Towards a Viewpoint-Based Framework for Reactive Systems Modeling

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Context : Reactive systems modeling

- Systems which react continuously to the environment
- Heterogenous dimensions : timing, tolerable rate, power consumption

Varying degrees of details to model

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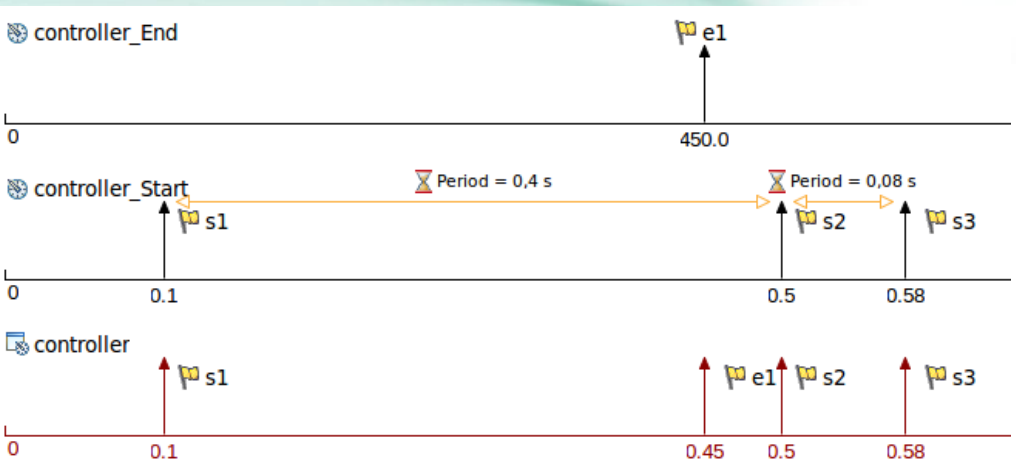
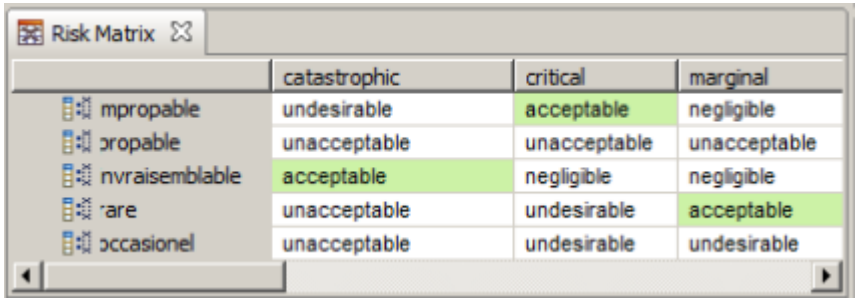
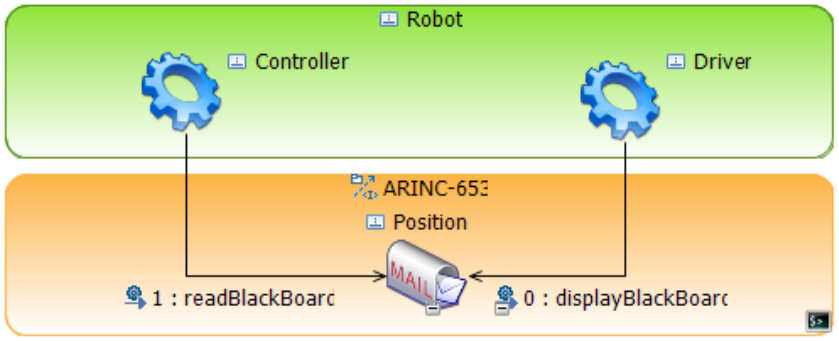
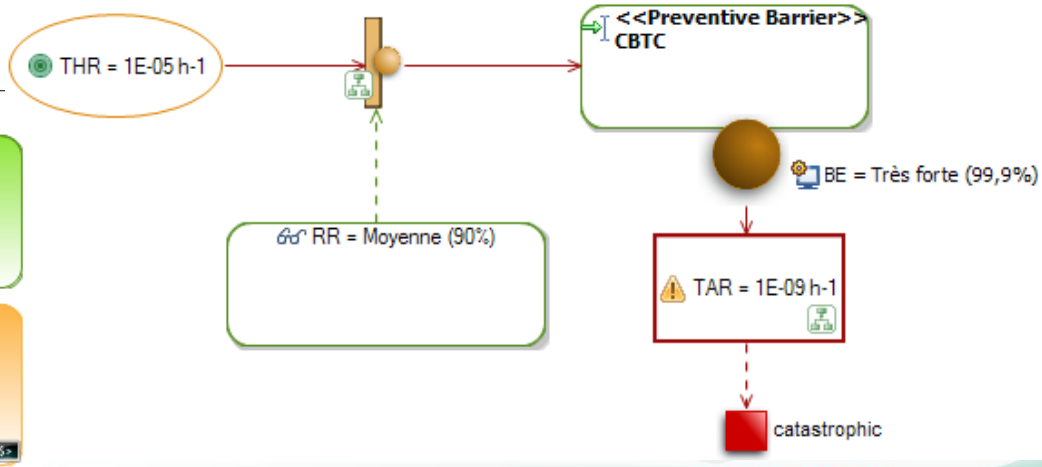
Different views

