
The GEMOC Initiative

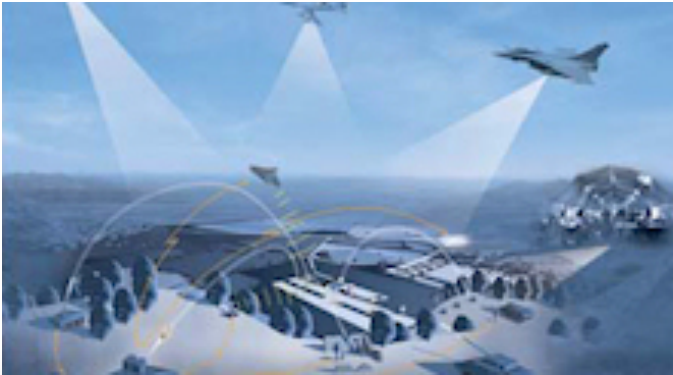
On the Globalization of Modeling Languages

<http://www.gemoc.org>

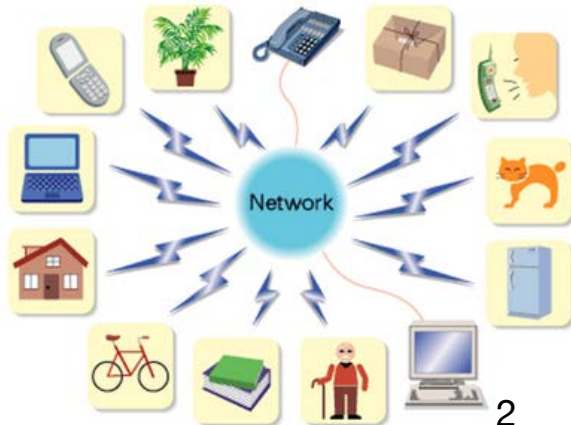
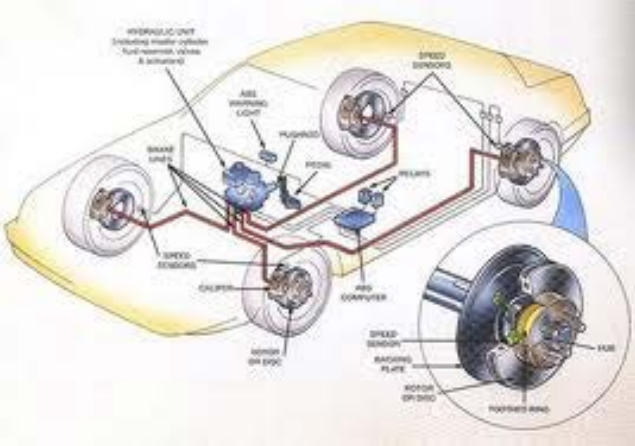
Contact: Benoit Combemale
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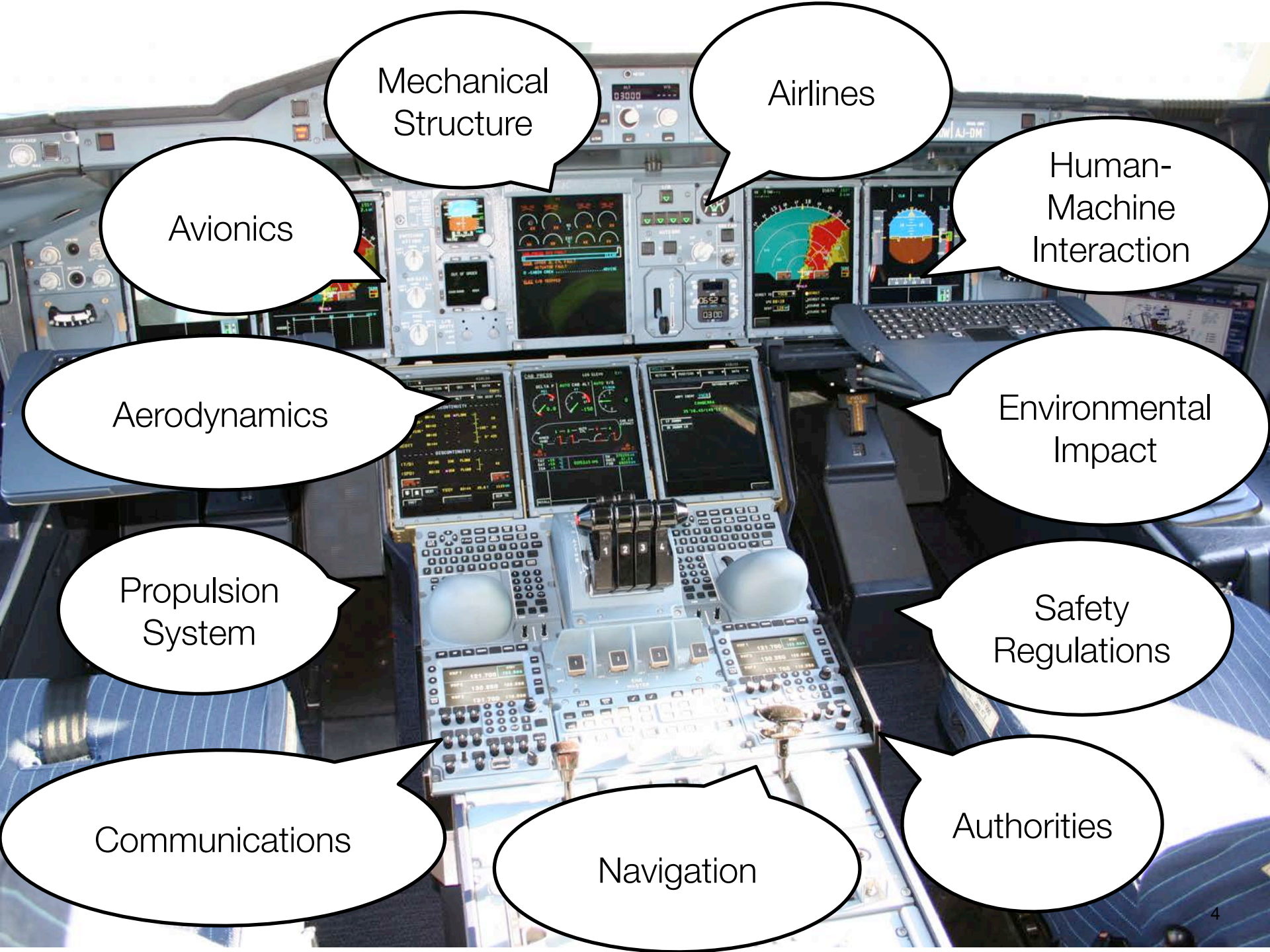
Version: June, 2013

