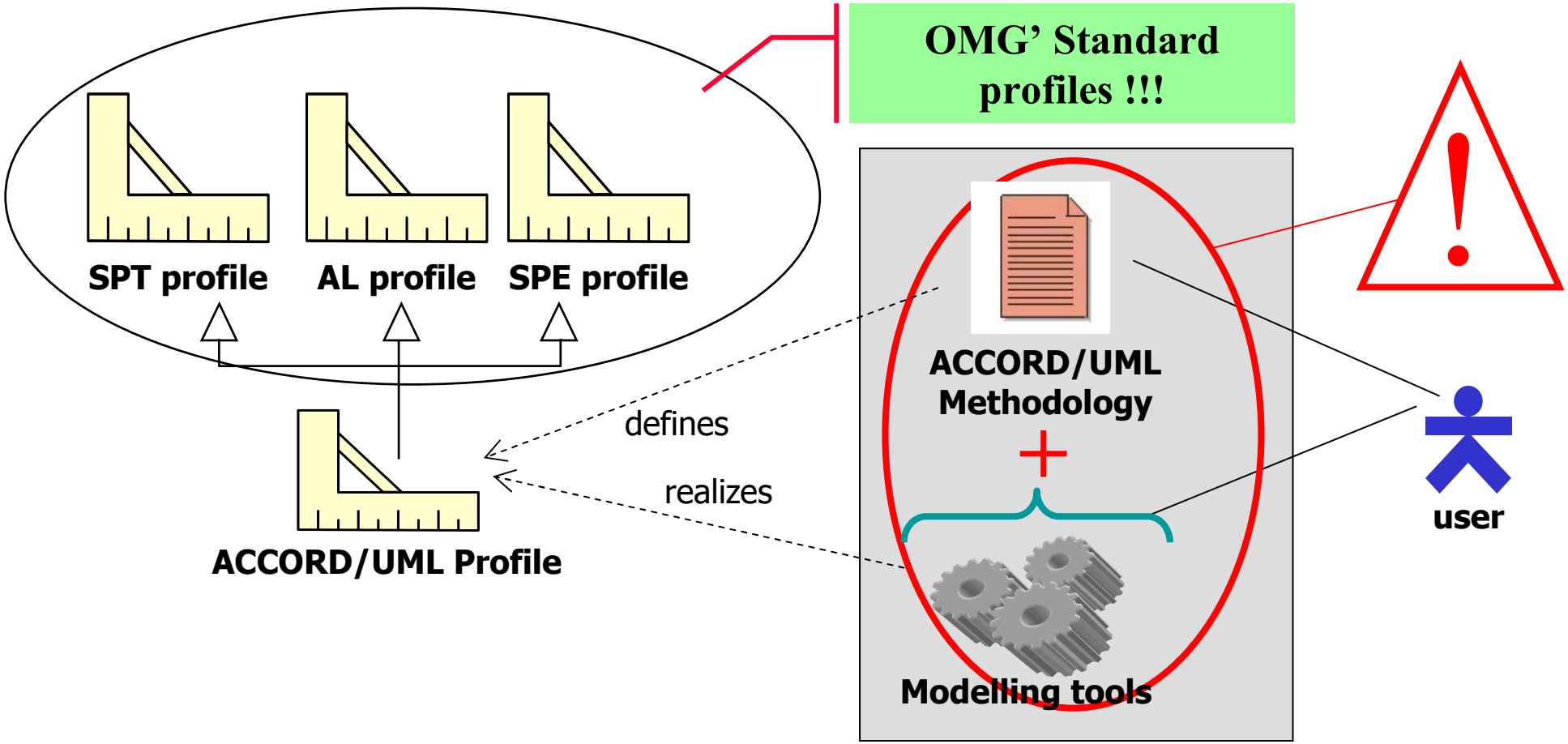




Model Driven Engineering

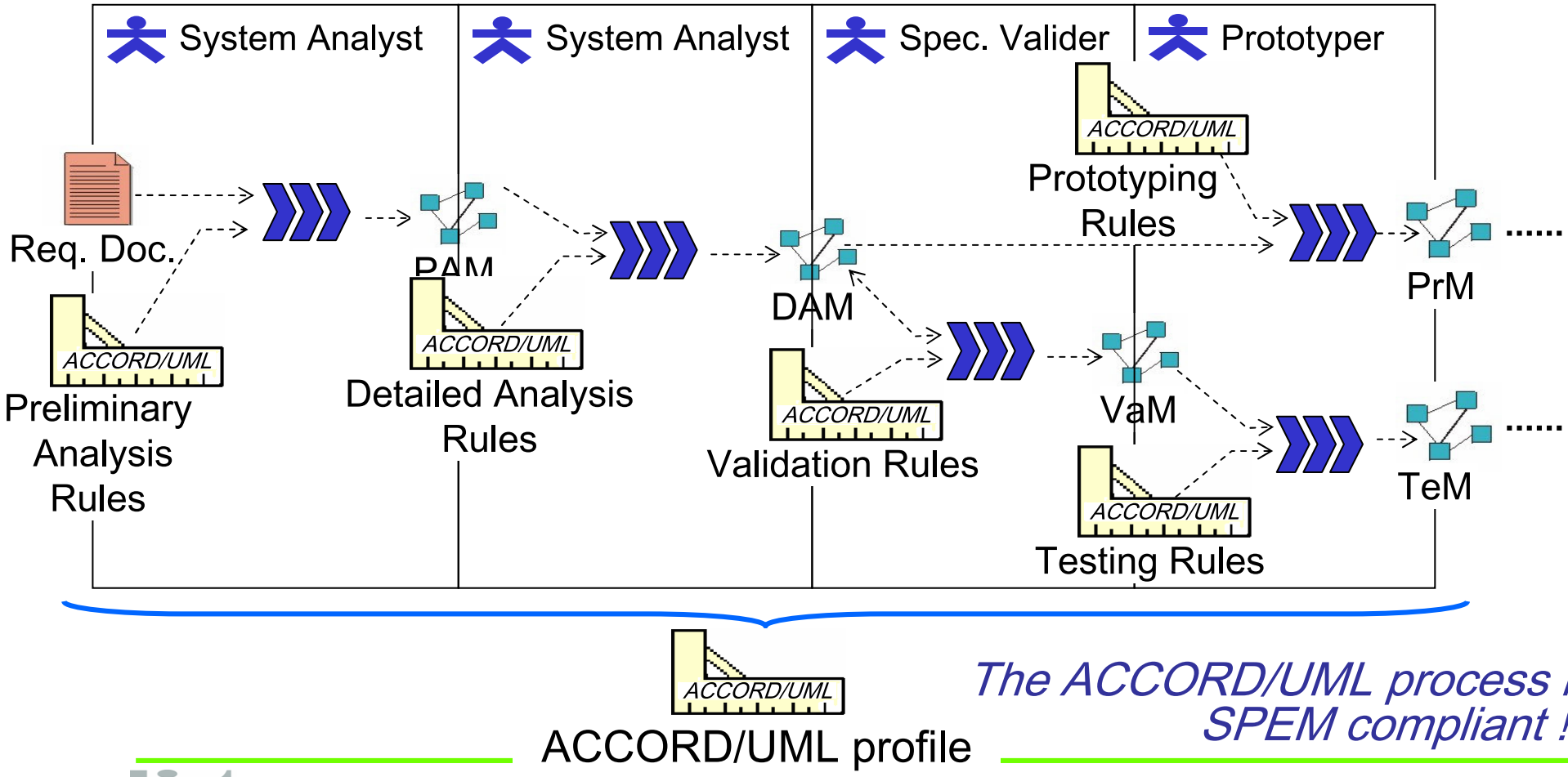


Structure of the Methodology



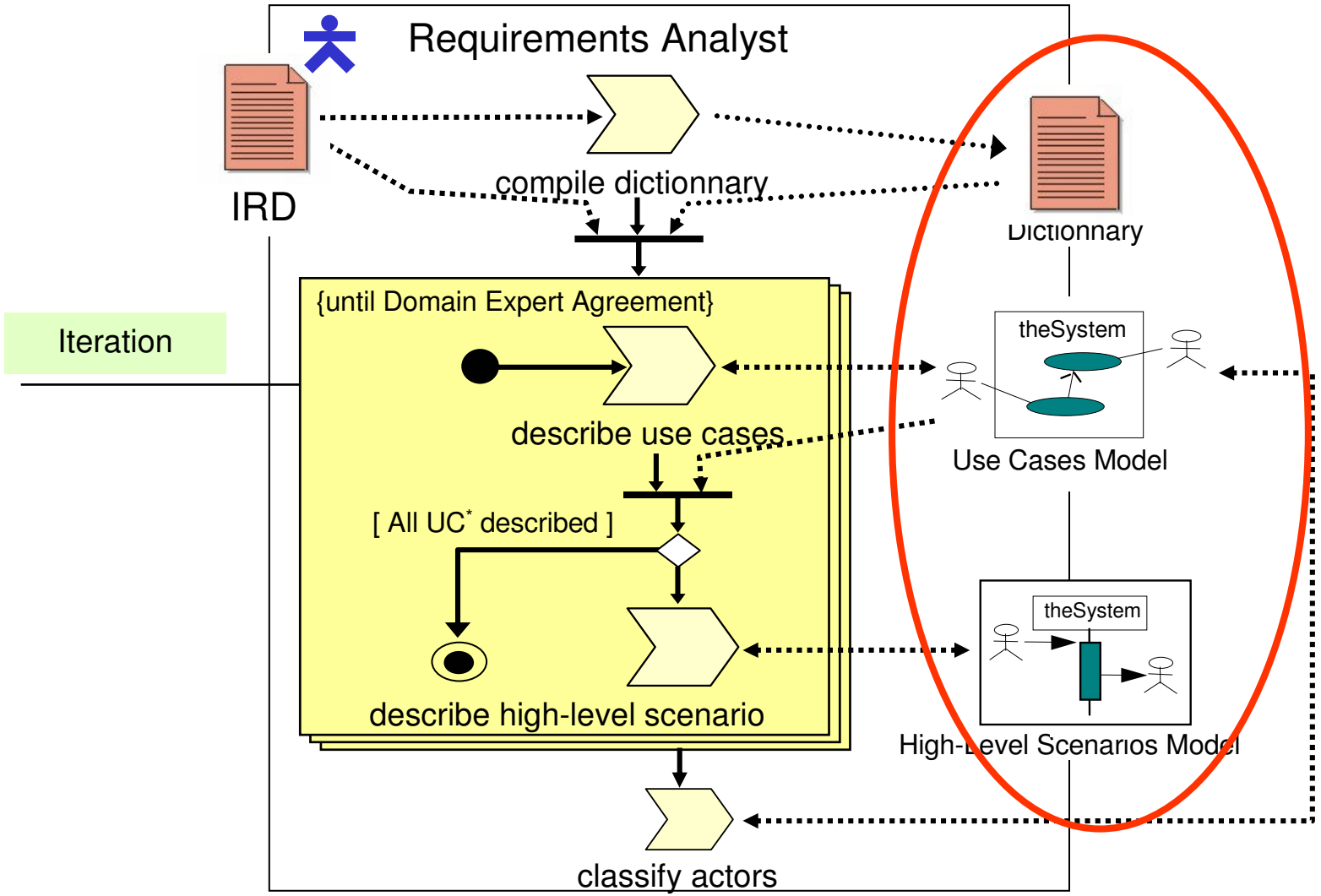
Several modeler points of view

- **System models struct. based on dev. cycle**
  - ✓ PAM, DAM, VaM, PrM, TeM…



The ACCORD/UML process is SPEM compliant !!!