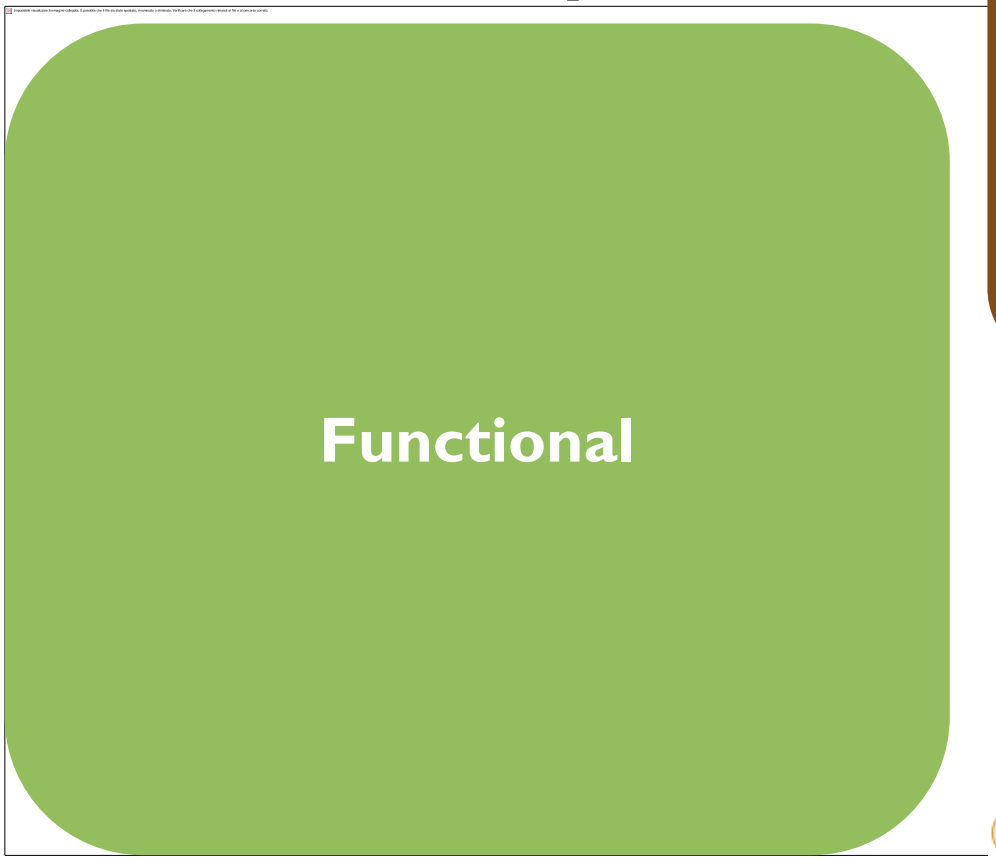








Different viewpoints



Functional

Performance

Safety

Multitasking design

Viewpoint definition

- Many academic and industrial works define the viewpoint concept

  [Kruchten95] [ISO/IEC WD3 42010] [Spanoudakis97]