Context



Software intensive systems





Mechanical
Structure

Airlines

Human-
Machine
Interaction

Avionics

Aerodynamics

Environmental
Impact

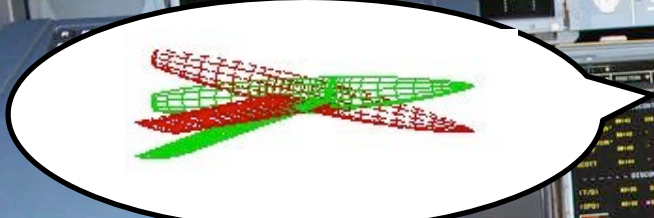
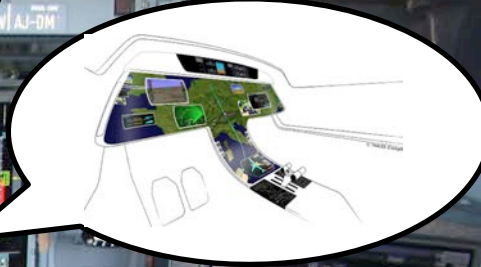
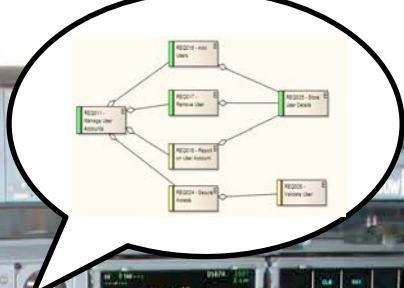
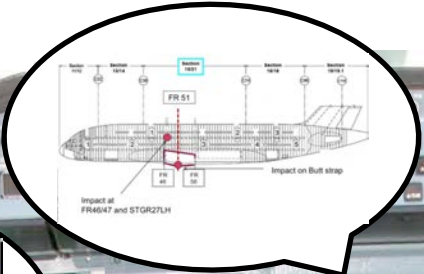
Propulsion
System

Safety
Regulations

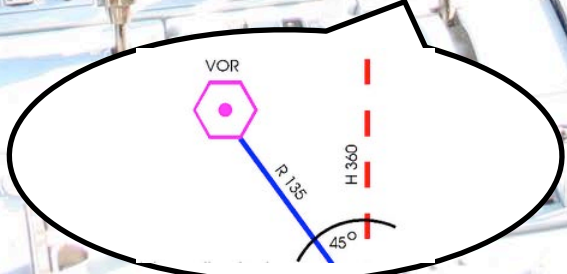
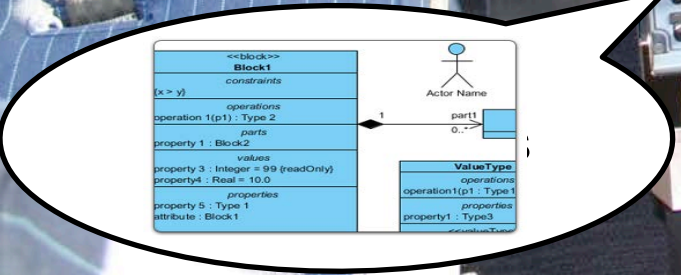
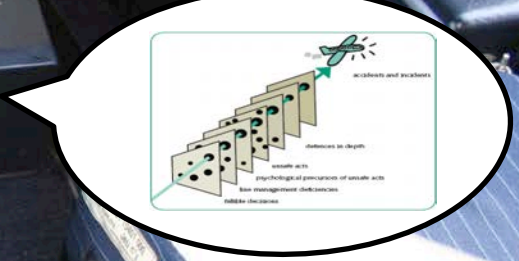
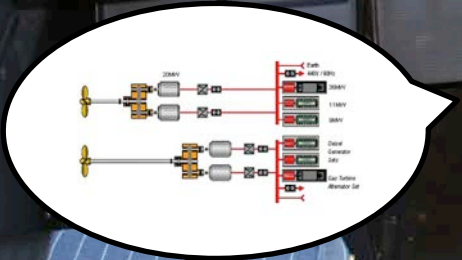
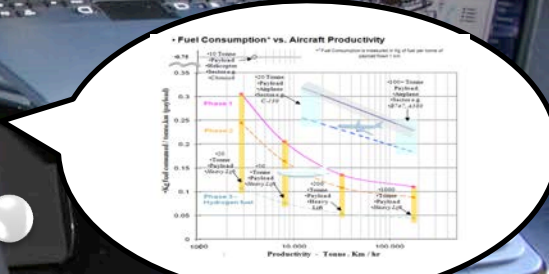
Communications