Activity – “build preliminary analysis”



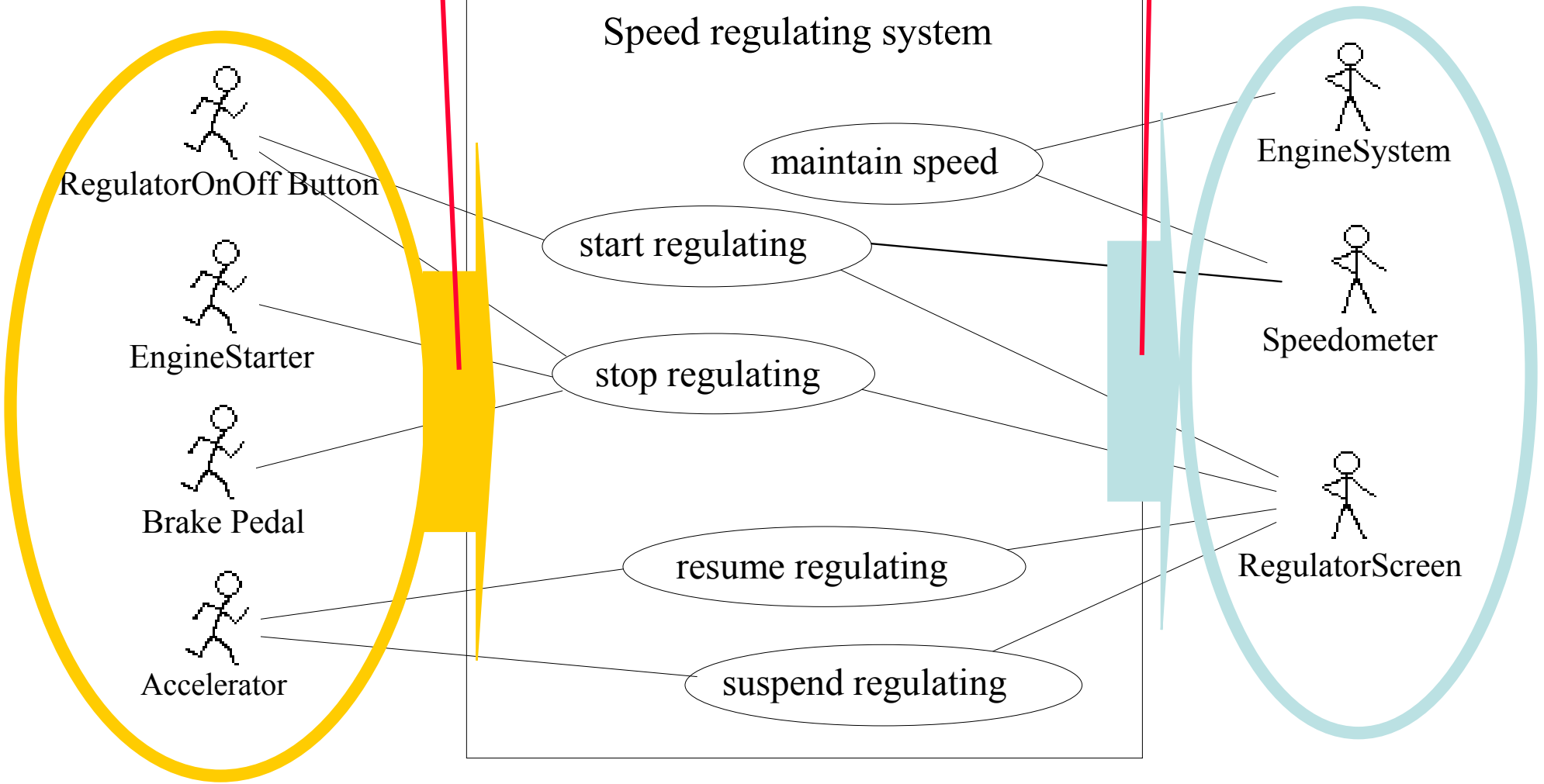
Introduction of Modeling concepts

- Active / passive actors
- Signal communication
- Control / Trigger state machines ➔ ***UML2.0***
- Real Time Objects / Passive Objects
- Real Time Feature ➔ ***SPT & QoS profiles***

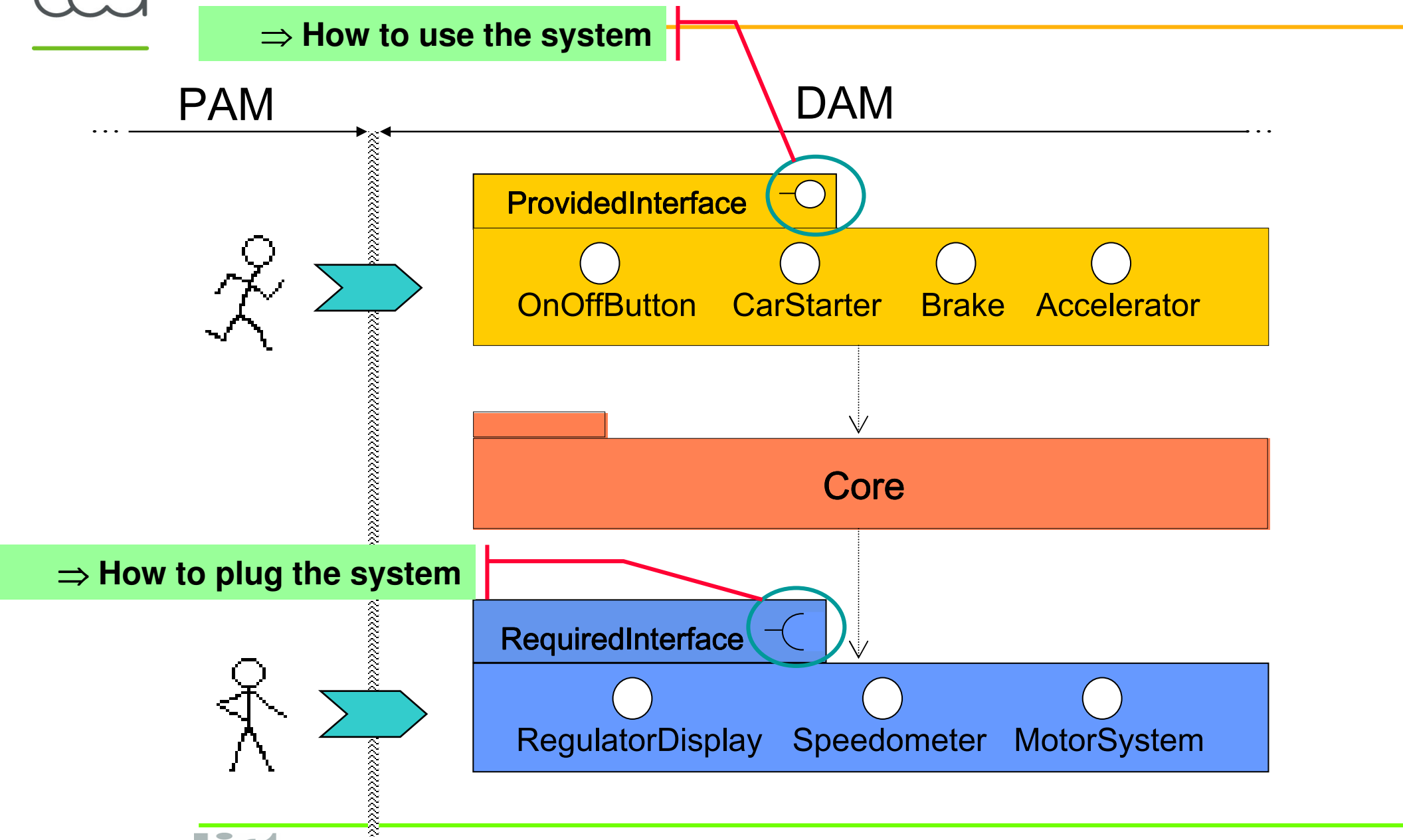
« classify actors » (seq.)