  - There is not a common definition [Movida09]

  [IEEE 1471-2000]

  - A viewpoint is **a pattern or template from which to develop** individual **views by establishing the purposes** and **audience** for a view **and the techniques for its creation and analysis**
  - **A view is a representation of a system from the perspective of a related set of concerns.**

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Viewpoint interests

- Main expected result is the "separation of concerns"
  - Manage varying degree of details in separate views
- **But,**
  - To provide adequate views for each customers is a noteworthy challenge for tool provider
    - Views are statically coded in the tools
    - Few industrial modeling tools provide and are driven by viewpoints in system engineering
  - Varying degree of details implies specific business views
    - Views are mapped to the “4+1” views [Kruchten95]
    - Views = graphical representations ?

Problems

- What would be a technological viewpoint-based framework ?
- How can we provide a framework which could be adaptable to specific engineering processes (specific views) ?
- What could be a viewpoint-based framework which is not only graphical representations ?

A synthesis

- A viewpoint is a set of rules for extracting information from a set of models. Those rules suit particular concerns.
  - To describe rules
  - To extract the information dynamically
  - To abstract the implementation technology to be concentrate on the rules
- A viewpoint is a set of rules for manipulating and computing information in a way that the set of models is still consistent after the manipulation
  - To provide a langage to manipulate and navigate into the models
- The view is the result of applying a viewpoint
  - The tool shall manage the view consistency

