

ANR INS GEMOC

<http://www.gemoc.org/ins>

Mid-term Review, June 3rd, 2014

All materials (slides, periodic reports, technical deliverables, publications) are available at <http://www.gemoc.org/ins-midtermreview>

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benoit.combemale@inria.fr or benoit@gemoc.org

ANR INS GEMOC: Identification

- Project Coordinator: Benoit Combemale, INRIA (benoit@gemoc.org)
- Consortium: Inria, CNRS I3S, INPT IRIT, ENSTA Bretagne, Thales, Obeo
- 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>



Outline

- Overview of the project
 - Context
 - Objectives
- Major achievements (M0-M18)
 - Scientific breakthroughs
 - Technological results
- Project management and dissemination
- *Demonstrations...*
- Conclusion and perspectives

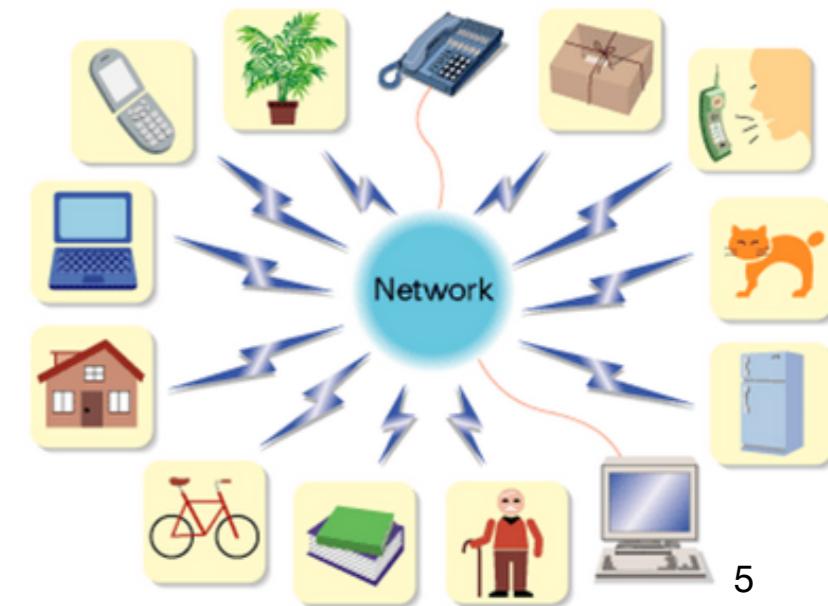
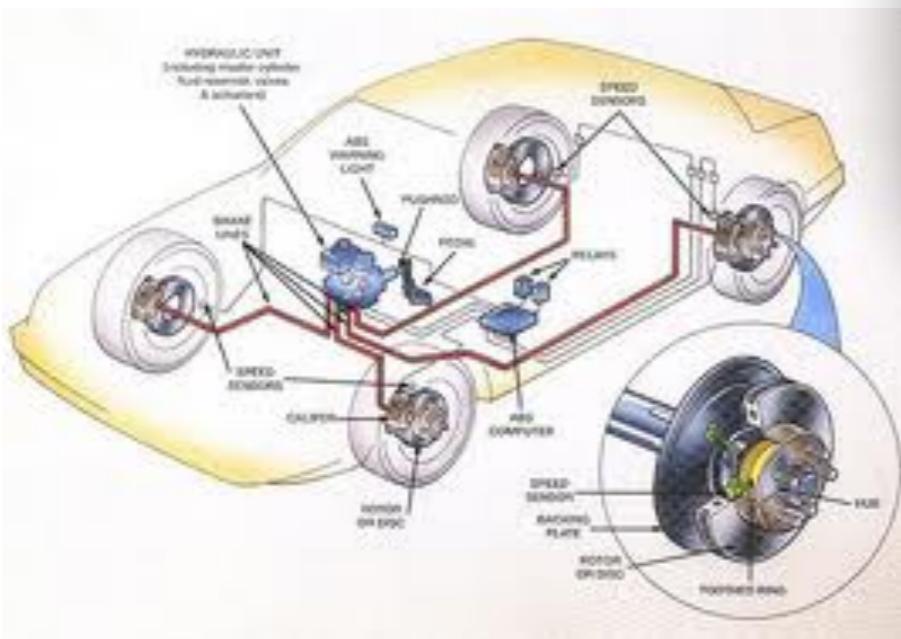
Outline

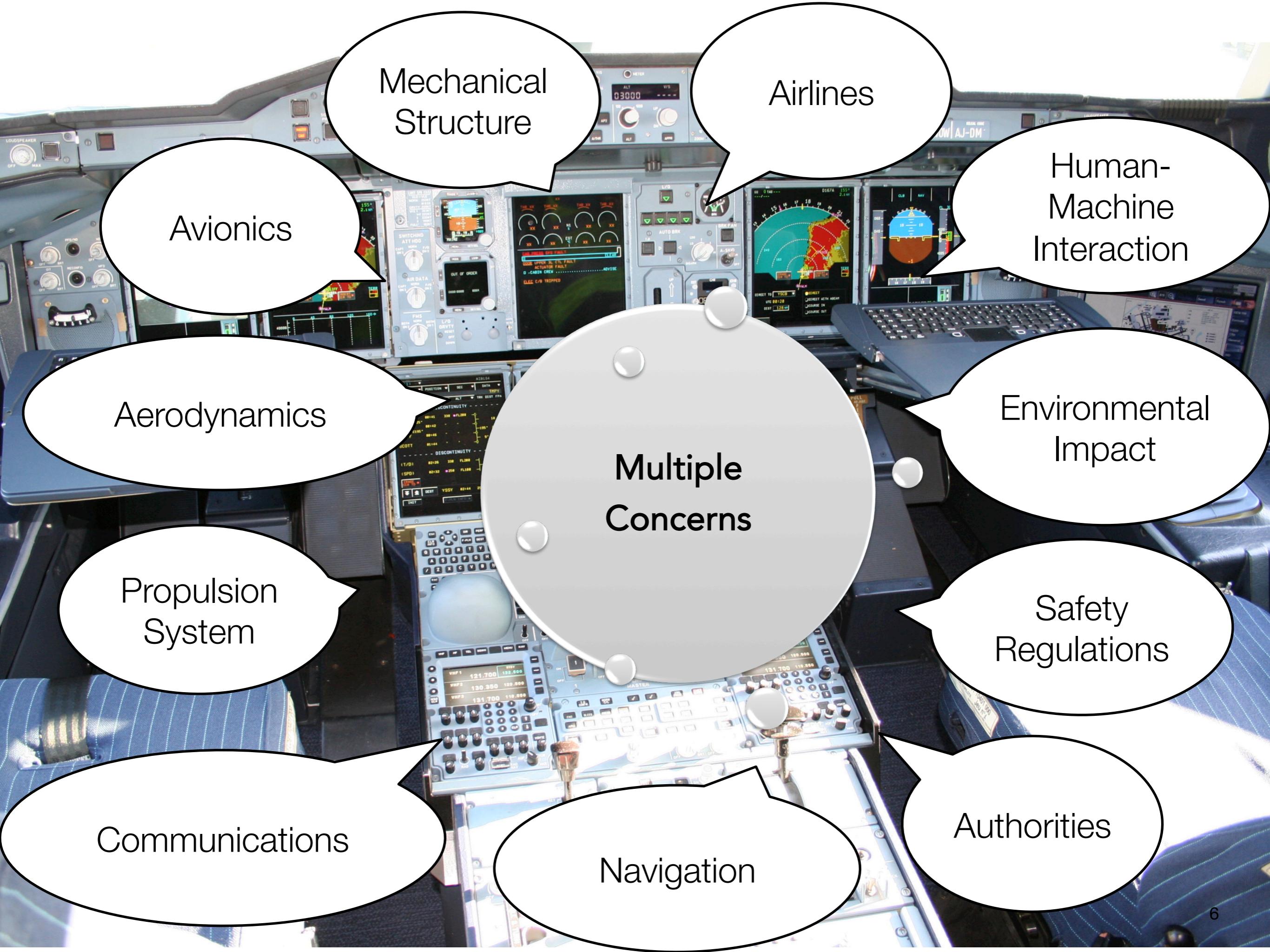
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Context