Navigation

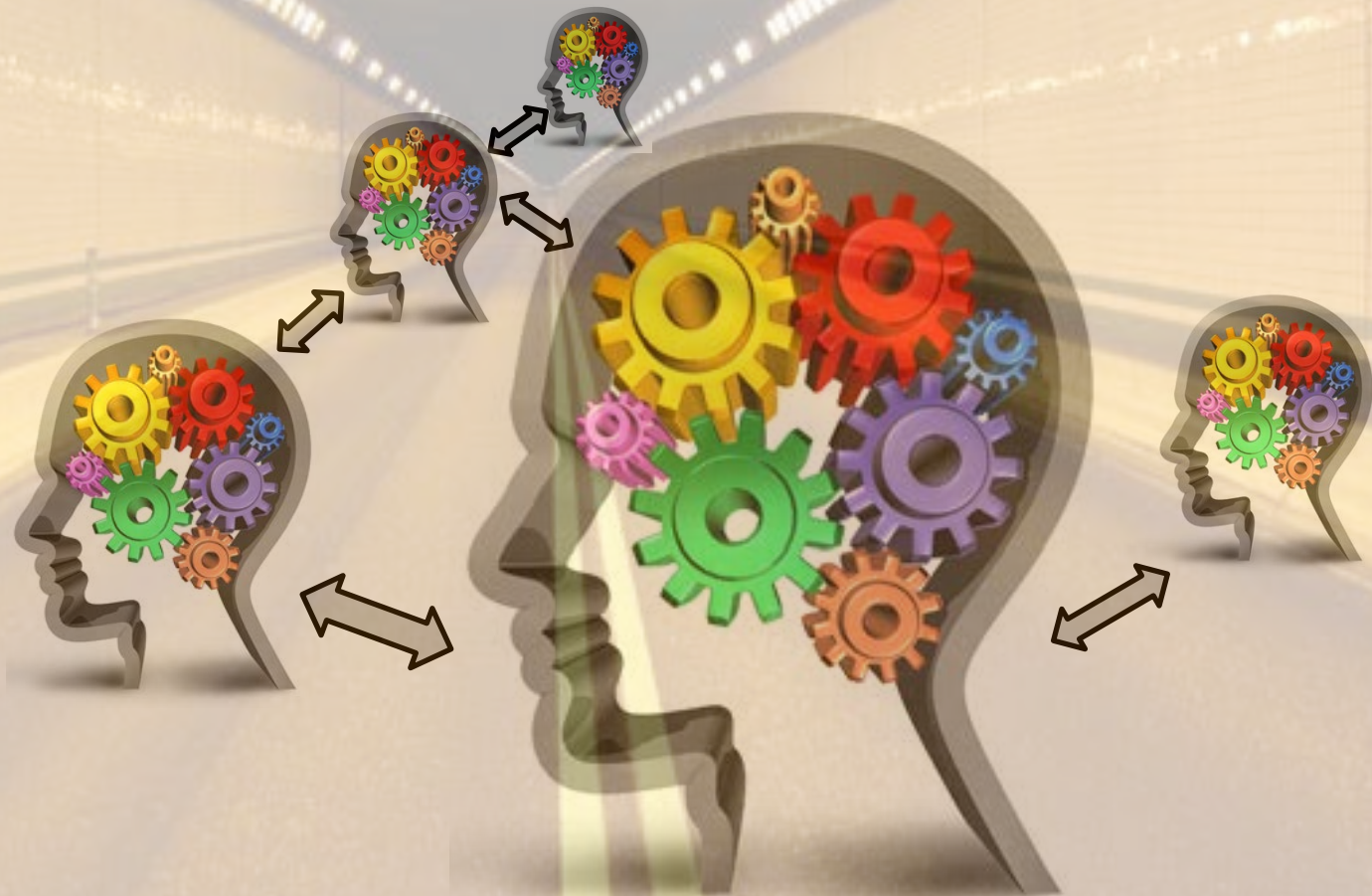
Authorities



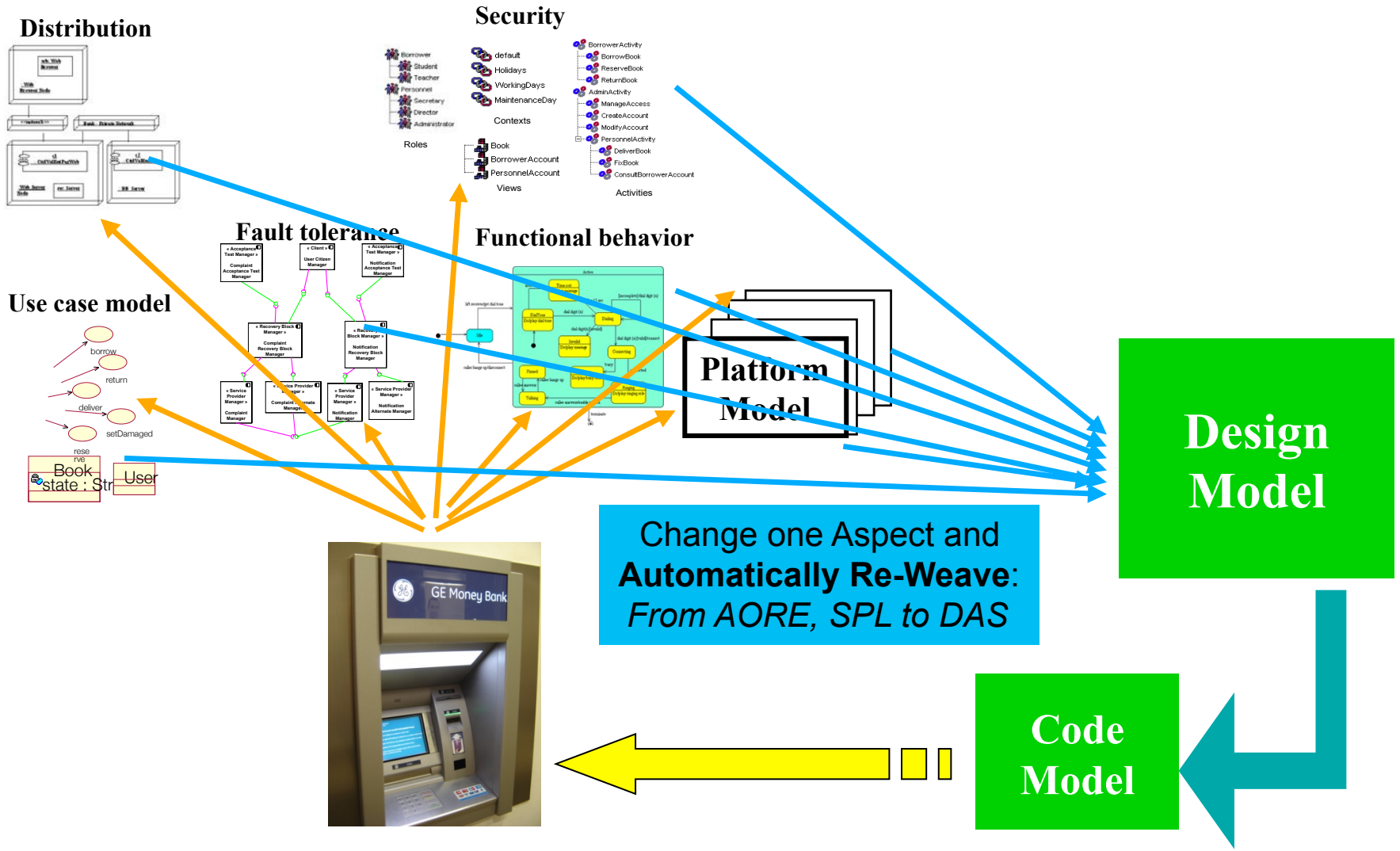
Heterogeneous Modeling Languages



Heterogeneous Modeling in Global Software Engineering



Model Driven Engineering...



=> *Software Language Engineering*

- The separation of concerns...

Modularization [Parnas72] to allow the structure of the product to resemble the structure of the organization that designed it [Conway68]

- ... at the language level

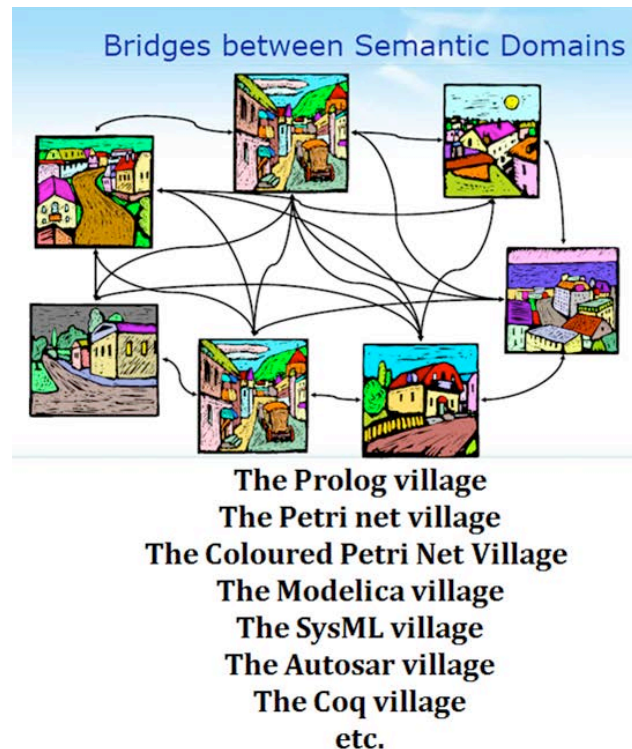
Domain-Specific (Modeling) Language (DSML) should serve to implement a solution in terms of a problem (socio-technical coordination [Herbsleb07]).

- requires to manage the relations between languages

to avoid social isolation and non sharing information (as observed for example in the use of APIs [Souza04])

At some point in the software lifecycle...

- Interoperable and Collaborative Models



The Village Metaphor

A. Vallecillo. "A Journey through the Secret Life of Models".

Across the software life cycle...

- Executable, Composable and Intuitive Models (i.e., *runware*) from design to run time

⇒ the two-way tunnel-digging



The tunnel digging analogy
[Harel et al., SoSyM'12]

Challenges

- *Model Driven* Engineering
 - ➔ *Software Language* Engineering
- Language relationships should be capitalized
 - ⇒ from transformation to composition
- Global model coordination and analysis
 - ⇒ from design to runtime