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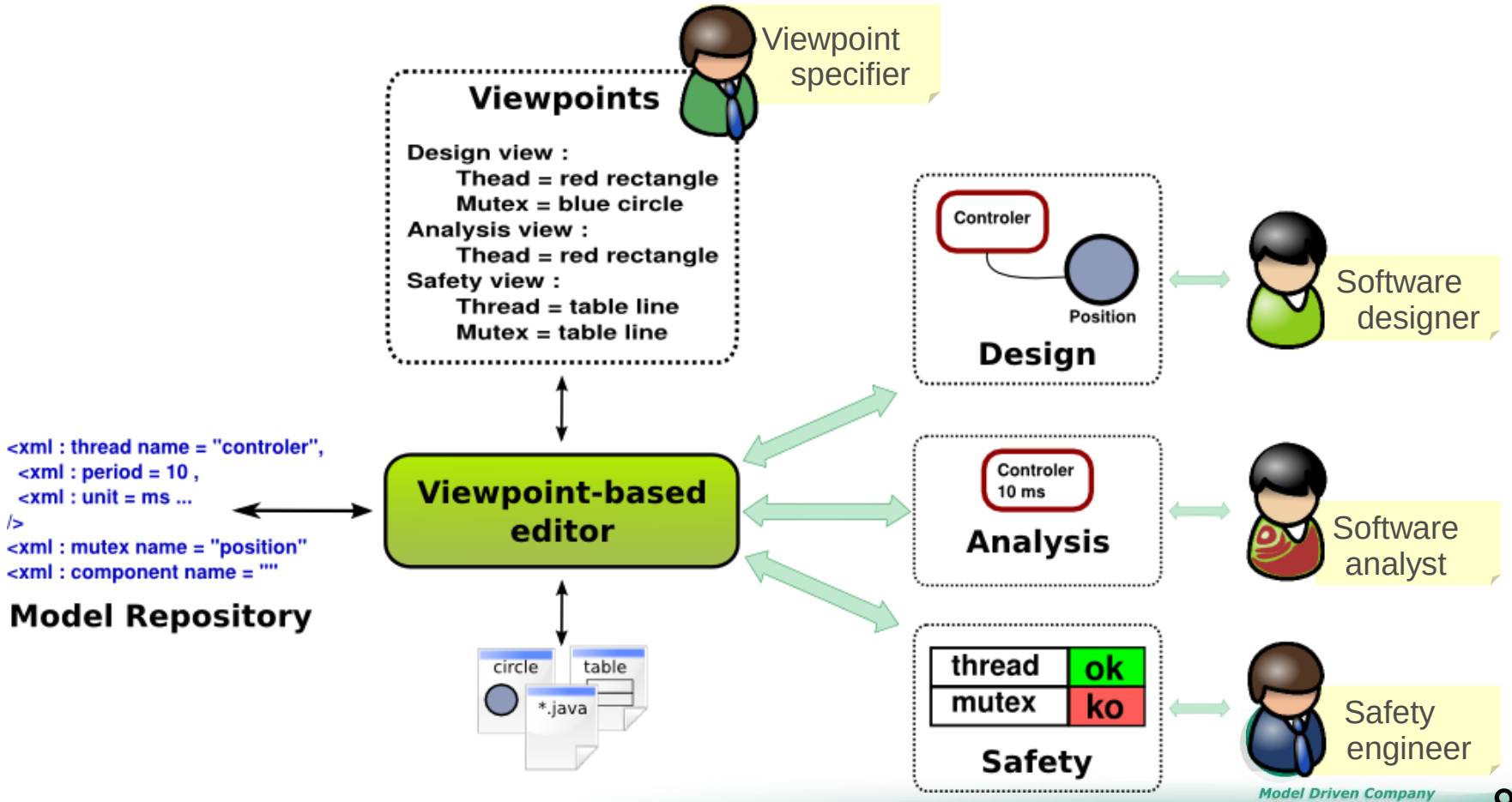
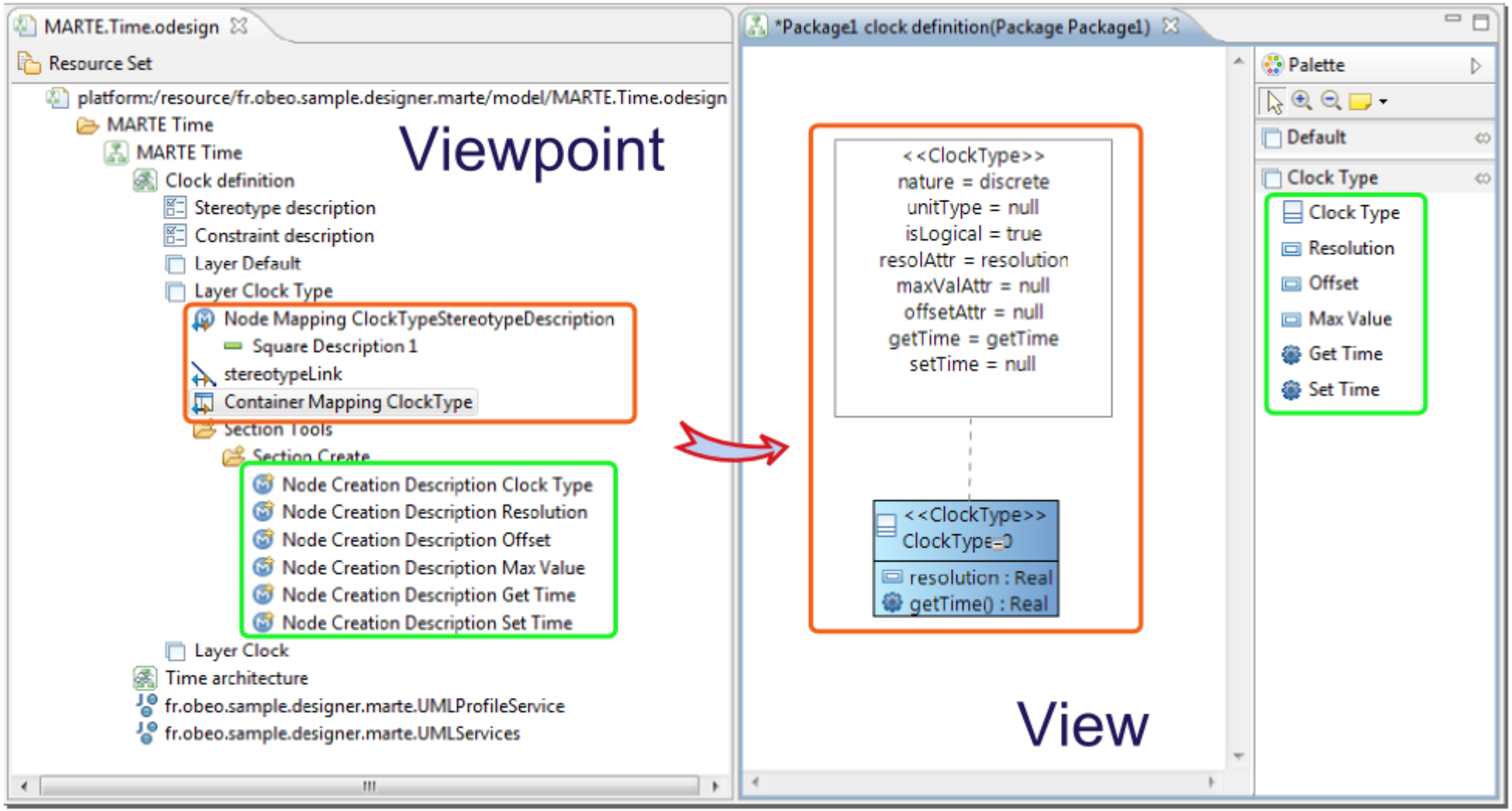
What's a graphical viewpoint ?