Software intensive systems





Multiple
Concerns

Avionics

Aerodynamics

Propulsion
System

Communications

Navigation

Airlines

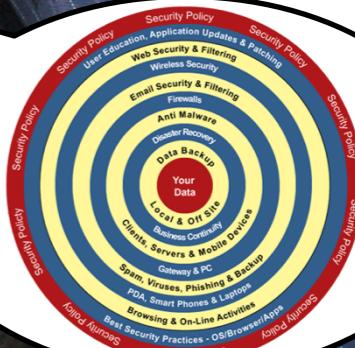
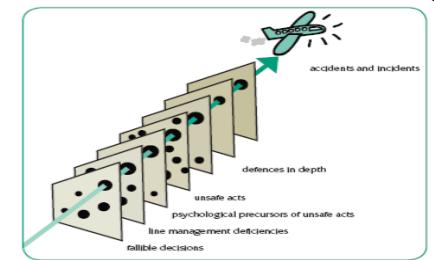
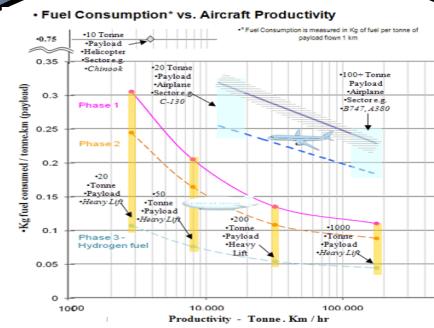
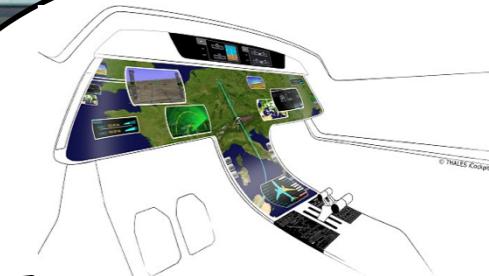
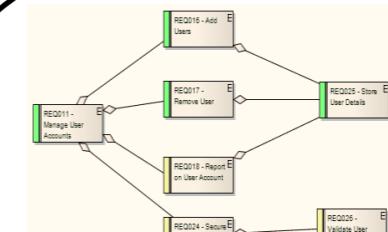
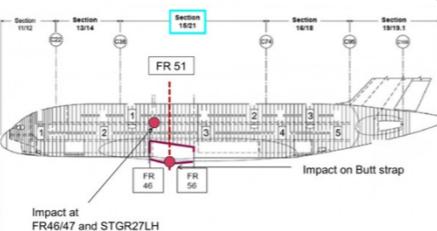
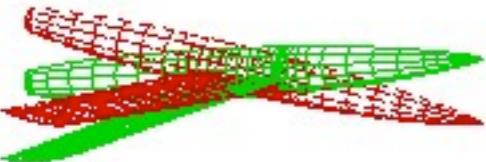
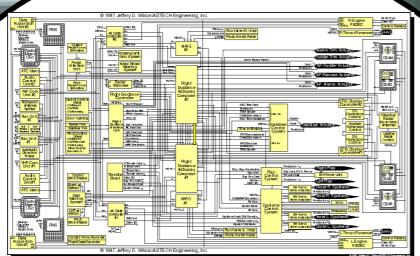
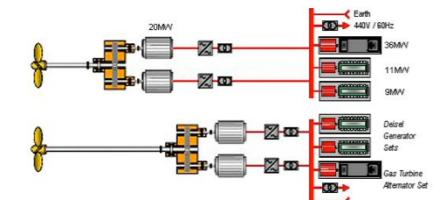
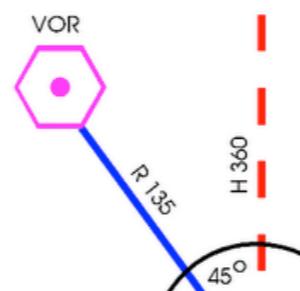
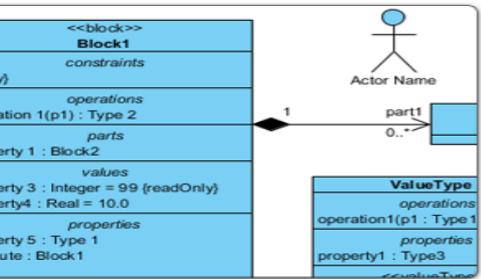
Human-
Machine
Interaction