Interactions from environnement to system

Interactions from environnement to system

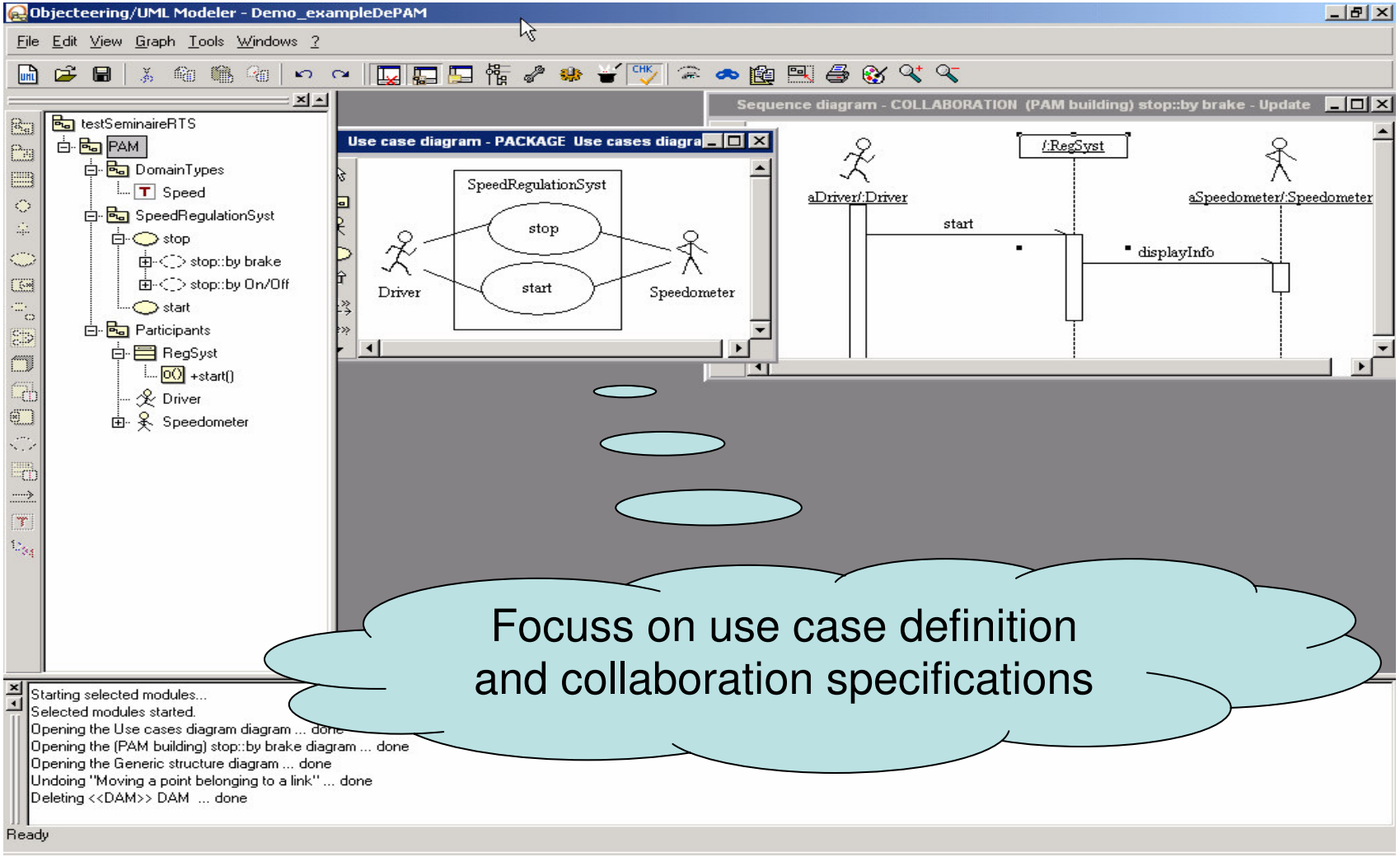


« build structural basis » (seq.)



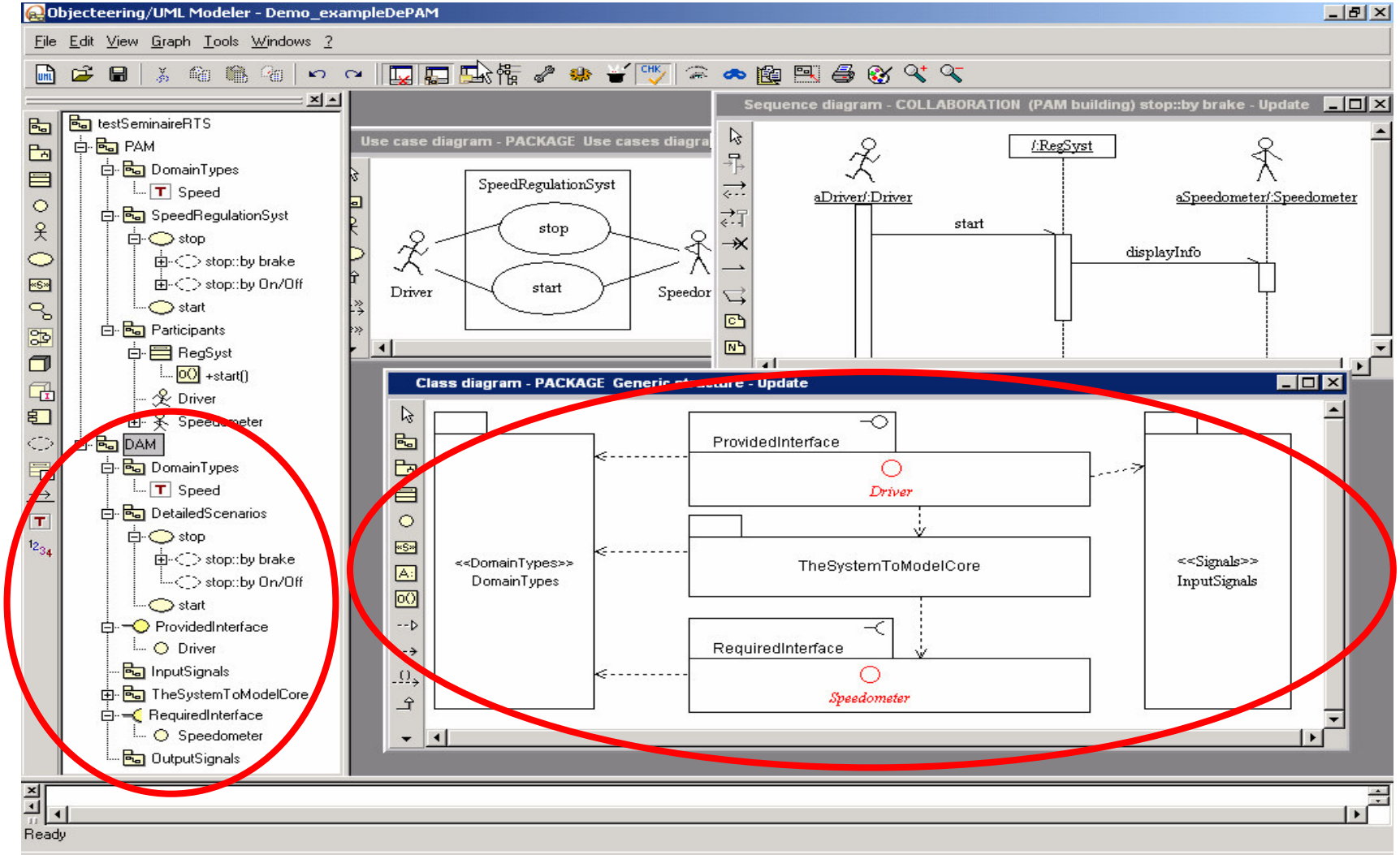
E.g.: ACCORD/UML PAM → DAM

- **PAM : interactions with the system as a blak box**



E.g.: ACCORD/UML PAM → DAM

- **DAM squeleton synthesis + traceability links**



Additional Well-Formedness Rules

SendAction

[3] The target of a *SendAction* is the set of instances constituent of the system and owning a reception to the signal associated to executed send action.

self.target.body = "all"

SignalEvent

[1] The parameter direction of a signal event are always « in » parameters.

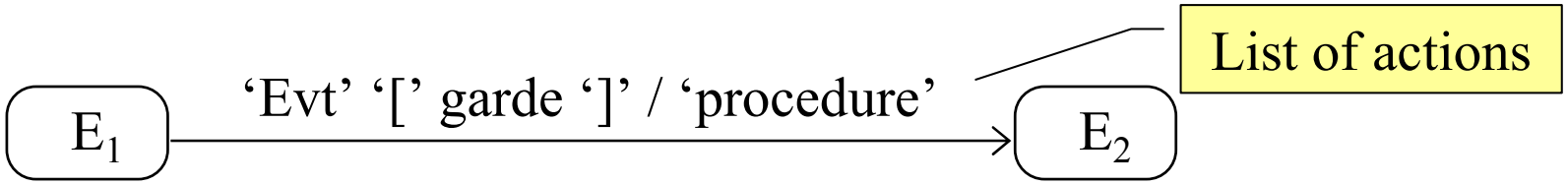
self.parameter → forAll(p | p.kind = # in)

[2] A SignalEvent has as many paramaters as its associated signal has attributes.