- **Graphical Viewpoint** : a set of rules used to identify which graphical information must be displayed and which user interactions are allowed.



A model driven approach



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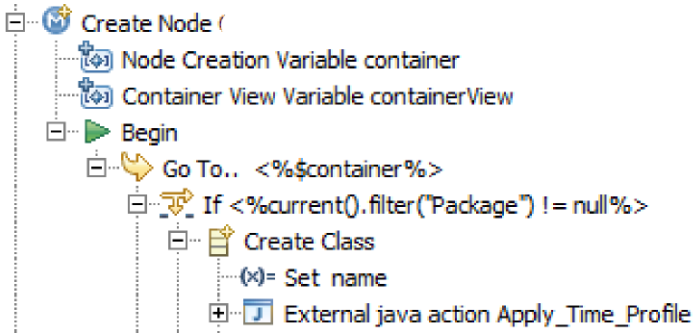
What's a graphical viewpoint-based framework ?

- A viewpoint metamodel
  - Node, Edge, Container
  - Filter, layer
  - Graphical and semantic validation rules
- Synchronization and consistency mechanisms among
  - Graphical representation(s)
  - Semantic model(s) of the system
  - Viewpoint description model(s)
- Abstract the modeling technologies



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Implementation

- An industrial graphical viewpoint based framework
  - It provides a metamodel for describing graphical viewpoints
  - It allows represent UML and DSLs models in the same session
  - The metamodel is based on the IEEE1471-2000 standard
  - It provides graphical, tabular and sequence views

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Problems

- What would be a technological viewpoint-based framework ?
- How can we provide a framework which could be adaptable to specific business views ?
- **What could be a viewpoint-based framework which is not only graphical representations ?**