Environmental
Impact

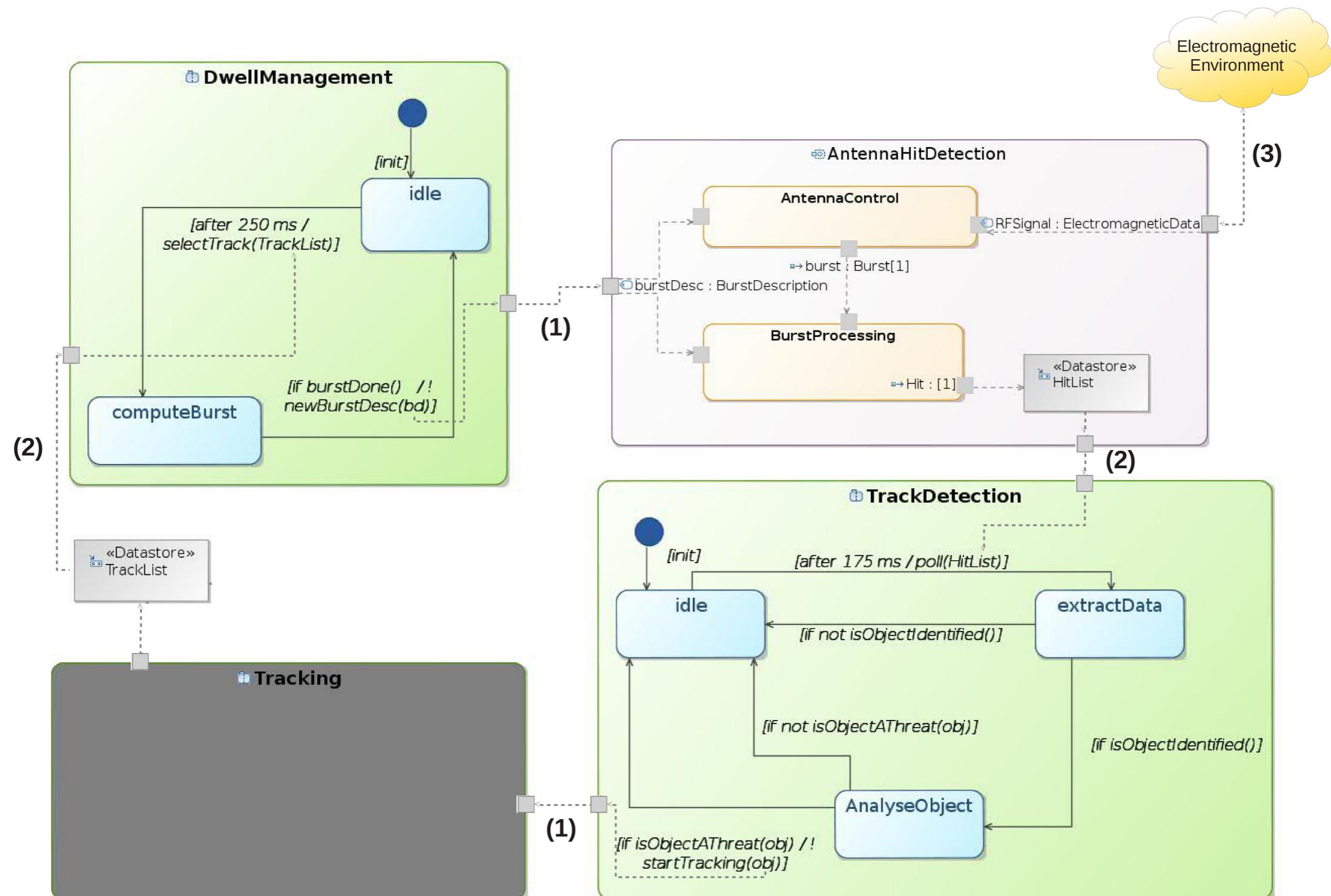
Safety
Regulations

Authorities

Heterogeneous Modeling and Simulation



Context [Génie Logiciel 2013]



The Grand Challenge

« Supporting coordinated use of modeling languages leads to what we call the globalization of modeling languages, that is, the use of multiple modeling languages to support coordinated development of diverse aspects of a system. »

– THE GEMOC INITIATIVE [Computer, 2014]

SOFTWARE TECHNOLOGIES


Globalizing Modeling Languages

Benoit Combemale, Inria and University of Rennes 1
 Julien DeAntoni, University of Nice Sophia Antipolis
 Benoit Baudry, Inria
 Robert B. France, Colorado State University
 Jean-Marc Jézéquel, University of Rennes 1
 Jeff Gray, University of Alabama

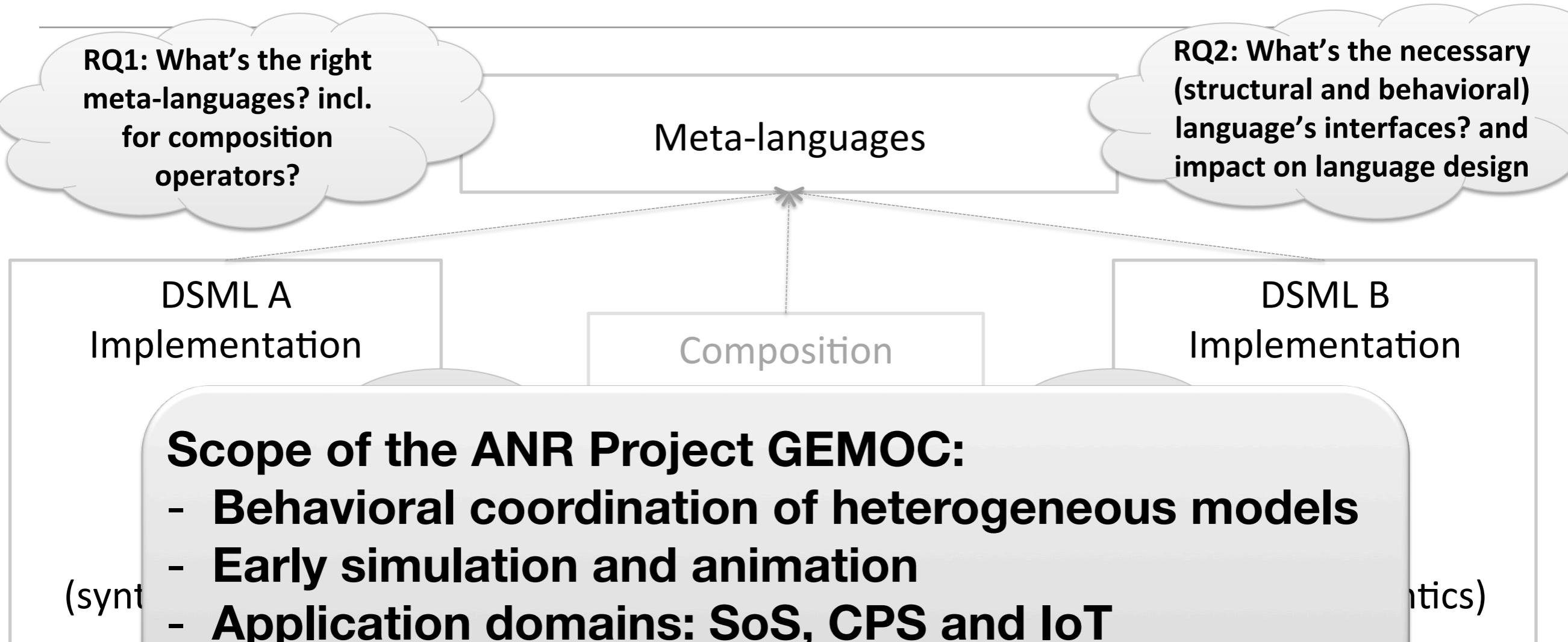
Coordinating domain-specific modeling languages provides support for language heterogeneity in software-intensive systems' development and runtime management.

In the software and systems modeling community, Domain-Specific Modeling Language (DSML) research is focused on providing techniques for the reuse of domain knowledge and tools that allow domain experts to develop system solutions efficiently. Underlying DSML research is the desire to have software and systems engineers to reuse models describing different system aspects because of the correlation between the domain-specific concepts expressed in different DSMLs. Here, we describe a research initiative that goes beyond the DSML research focus beyond independent DSML development to consider the globalized DSMLs—that is, DSMLs that facilitate coordination of work across different domains of expertise.

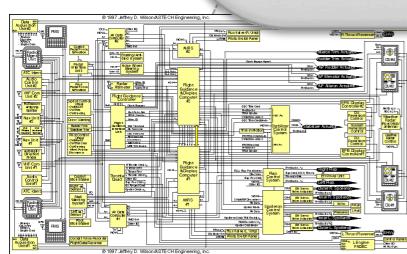
DOMAIN-SPECIFIC MODELING LANGUAGES
 Model-driven engineering (MDE) aims at addressing the complexity associated with developing complex software-intensive systems.¹ In MDE, a model describes an aspect of a system and is typically used for reuse, evolution, or analysis purposes. Separation of concerns is supported through the use of different models that represent different aspects of a system. For example, general stochastic Petri nets can be used to model the behavior of a system whereas the notation provided by the state-of-the-art modeling tool—such as Simulink—not is adapted to handle such models. MDE approaches provide support for manipulating models, such as for querying, translating, transforming, and executing (including executing) models. Modeling languages are thus at MDE's core.