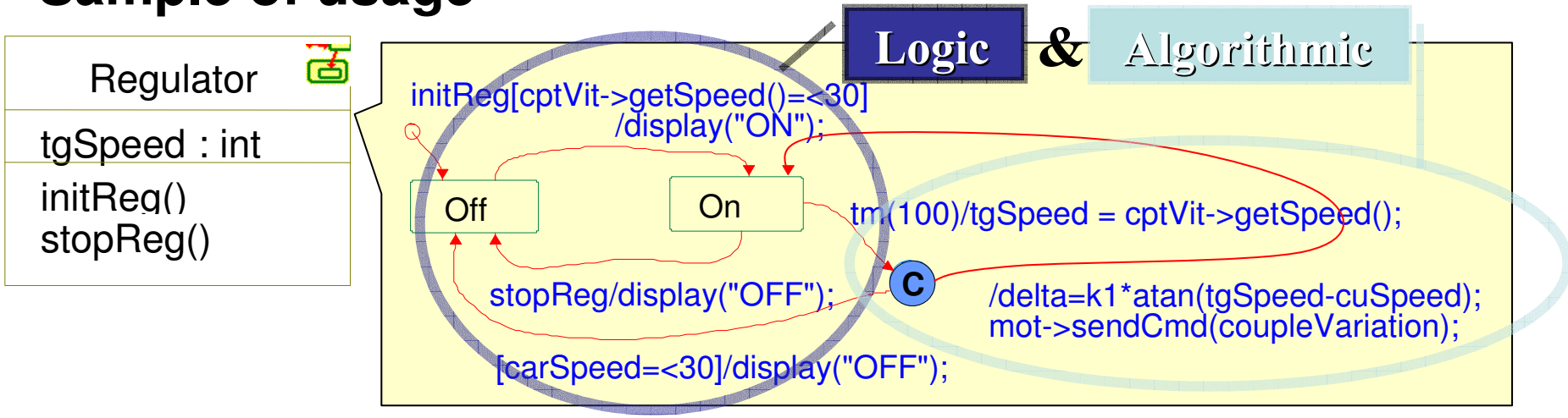
self.parameter → size = self.signal.allAttributes → size

• • •

Usual form of UML state machine



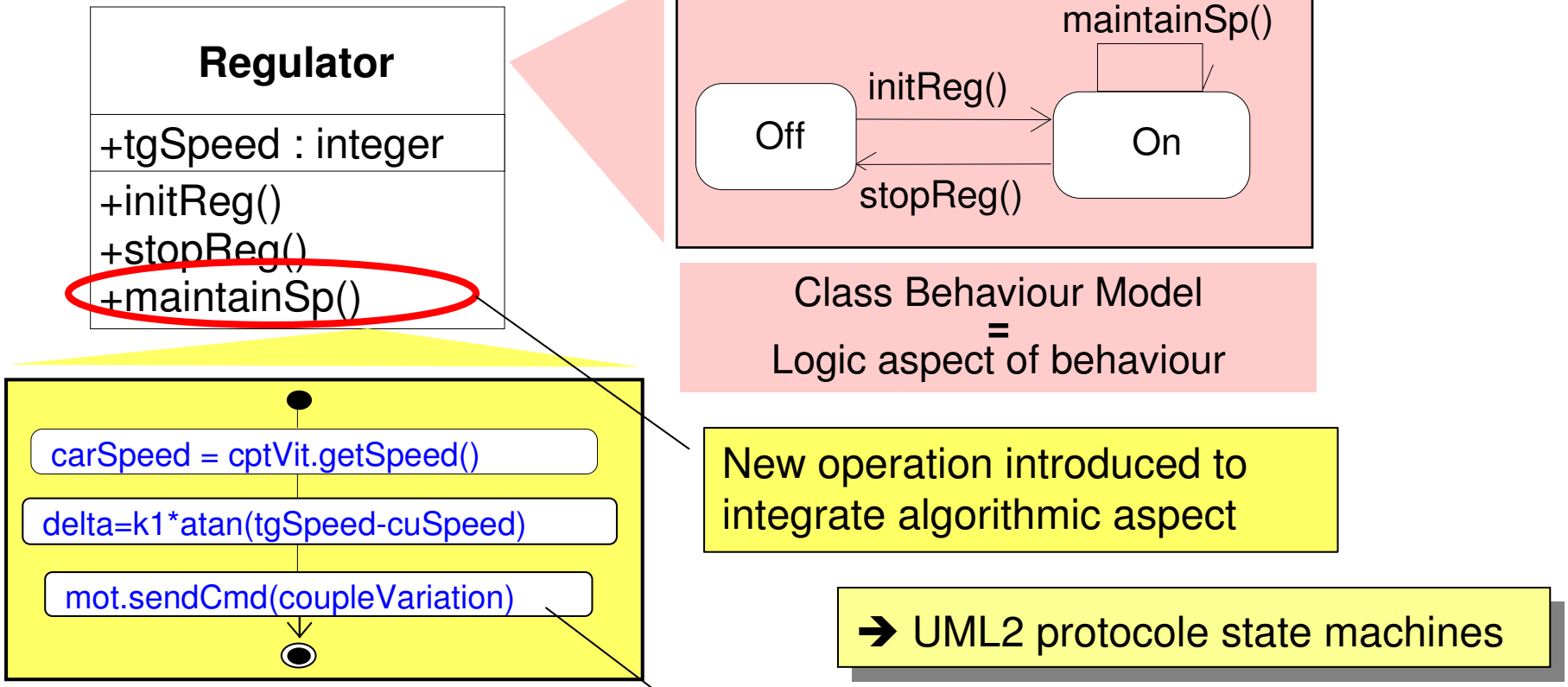
- **Sample of usage**



- **Issues related to this situation**
  - Maintainability ↘ because of different aspects combination
  - Reusability ↘ because of state-machine inheritance issues

Activity – "describe behavioural view"

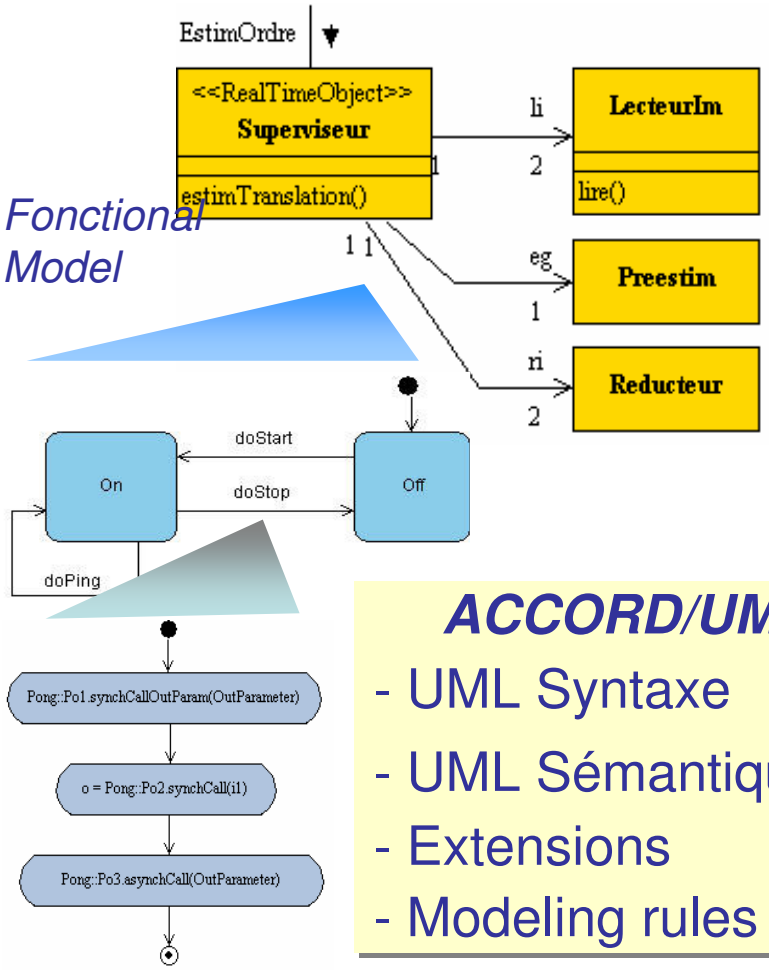
Method Behaviour Model
=
Algorithmic aspect of behaviour



- **Advantages of this proposition**
  - Maintainability ↗ because of separation of concerns
  - Reusability ↗ because of availability of usual OO inheritance mechanisms

• UML → Synchronous : «the fonctional model»