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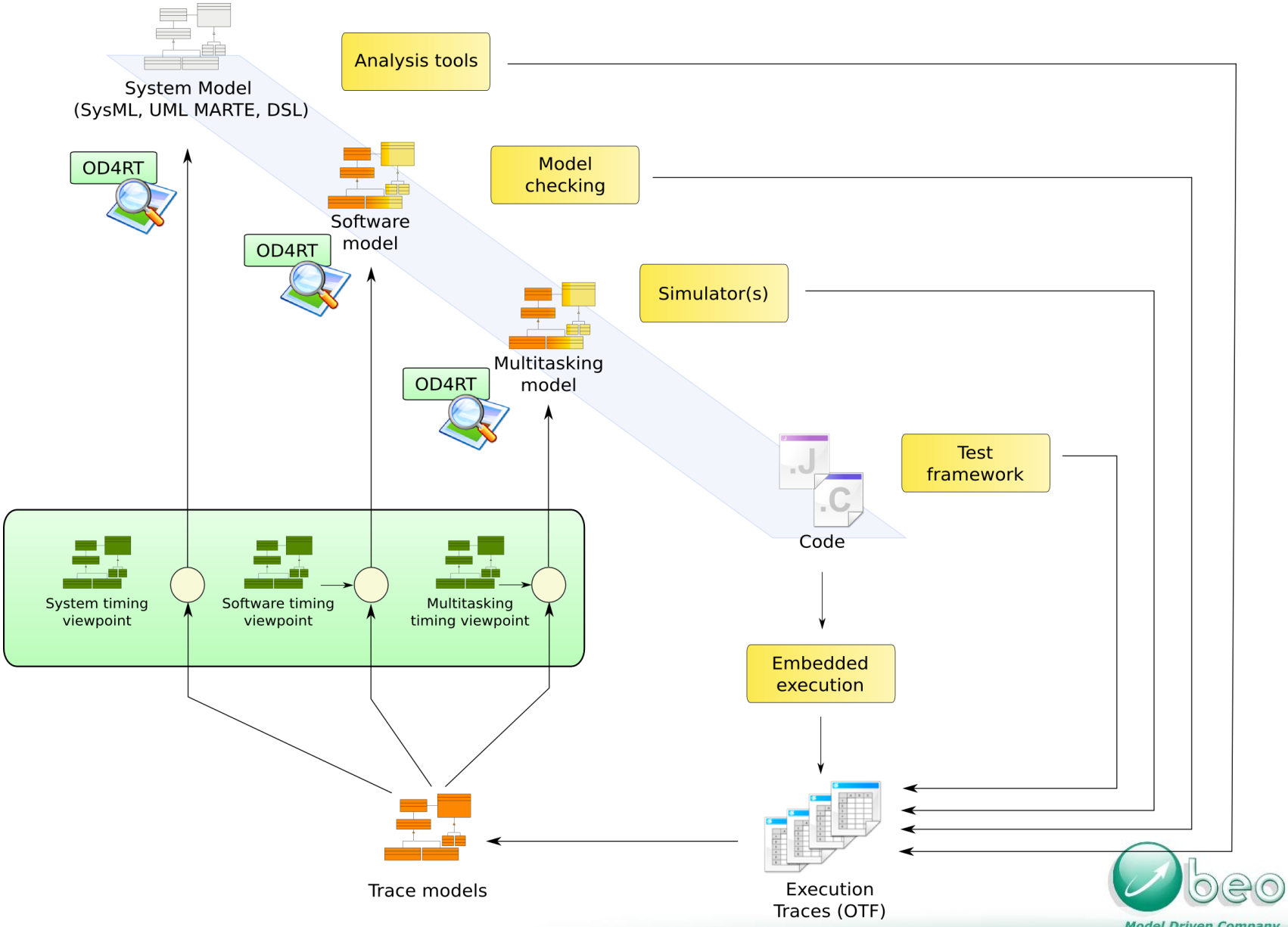
Time dimension during the development