Globalizing Modeling Languages (Benoit Combemale, Julien DeAntoni, Benoit Baudry, Robert B. France, Jean-Marc Jézéquel, Jeff Gray), IEEE Computer, pp. 68-71, June, 2014.

Globalizing Modeling Languages

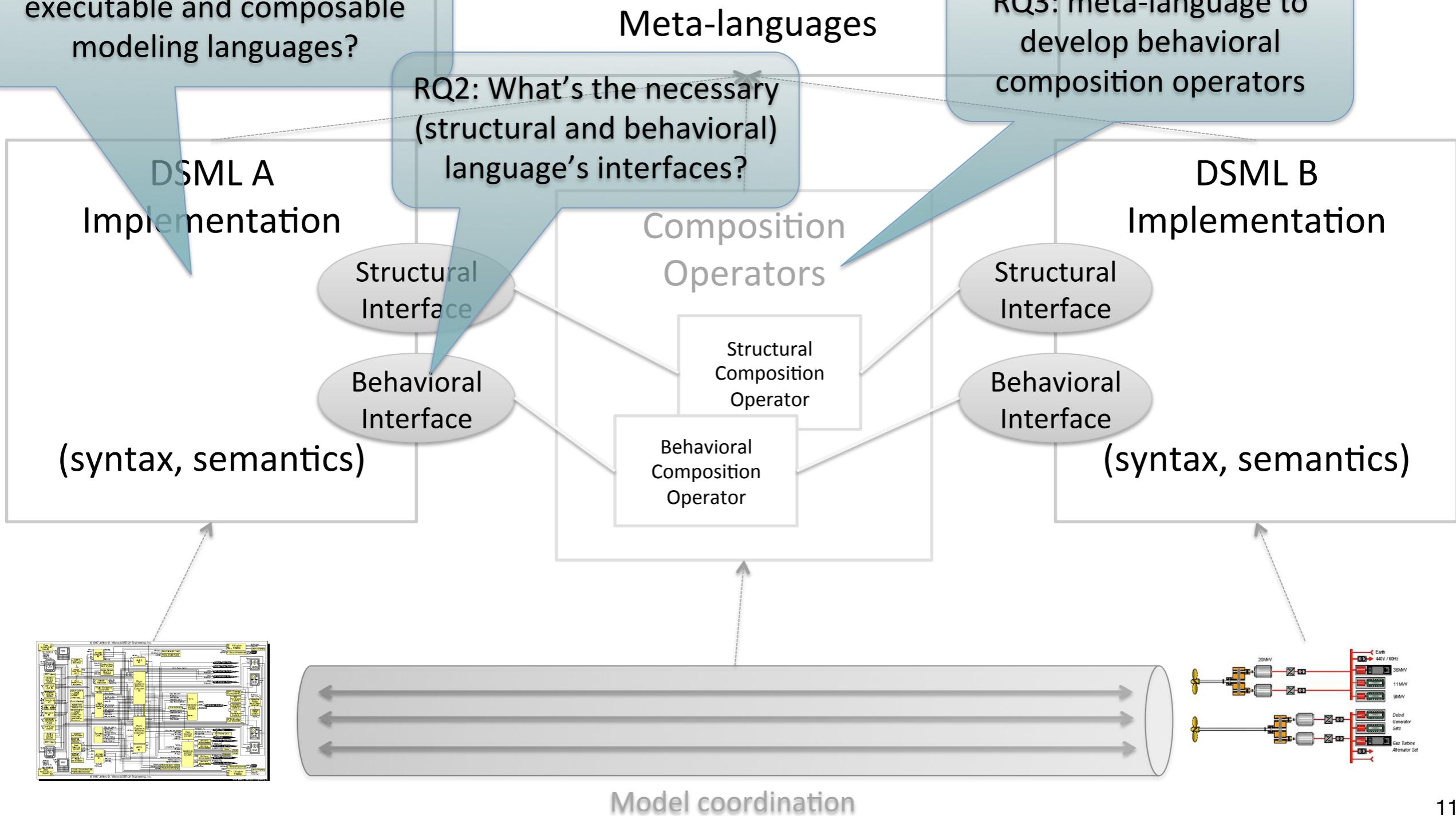


See [Genie Logiciel 2013]



Globalizing Modeling Languages

RQ1: meta-languages to develop executable and composable modeling languages?



Strategic positionning

- French research and industry are at the forefront of Model-Driven Engineering
 - ⇒ Integration of heterogeneity in models is the necessary next move to keep this leadership position
- Develop a generic, open source, domain-independent platform to ensure the widest possible application
- The project is strongly supported by major actors of French embedded software industry (e.g., Thales, Airbus)
- Exploitation is strongly supported by major consortiums and platforms (e.g., Topcased, IWG Polarsys)

Challenges

- Scientific challenges:
 - Formal foundations for executable and concurrent domain-specific language design and implementation
 - Formal foundations for semantic composition of domain-specific languages
 - Associated tool-supported methodology leveraging on executable metamodeling and models of computation
- Technical challenges: an Eclipse-based studio integrating
 - A language worbench for language development and composition
 - A modeling workbench for concurrent execution of heterogeneous models

Scientific background

- Language engineering: executable metamodeling
 - Effective environments for the definition of executable domain specific languages (e.g., Kermeta at INRIA)
 - BUT these environments do not allow the integration of heterogeneous models of computation
- Concurrency theory: heterogeneous modeling and simulation
 - Effective environments to deal with the simulation of models based on heterogeneous models of computation (e.g., Ptolemy at UC Berkeley)
 - BUT these environments do not allow adaptation to specific business domains

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xDSML:

Executable DSMI

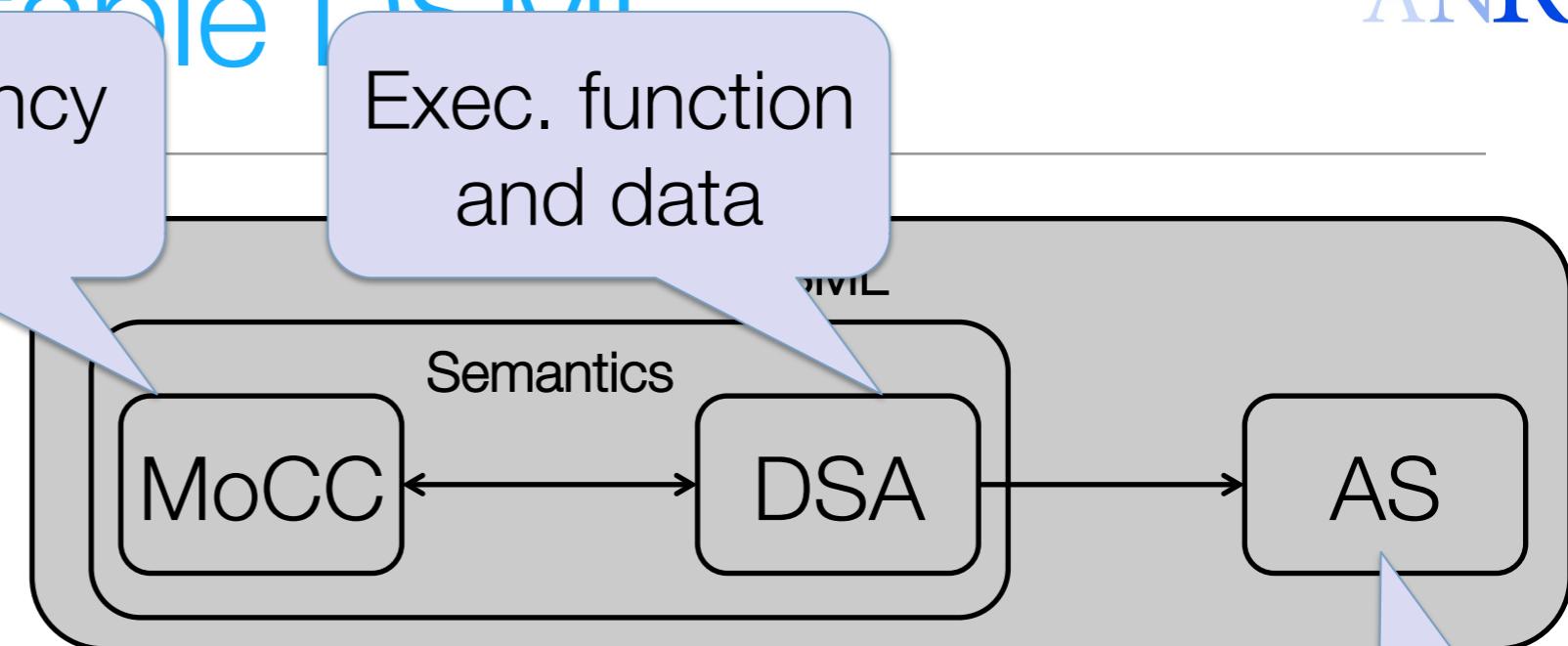
Concurrency Model

Exec. function and data

Breakthrough #1: modular and explicit definition of the behavioral semantics of modeling languages [APSEC'12, SLE'12, SLE'13]

Breakthrough #2: explicit mapping used as behavioral interface of modeling languages [GEMOC'13]

Breakthrough #3: integration of modeling languages for heterogeneous model coordination



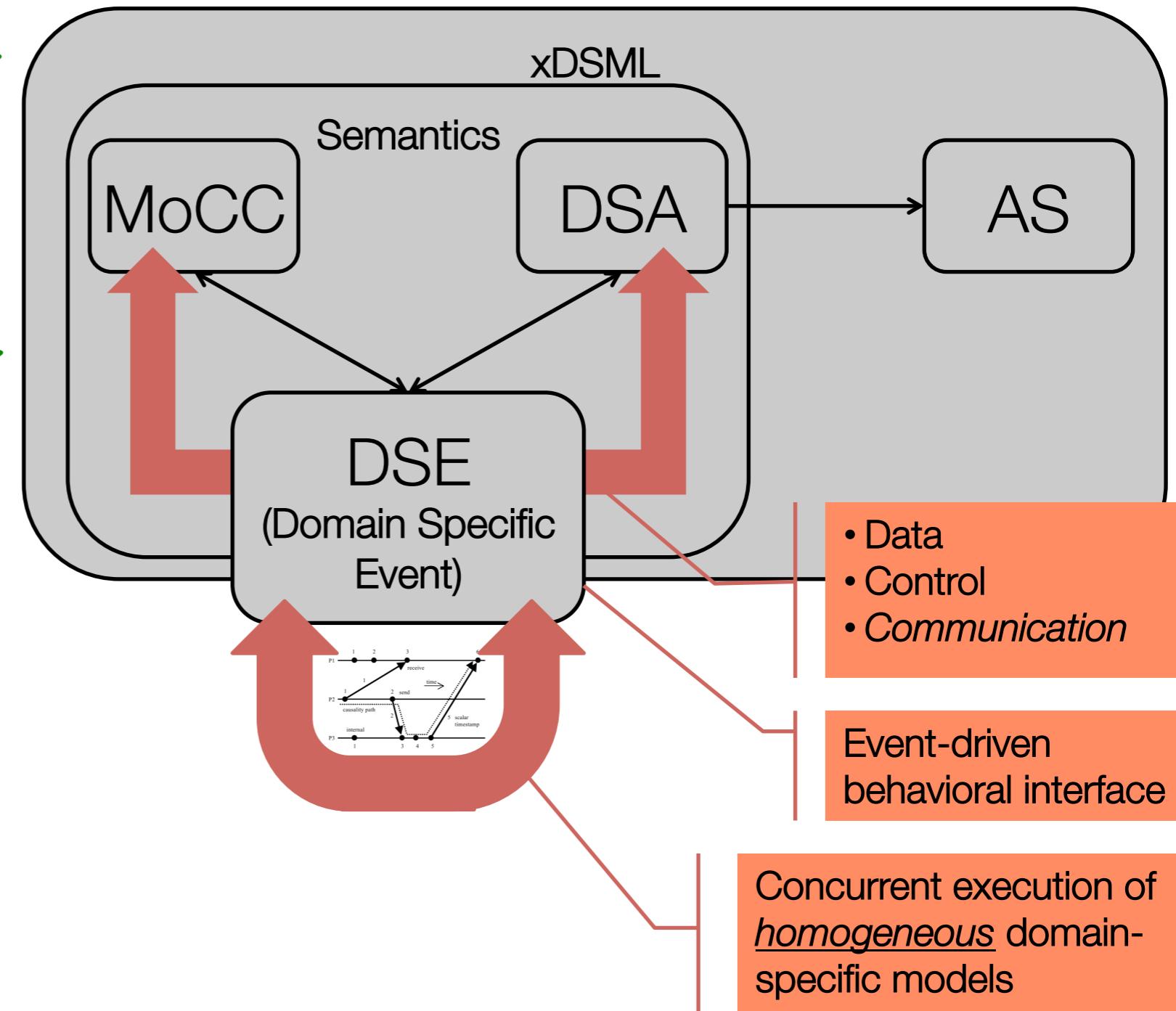
Abstract Syntax

xDSML: eXecutable DSML

Breakthrough #1: modular and explicit definition of the behavioral semantics of modeling languages [APSEC'12, SLE'12, SLE'13]