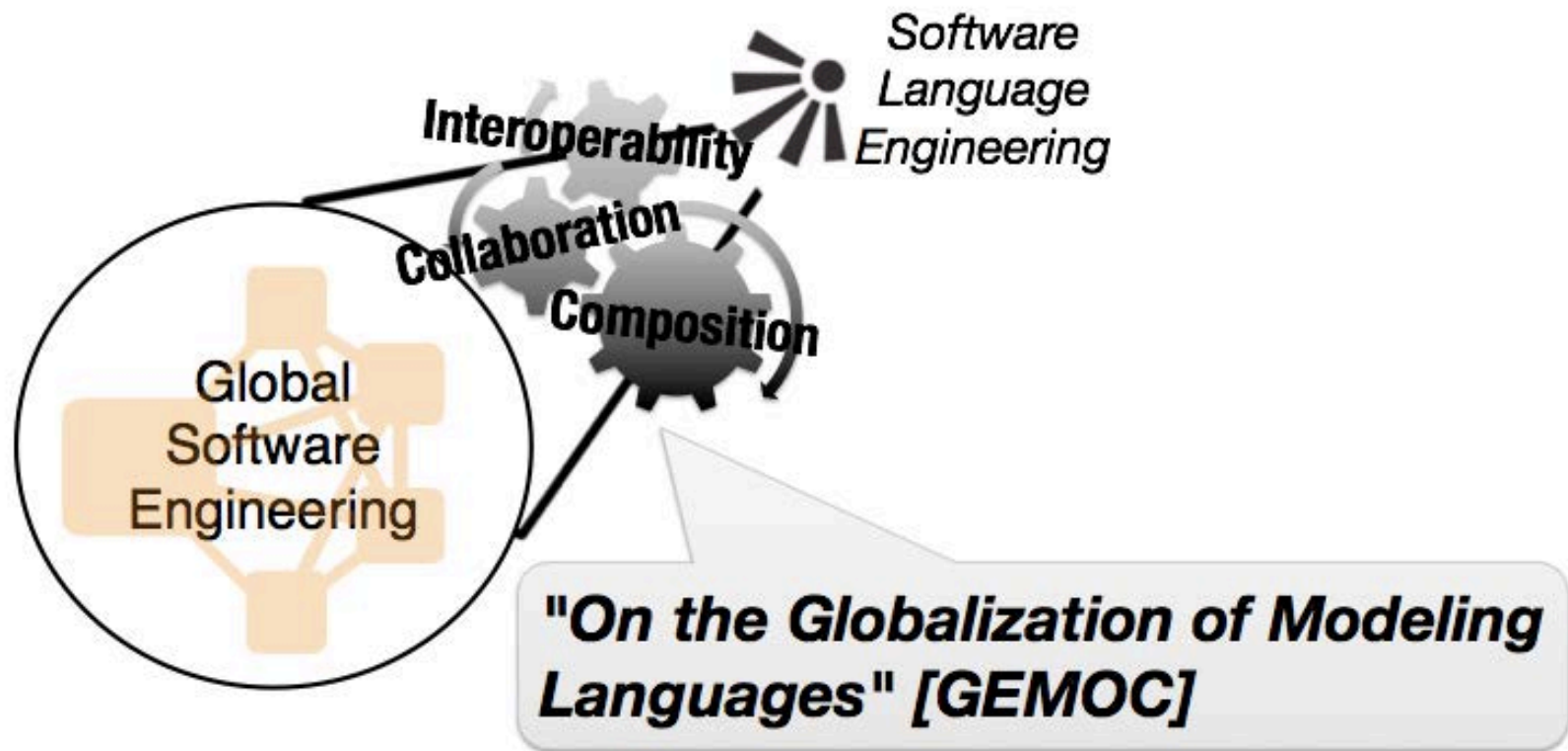


Gemot

***On the Globalization
of Modeling Languages!***

An Initiative...

Focuses on SLE tools and methods for interoperable, collaborative, and composable modeling languages



... Constantly Growing



... Constantly Growing



The GEMOC Initiative *is born!*

An open initiative to

- coordinate (between members)
- disseminate (on behalf the members)

worldwide R&D efforts on the globalization of modeling languages

<http://gemoc.org>

- Advisory Board: Benoit Combemale (Fr.), Robert B. France (USA), Jeff Gray (USA), Jean-Marc Jézéquel (Fr.)
- Funded by complementary and successive projects
- IP left to PCA of each projects

Current Projects

completed, ongoing

CNRS GDR GPL
Specific Action
2011

- Survey of the techniques and tools to compose DSMLs and their respective MoCs
- *Partners: IRISA (Triskell), I3S (Aoste)*
- Cf. <http://gemoc.org/as2011>

ANR INS
GEMOC
2012-2016

- A Language Workbench for Heterogeneous Modeling and Analysis of Complex Software-Intensive Systems
- *Partners: Inria (Triskell), I3S (Aoste), IRIT, ENSTA-Bretagne, Thales, Obeo*
- Cf. <http://gemoc.org/ins>

CNRS PICS
MBSAR
2013-2015

- Travel funds for permanent staff and PhD students
- *Partners: IRISA (Triskell), CSU*
- Cf. <http://gemoc.org/mbsar>

ANR INS GEMOC (2012-2016)

"A Language Workbench for Heterogeneous Modeling and Analysis of Complex Software-Intensive Systems »

Tools and methods for the definition and coordination of *heterogeneous executable modeling languages over heterogeneous models of computation*