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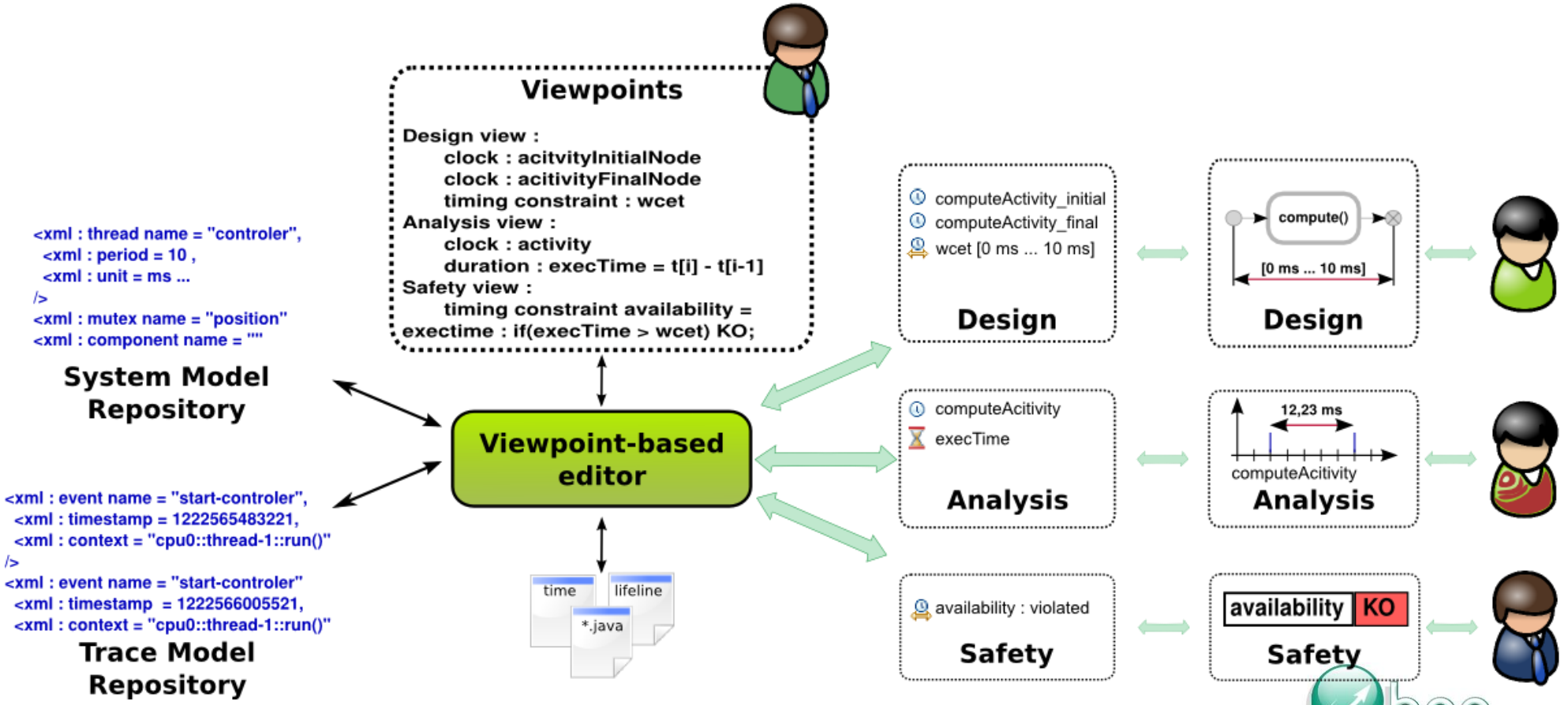
Timing viewpoint description

- **Timing viewpoint** : a set of rules used to identify which temporal information is accurate for a specific concern.



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Why a timing viewpoint-based framework ?

- To provide generic tools to navigate/animate/debug the models
- To limitate the import/export on the semantic models

But,

- A common trace metamodel,
- A language to describe how to reconciliate the trace with the semantic model elements
- A tool to manage the consistency among :
  - The semantic model(s)
  - The trace model(s)
  - The timing viewpoint description

RT-Simex research project

(www.rtsimex.org)