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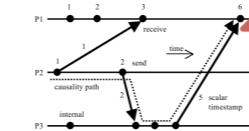
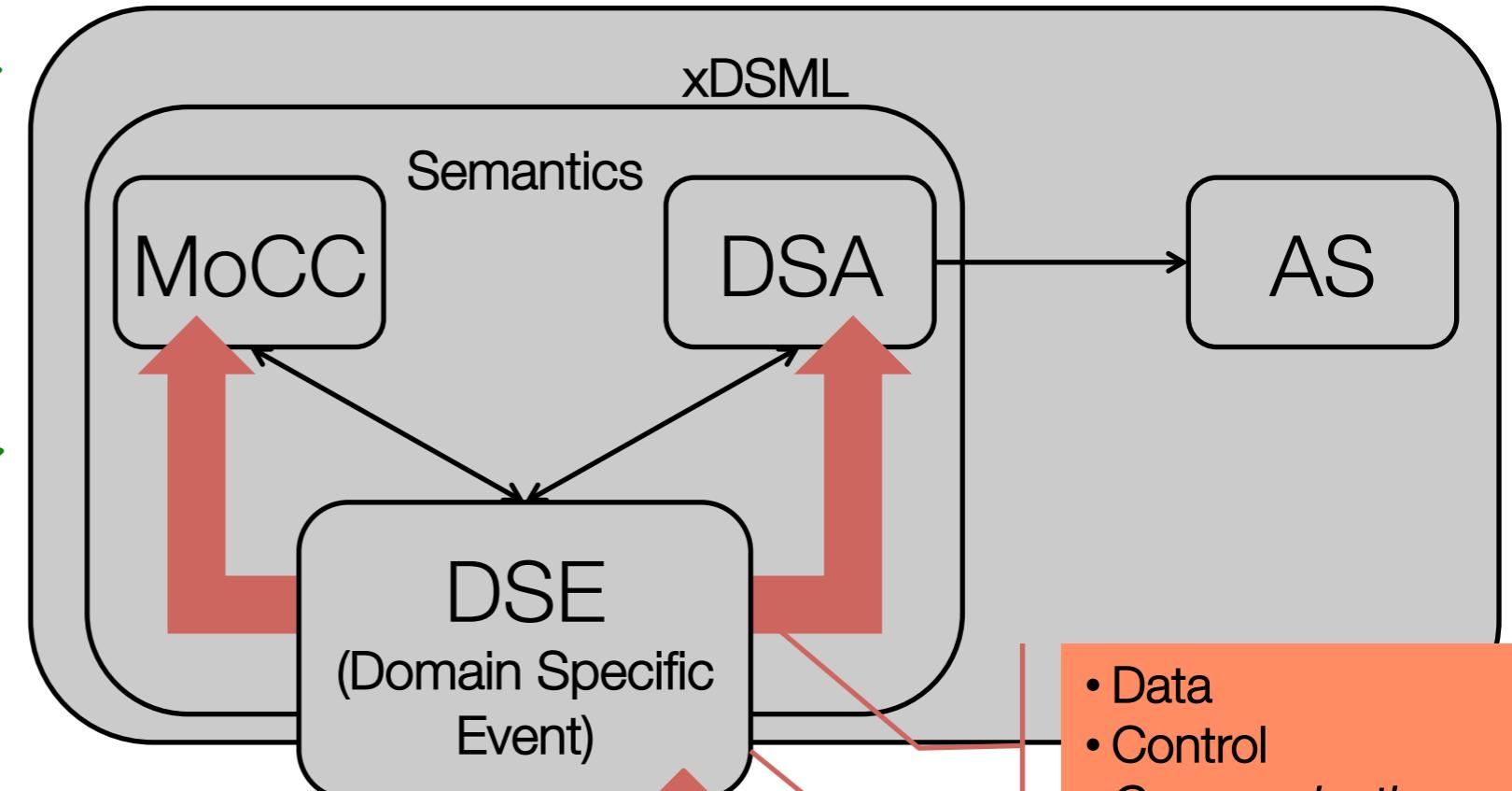


xDSML: eXecutable DSML

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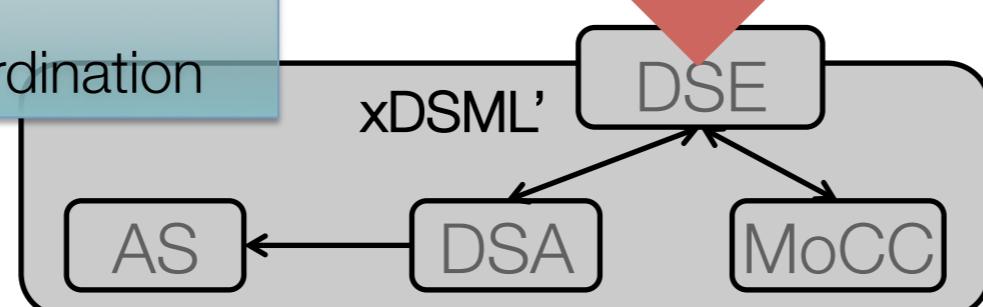
Breakthrough #2: explicit mapping used as behavioral interface of modeling languages [GEMOC'13]

Breakthrough #3: integration of modeling languages for heterogeneous model coordination