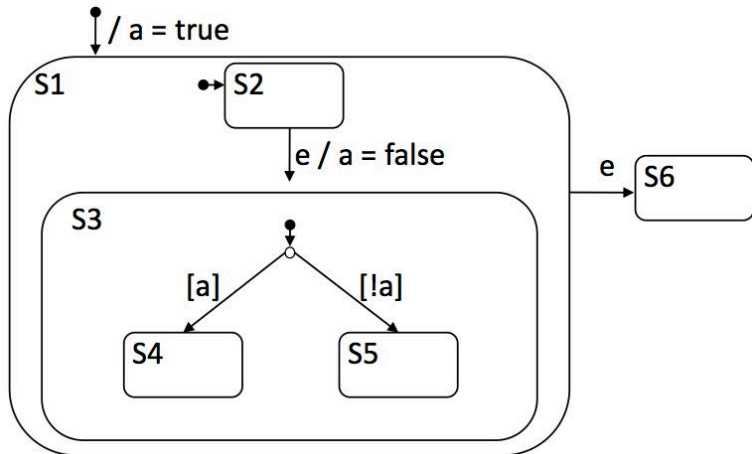
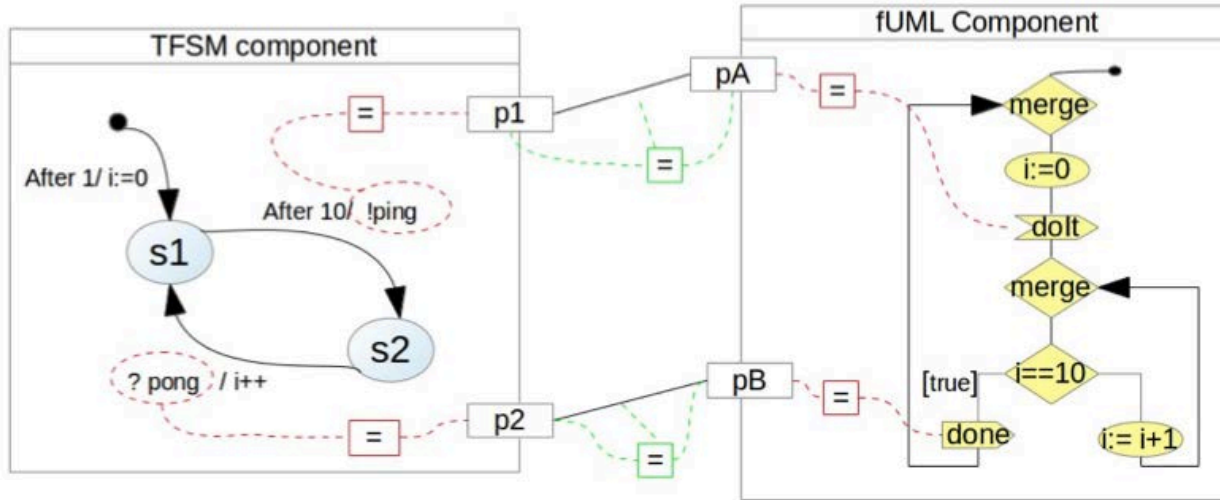


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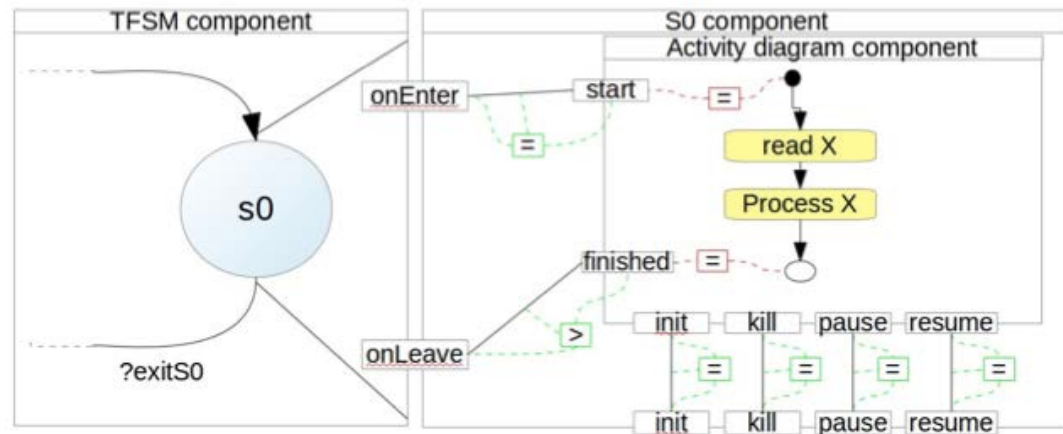
Model Composition

Many possible interactions between models
(structural vs. behavioral, flat vs. hierarchical, refinement...)