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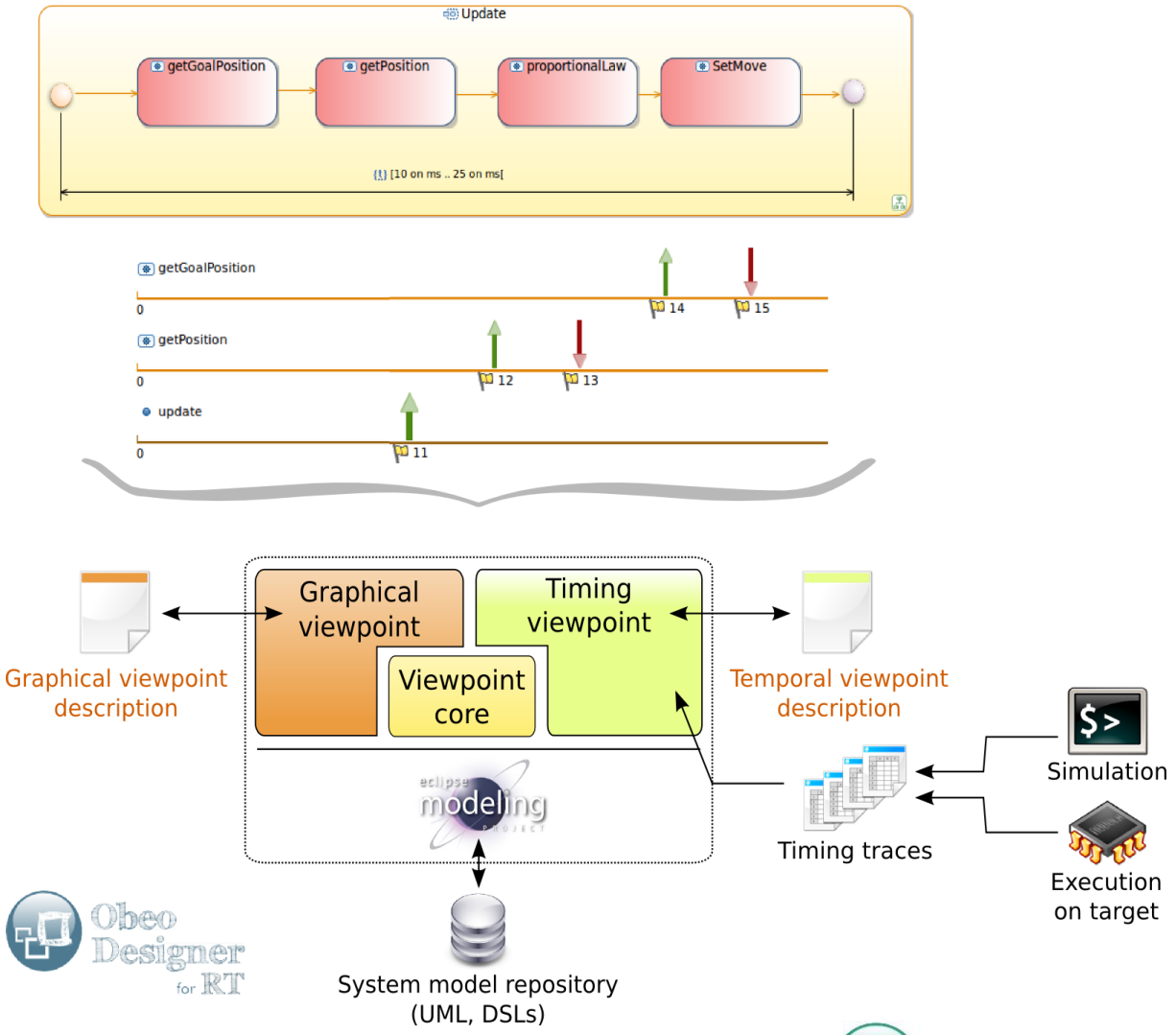
Our first results

- An extension to the graphical viewpoint based framework
- A timing viewpoint language based on the TIME UML MARTE domain model
- Acceleo is used to navigate and reconciliate the trace and the semantic models.



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Towards a viewpoint-based framework

- From our experiment, a viewpoint-based framework provides :
  - Means to describe viewpoint models in order to adapt the generic plug-ins for a set of particular concerns
    - Separation of the preoccupations and abstraction of the Java implementation for the tool architect
  - Capitalization of plug and play plug-ins
    - Graphical plug-ins : forms, links, layer, filter mechanisms
    - Timing plug-ins : constraint checking, graphical viewpoint description generation, animation, debug
  - A end-user tool which suit to its particular needs.
  - Means to use several languages (metamodels) in the same framework
  - Views composition ?

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Conclusion

- Viewpoint-based framework is a promising approach :
  - Not limited to graphics
  - Enables one to separate the concerns
    - Meta-Tool providers (know model technologies and provide the framework-based tool)
    - Business tool architects = viewpoint specifiers (parameterize the framework for their business language(s) and rules)
    - Users who make models which are conform-by-construction with the business rules
- We are working on technologies to enhance views consistency such as the synchronization and the composition of views (http://movida.gforge.inria.fr/)

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Thanks !

Do you have a different viewpoint ?

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