Event-driven behavioral interface

Concurrent execution of heterogeneous domain-specific models

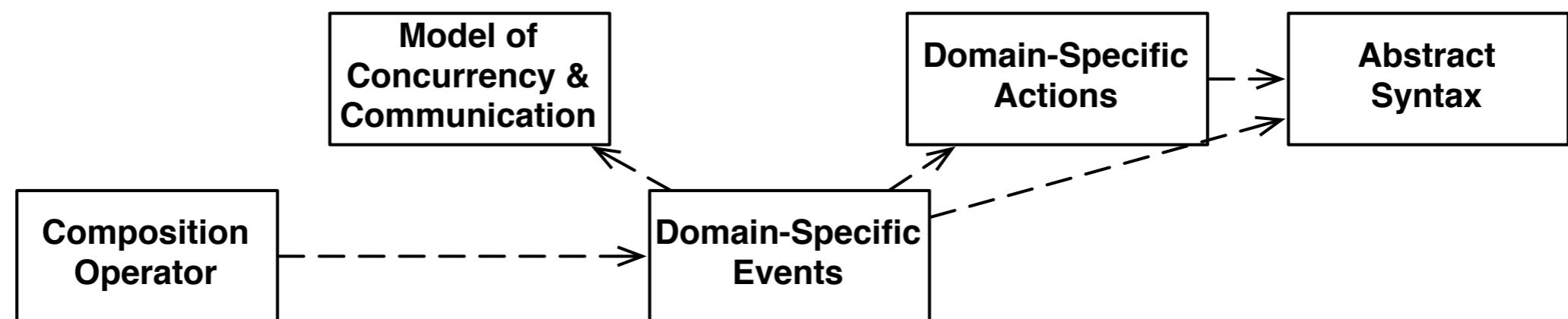


xDSML: from theory to practice

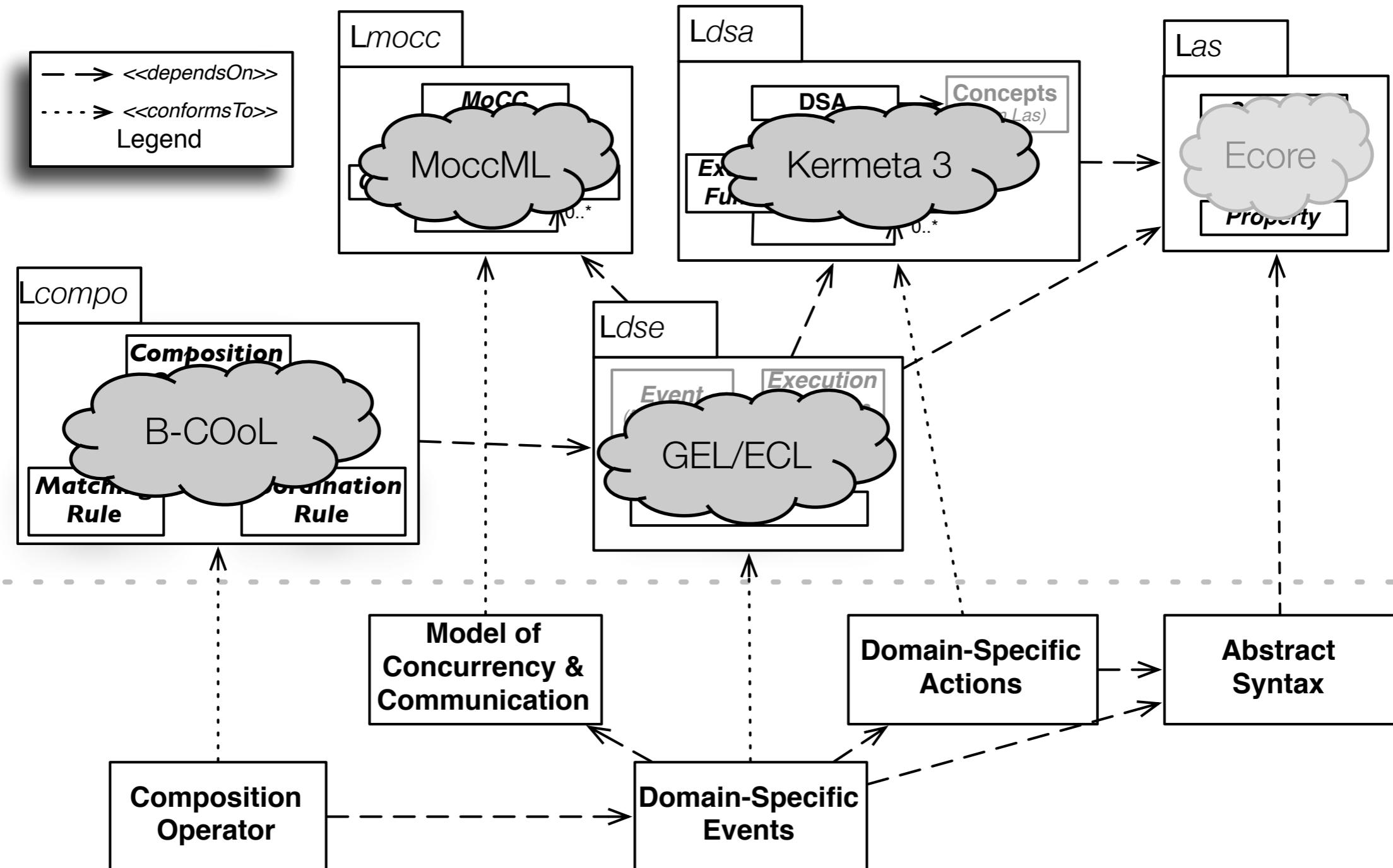


<http://gemoc.org/studio>

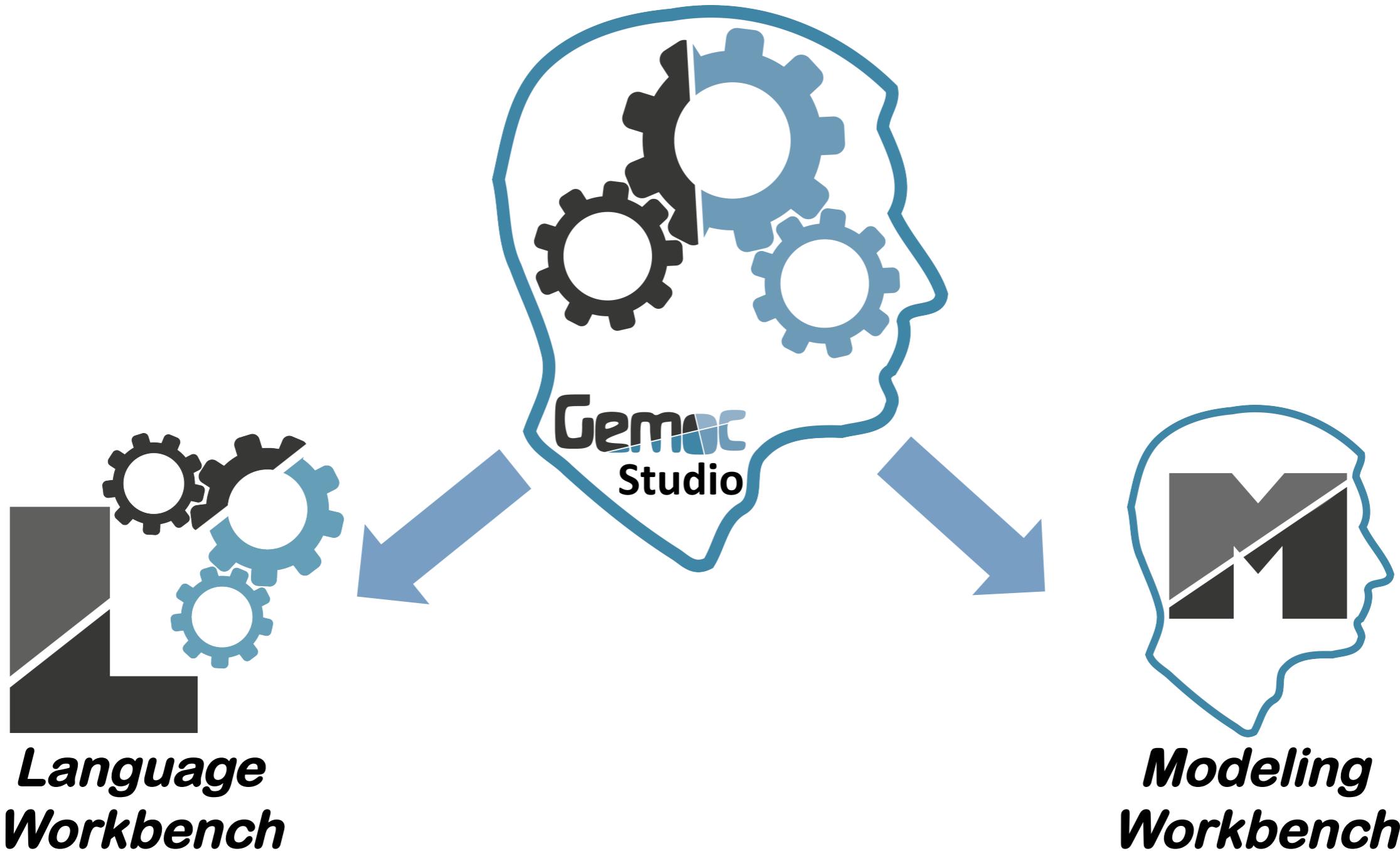
xDSML: from theory to practice