Fonctional Model



ACCORD/UML

- UML Syntaxe
- UML Sémantique
- Extensions
- Modeling rules

→ Restrict the UML model semantics

ACCORD

- An automaton : active object life cycle
- Algorithms inside the operations

➔ ***Introduction of an action language***

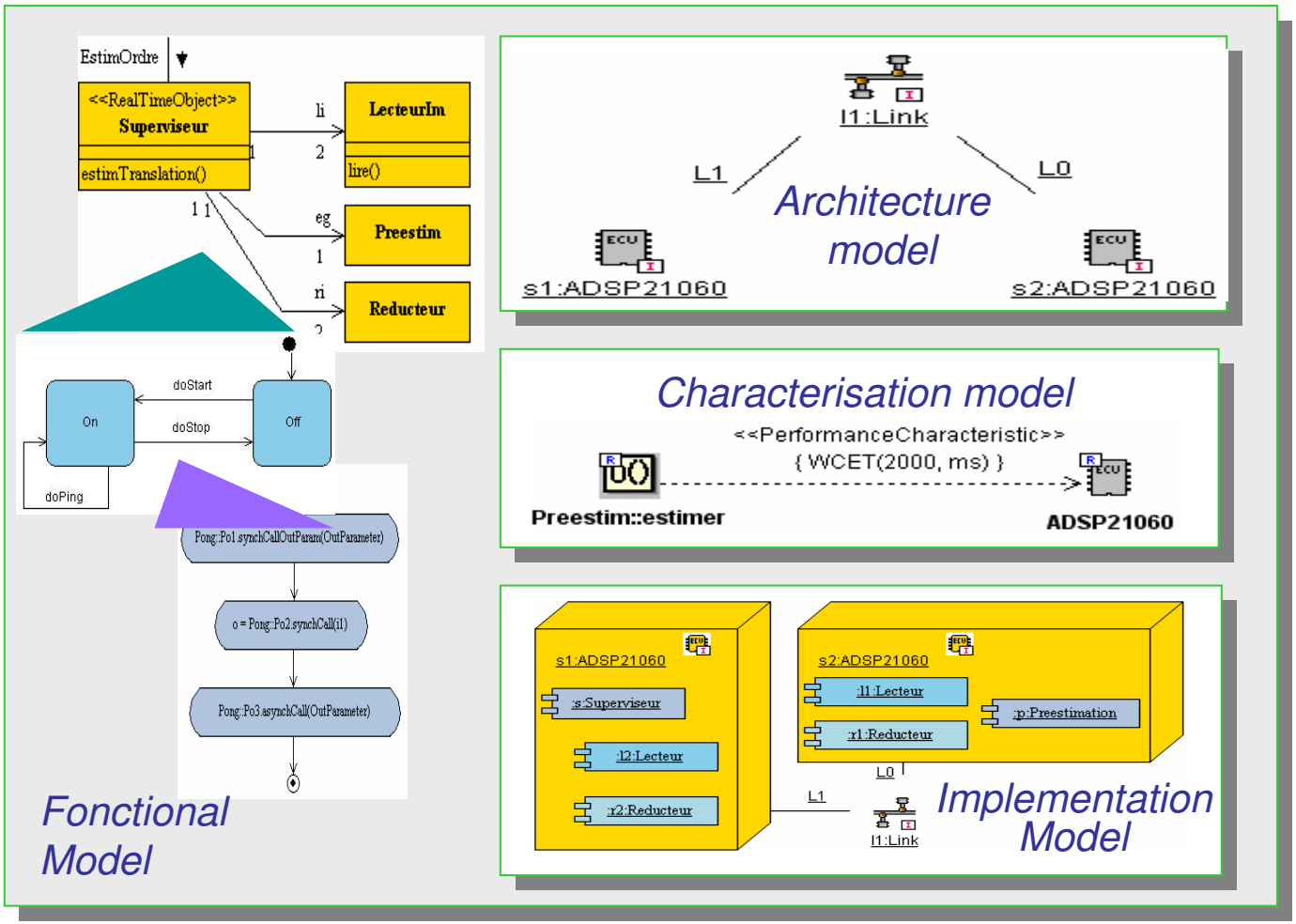
SIGNAL

- Management of a «Message File » struct
- Execution of the related automaton
- Translation of the action language

➔ ***Action clocks synthesis:***
operation calls, send of signals, exploitation of message parameters

• **Simulation & Verification**

- **Hardware architecture characterisation:**



UML

- → HW archi model
- → **Characterisation**
  - ➢ **Operations**
  - ➢ **Datas**
  - ➢ **Deploiement**
- → Iimplementation model

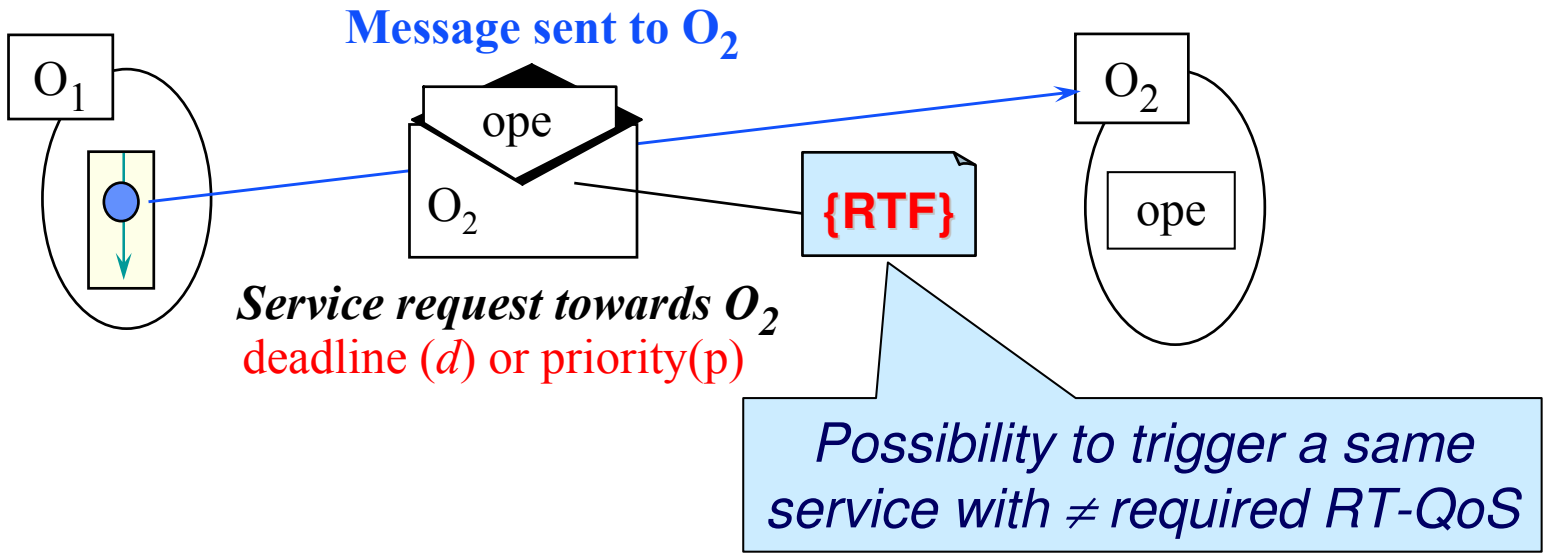
SynDEx

- **Archi translation.**
- Algo. import (*SIGNAL*)
- **Translation mapping**
- **Adequation**
- Coding

Express system timing requirements

Users (PSA, Delphi, IntraCOM) requirements: set deadlines, readytimes, periods, jitters…

➔ Required Real-Time QoS constraints set on message !



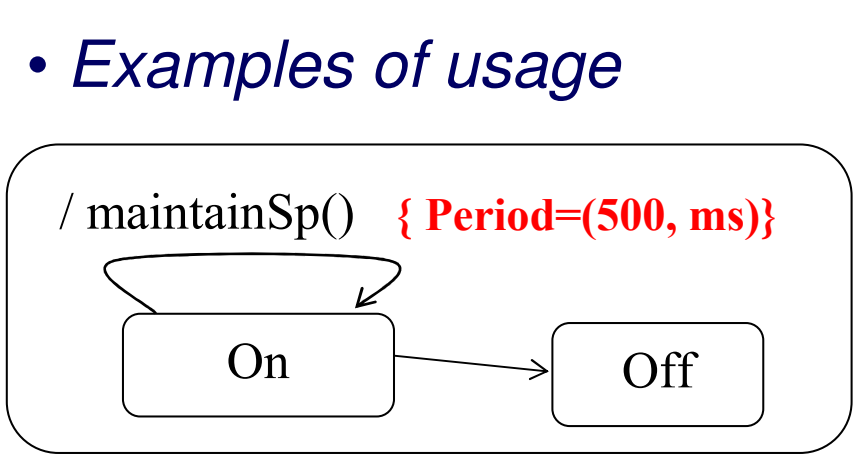
UML extensions

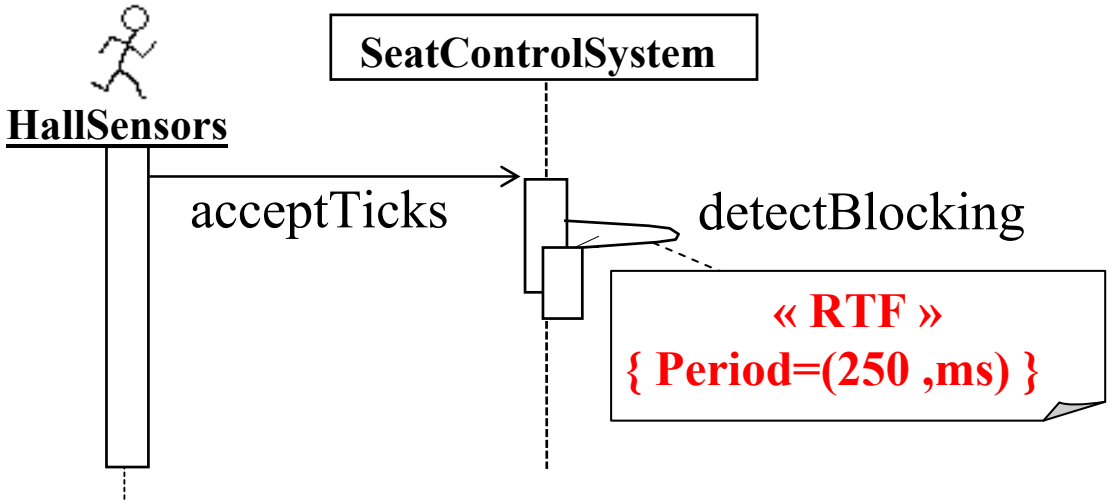
Profile

with Real-Time Features (RTF) and its associated Tagged values

Stereotype	BaseClass	Tags	Tag Type	Tag Multiplicity
«RTF»	Action	Tref	RTtimeValue	[0..1]
	Transition	Deadline	RTtimeValue	[0..1]
	Message	Priority	RTtimeValue	[0..1]
		ReadyTime	RTtimeValue	[0..1]
		Period	RTtimeValue	[0..1]
		…		

- *Examples of usage*



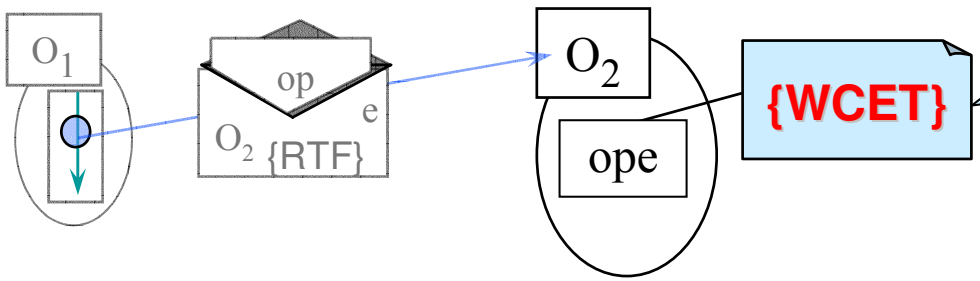


Express implem. timing properties

ACCORD/UML

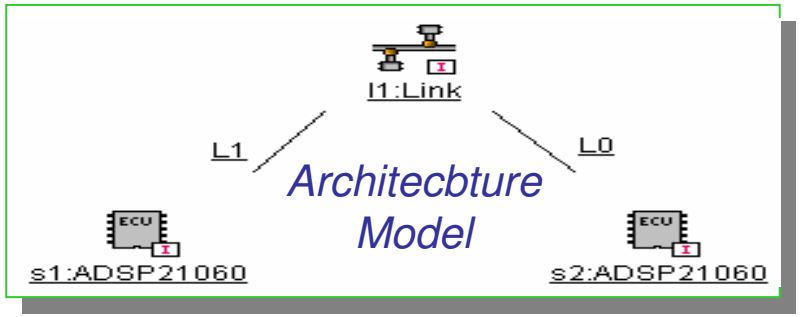
ACOTRIS ⇒ *Users (MBDA, CS-SI…) set computation time…*