here are some examples of compositions of executable models



Event "e" leads to
S4 (UML), S5 (Rhapsody), or (S6) Stateflow



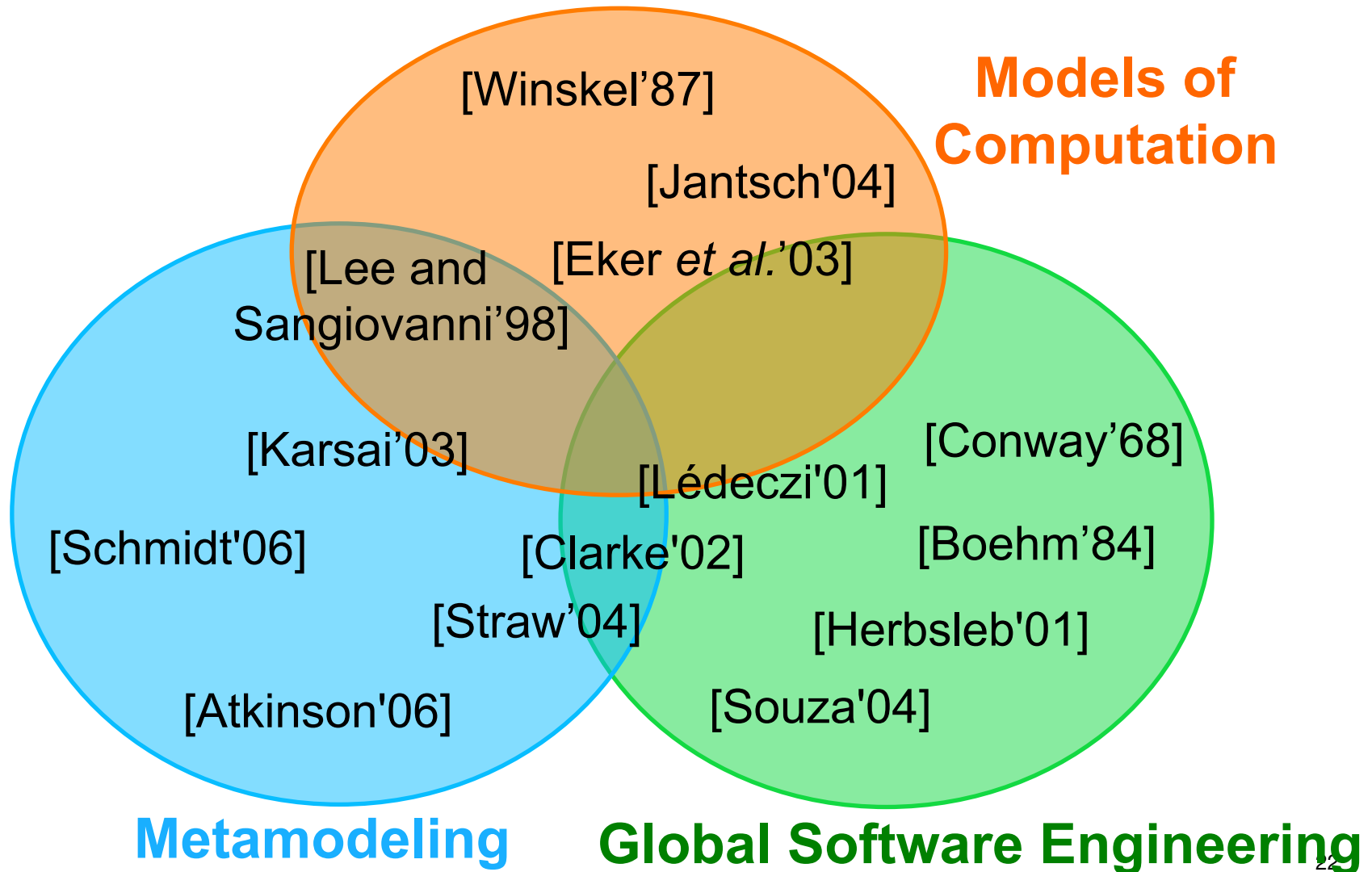
Executable Metamodeling

- Effective environments for the design and implementation of executable domain specific languages (*e.g.*, Kermeta at Inria)
- BUT these environments do not allow the integration of heterogeneous models of computation (concurrency, communication...)

Models of Computation

- Effective environments to deal with the execution and analysis of models based on heterogeneous models of computation (*e.g.*, Ptolemy at UC Berkeley, ModHel'X at Supélec)
- BUT these environments do not allow adaptation to specific business/application domains

Heterogeneity and SE



ANR INS GEMOC: Issues

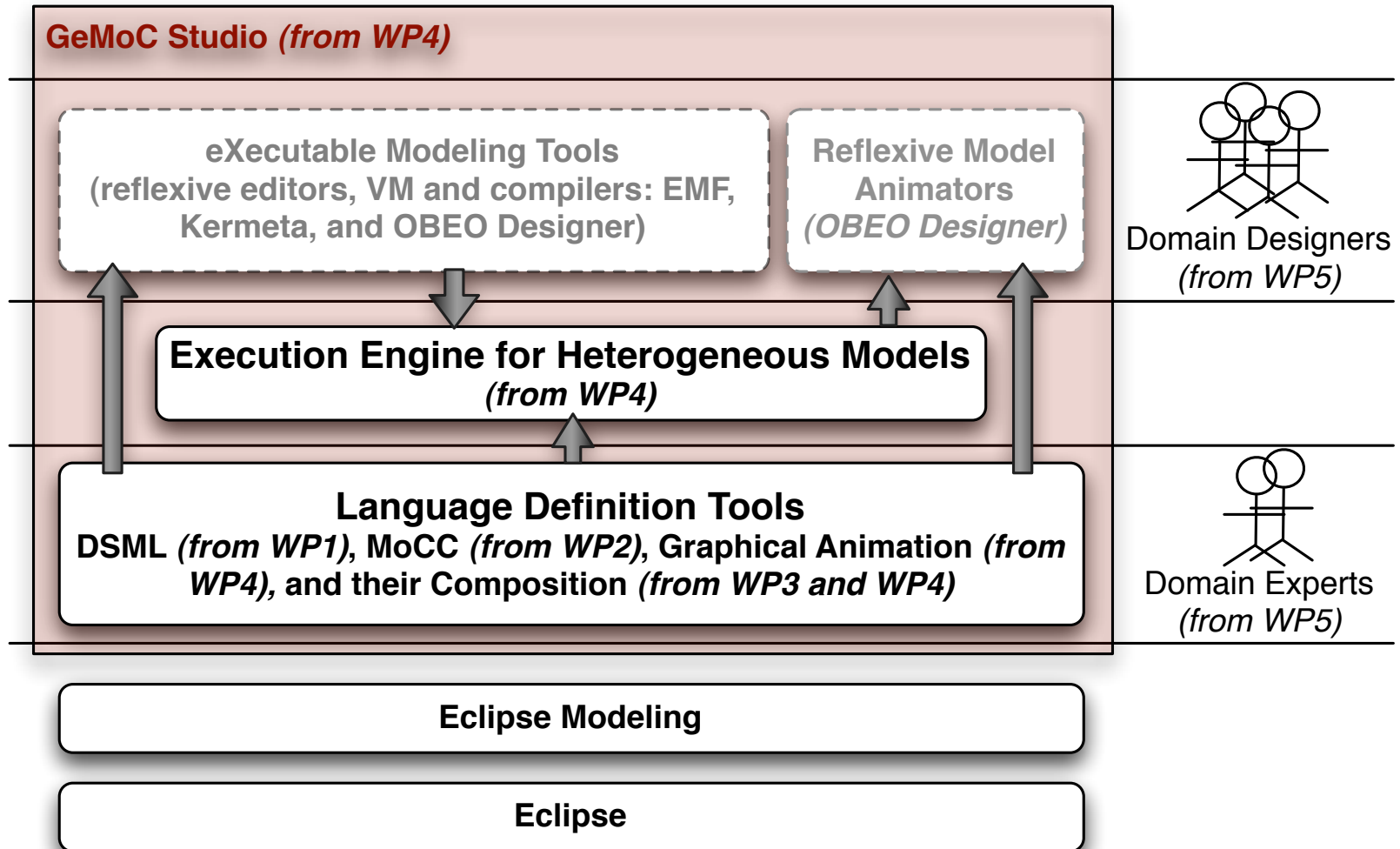
- **Scientific Issues:**

- Formal foundations for composable software language design and implementation
- Formal foundations for semantic coordination of software languages
- Associated tool-supported methodology leveraging on executable metamodeling and models of computation

- **Technical Issues:** an Eclipse-based GEMOC studio integrating

- A language workbench
- A language coordination and execution engine
- A workbench for viewpoint definition and animation over heterogeneous models

ANR INS GEMOC: Expected Studio



Cross Road Traffic Light

<http://youtu.be/gT1QUImFkLM>

The screenshot displays the Eclipse IDE interface for a traffic light simulation project. The main window shows two state machine diagrams: 'Control' and 'Semaphore0'. The 'Control' diagram has states 'Night' and 'Day', with transitions based on time intervals and a 'switch' event. The 'Semaphore0' diagram has states 'Green0' and 'Red0', with transitions based on time intervals and a 'switch' event. A legend indicates that a red square represents a 'switch' and a diamond represents 'minutes'. The simulation timeline shows a sequence of events: mainBlock:Red0_entering, mainBlock:Red0_leaving, mainBlock:Red0_to_Green0_fire, mainBlock:Green0_entering, mainBlock:Green0_leaving, mainBlock:Green0_to_Red0_fire, mainBlock:switch_occurs, and mainBlock:Day_to_Day_fire. The console window shows timing logs for VCD Generation, EMF Code Execution, and Obeo ViewPoint Animator. The 3D visualization shows a traffic light at night, with the red light illuminated. The simulation is running at 61 minutes.

```
priority specification : 2013_0617_224845
Timing Output (VCD Generation) : 3 ms
Timing Output (EMF Code Execution) : 85 ms
Timing Output (Obeo ViewPoint Animator) : 471 ms

Simulation (Step 29)
Timing Output (VCD Generation) : 3 ms
Timing Output (EMF Code Execution) : 89 ms
Timing Output (Obeo ViewPoint Animator) : 500 ms

Simulation (Step 30)
Timing Output (VCD Generation) : 4 ms
fire: Green0 to Red0 -> doRed
Timing Output (EMF Code Execution) : 142 ms
Timing Output (Obeo ViewPoint Animator) : 1112 ms
```


ANR INS GEMOC: Identification

- Project Coordinator: Benoit Combemale (benoit@gemoc.org)
- Consortium: Inria, CNRS I3S, INPT IRIT, ENSTA Bretagne, Thales, Obeo
- External Partner: Supélec
- Date: 01.12.12 – 30.03.16 (40 months)
- Budget: 2 700 000 €
- Supported by the *French Agency for Research (ANR)*
 - ▶ Program *Ingénierie Numérique et Sécurité (INS 2012)*
 - ▶ Grant n°ANR-12-INSE-0011
 - ▶ ANR Funding: 982 720€
- Competitiveness clusters: Image & Réseaux, Aerospace Valley, Systematic



➡ Visit <http://gemoc.org/ins>

GEMOC MEETING

July 1st, 2013, Montpellier, France
co-located with ECMFA, ECOOP and ECOSA 2013
Research-Project Symposium

- Official launch of the GEMOC Initiative
- Working group on the classification of the relations between modeling languages
- Coordination EU-US, and intra EU

<http://gemoc.org/meeting-ec2013/>

GlobalDSL 2013

International Workshop on *The Globalization of Domain Specific Languages*

July 2nd, 2013, Montpellier, France

co-located with ECMFA, ECOOP and ECSA 2013

- Topics of interest include *composability, interoperability, modularity, reuse, and variability* of programming/modeling languages
- Keynote by Prof. Dr. Bernhard Rumpe on "*Compositional Model-Based Software Development*"

<http://gemoc.org/globaldsl2013>

GEMOC 2013

International Workshop on *The Globalization of Modeling Languages*

September 29th, 2013, Miami, Florida, USA
co-located with MODELS 2013

- Topics of interest include *composability and interoperability of heterogeneous modeling languages, model and metamodel composition, multi-paradigm modeling and simulation*
- An open forum for sharing experiences, problems and solutions on the conjoint use of multiple modeling languages.

<http://gemoc.org/gemoc2013>