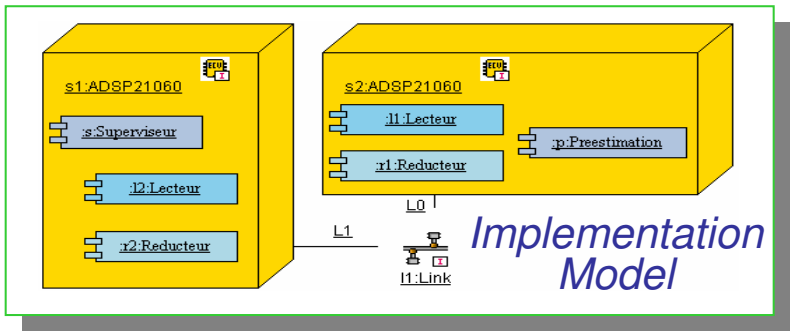
➔ Offered QoS properties or hypothesis on procedures !

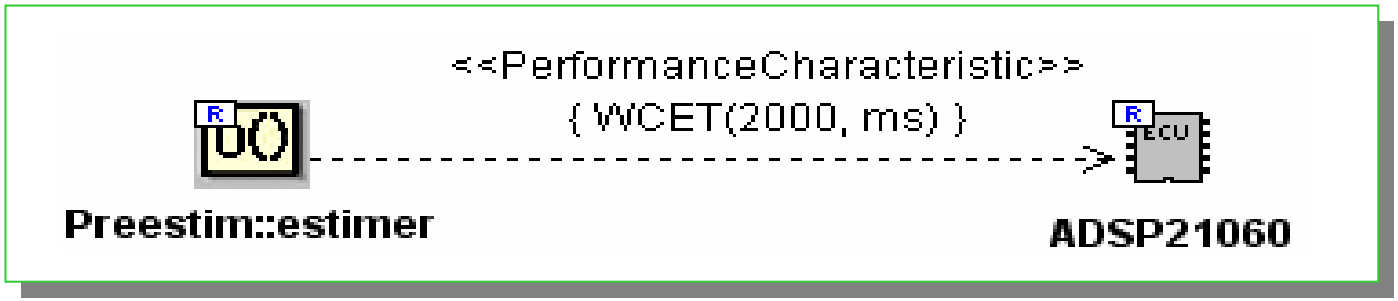


Values depend on mapping of functionnal models (PIM) on actual deployment models (PSM)

Profile *with architecture, deployment and performance description*

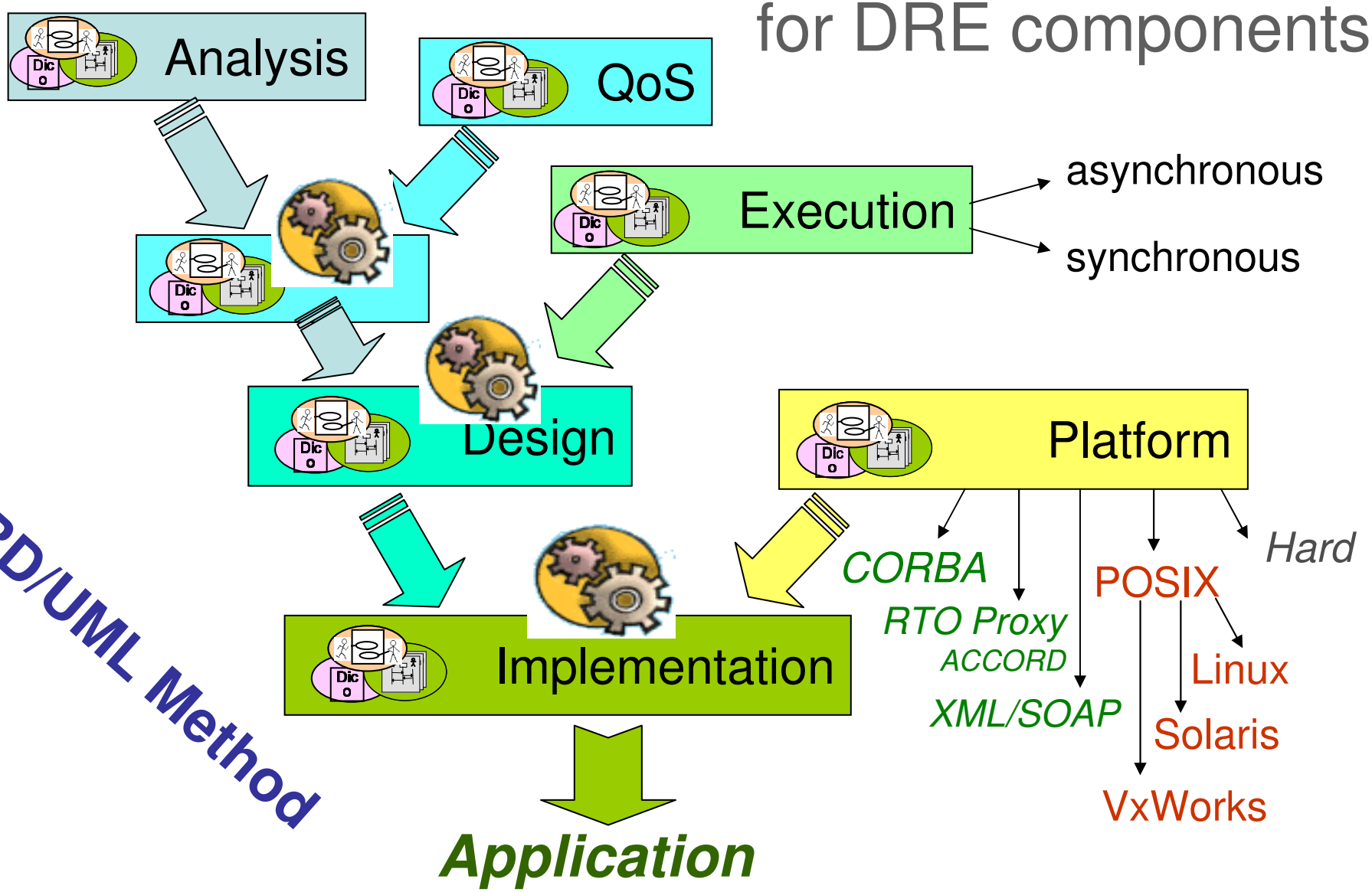




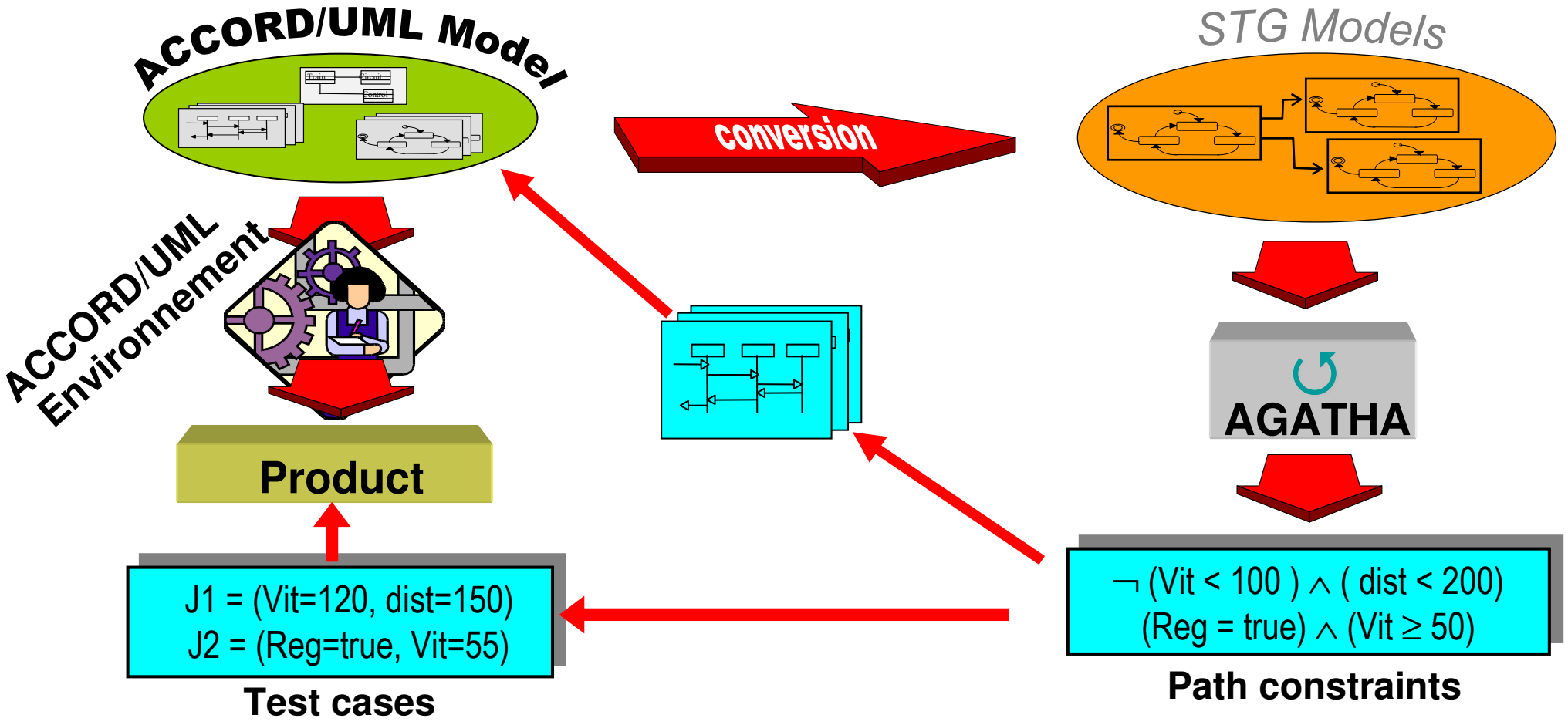


MDA development chain

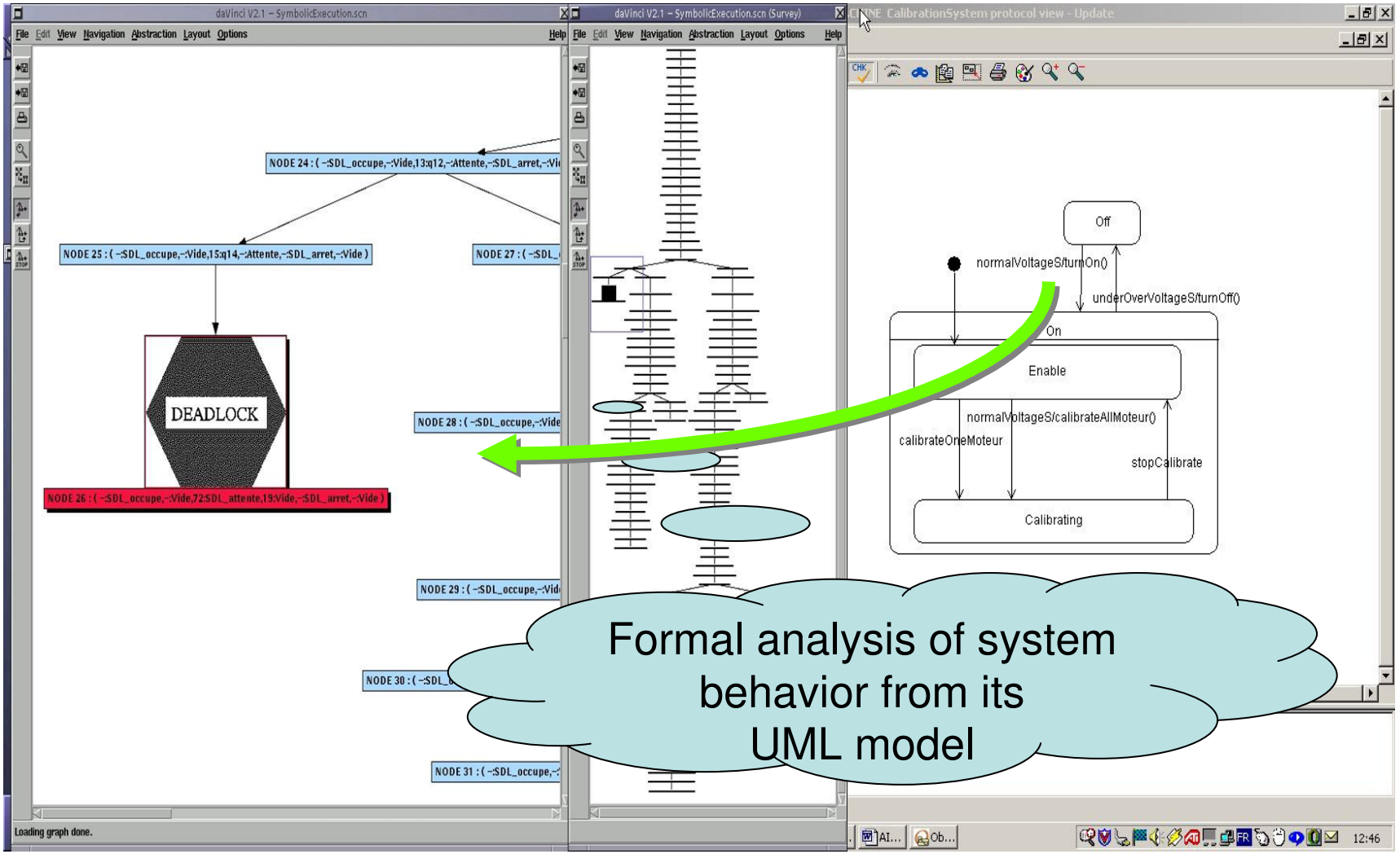
for DRE components



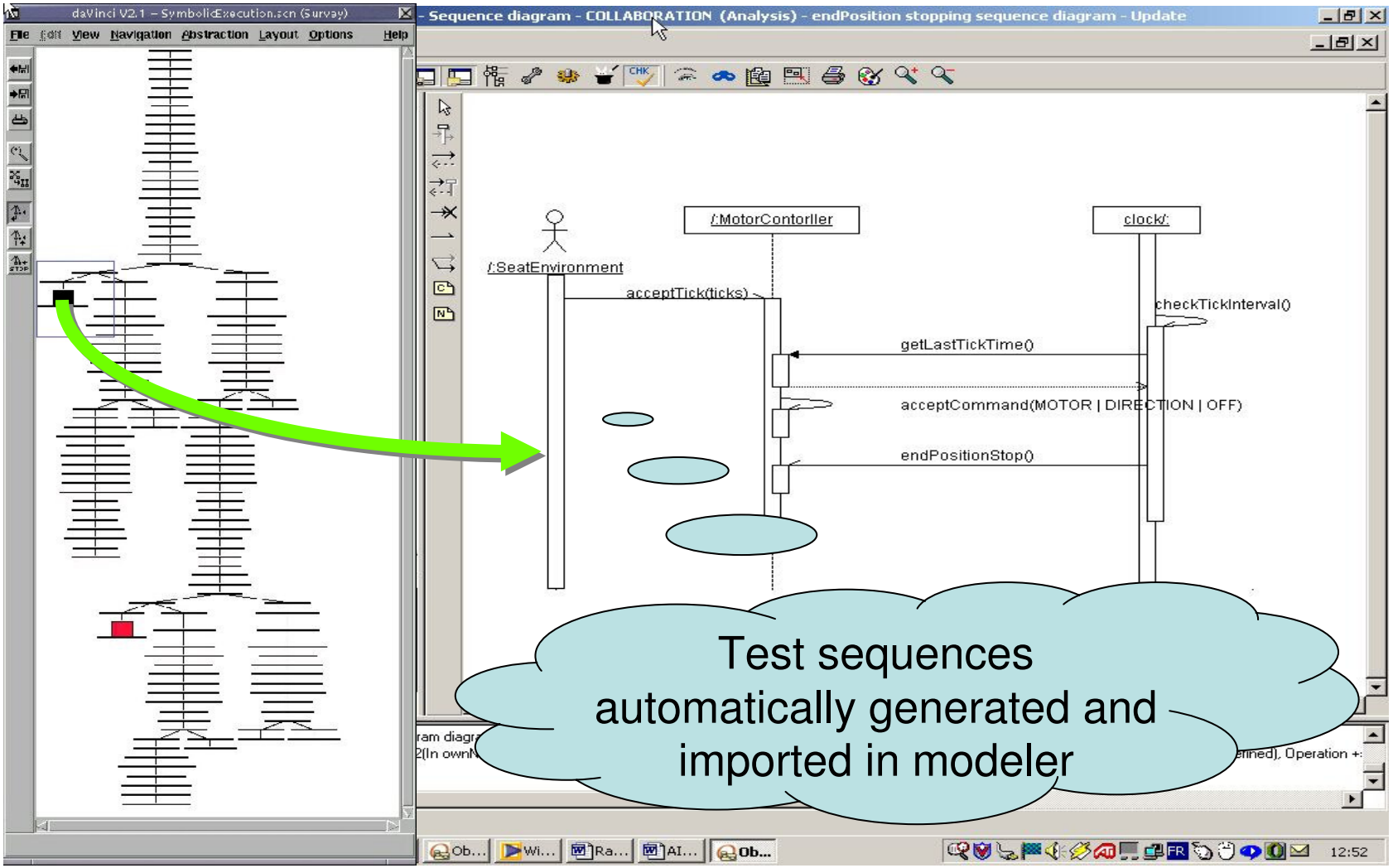
Connection between *ACCORD/UML* method and test case generation tool *AGATHA*



Agatha analysis of UML models

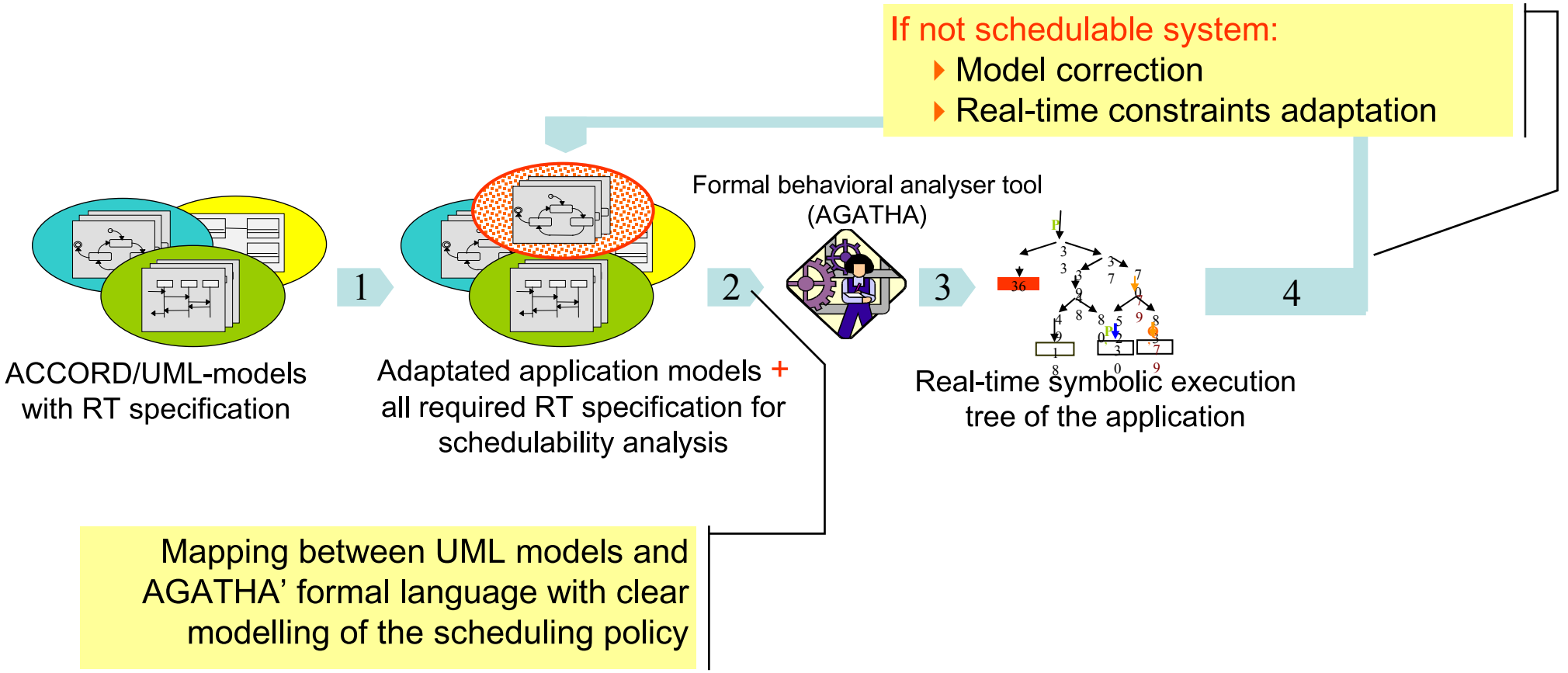


Test case representation in UML



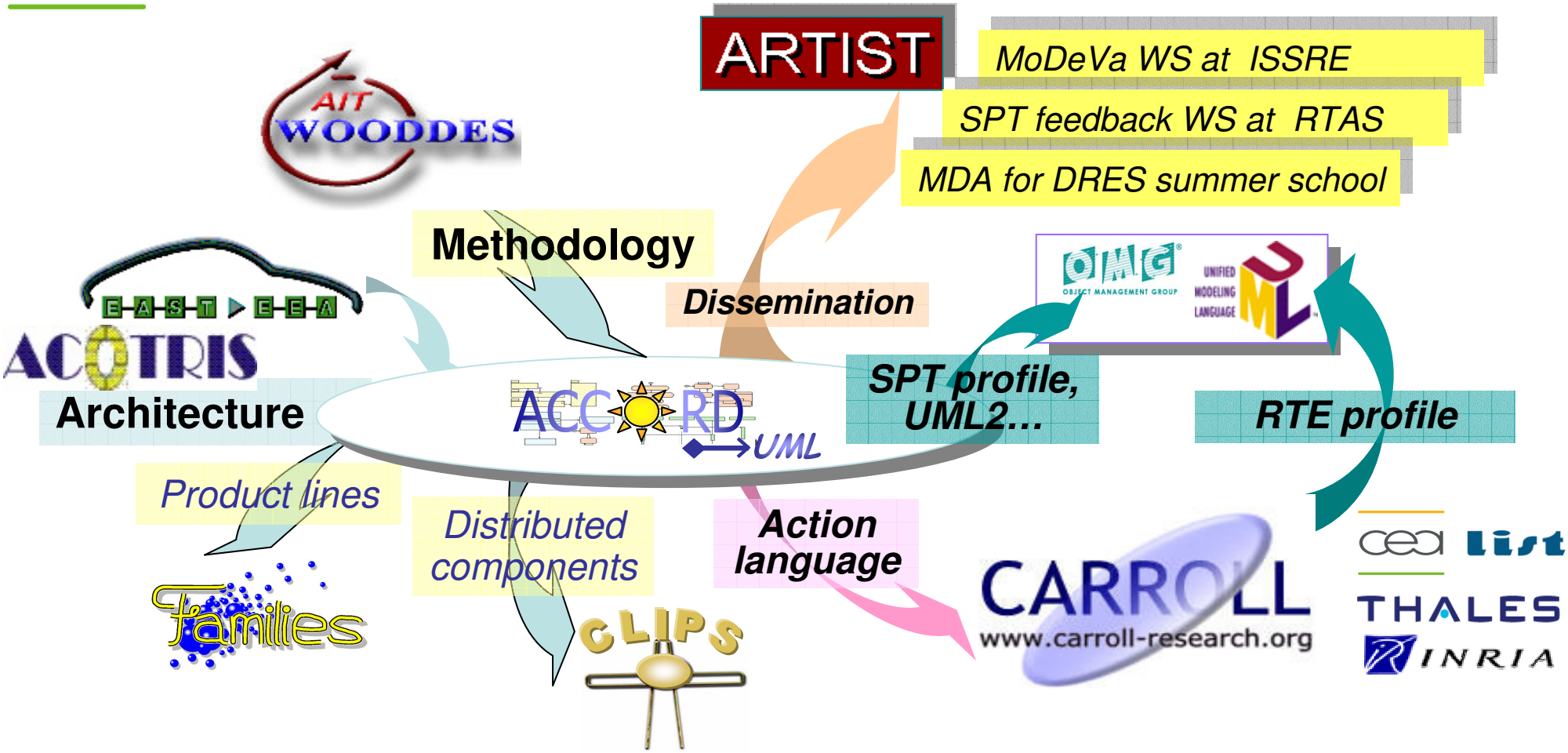
Schedulability analysis on UML models

➔ *Task model calculus & schedulability analysis*



➔ *Worst Case Execution Time calculus*

Basis in other projects

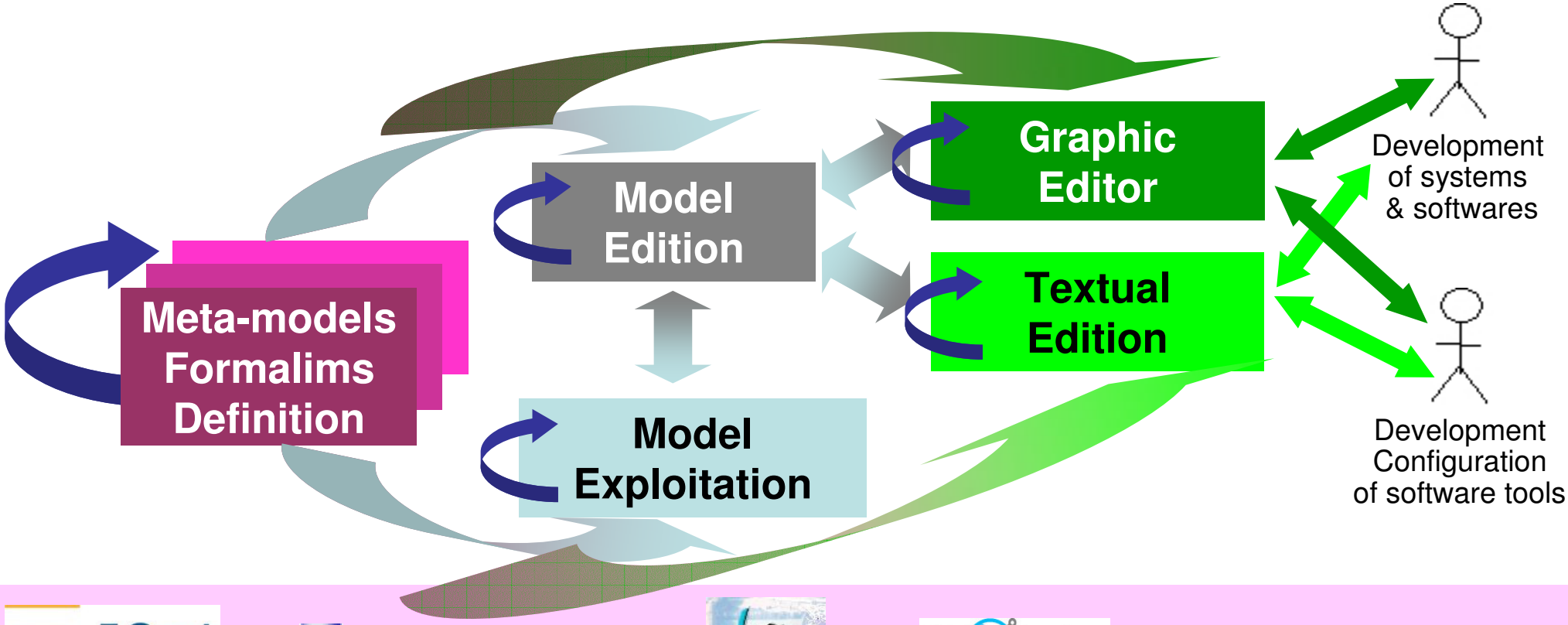


➔ *Limitation on modelling tool, transformation tools*

➔ *Needs of openess and interoperation*

TopModL Initiative

- Promote Model Driven Software Engineering
  - ➔ *Open-Source & Open-Model*
- Reference implementation of OMG's Standards *(UML2, MDA…)*
- Framework for research, tool experiment and development



cea list — INRIA - Triskell — lifL — mips

… All other welcome !

Web sites associated to the subject

wooddes.intranet.gr

www.acotris.c-s.fr

www.systemes-critiques.org/ARTIST

www.east-eea.net

www.esi.es/en/Projects/Families

www.carroll-research.org

www.topmodl.org

« MDA and DRES summer School » sancy.ensieta.fr/mda
« SIVOES-SPT workshop on feedback on SPT profile www.cs.virginia.edu/rtas04
« SIVOES – MoDeVa workshop on Modelling, Design and Validation » www.issre.org/2004

www-drt.cea.fr/acclist.htm