xDSML: from theory to practice



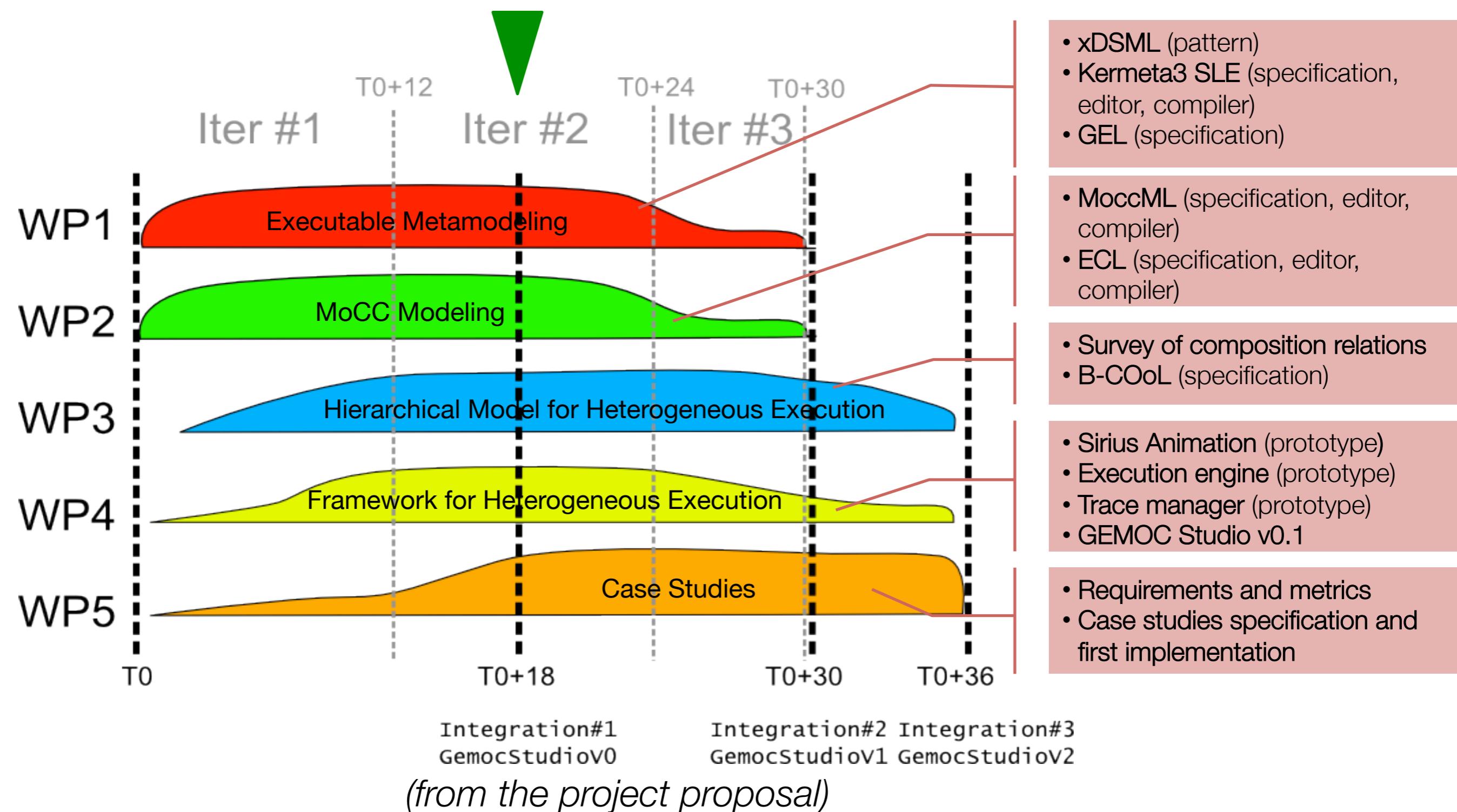
The GEMOC Studio



Outline

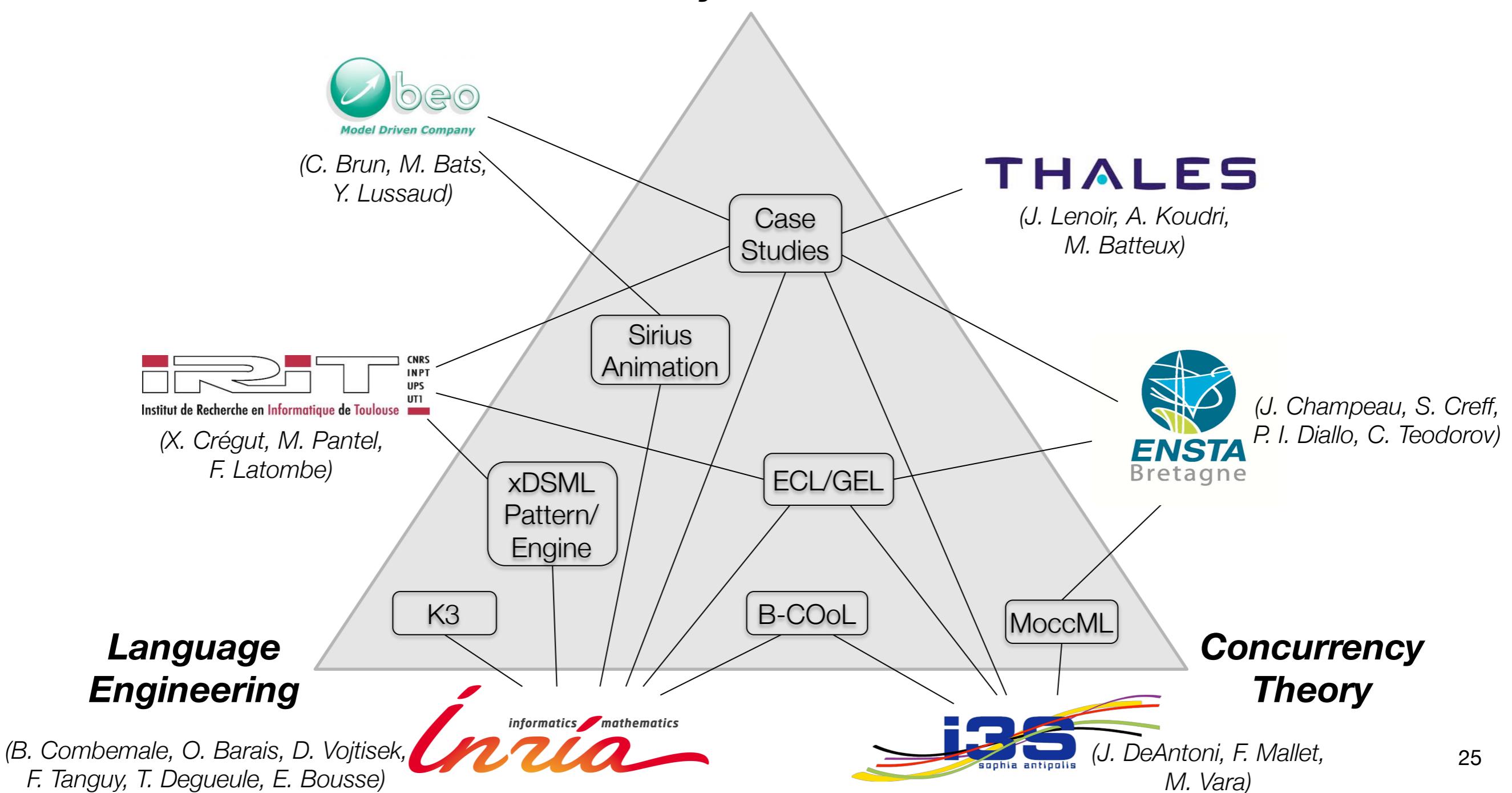
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Progresses per WP (M0-M18)

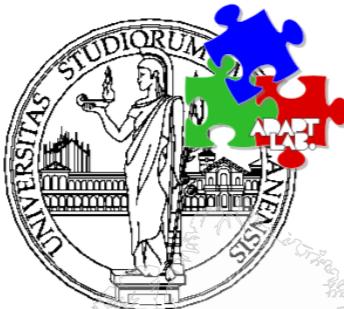


The consortium, the (main) team, the expertise, and the contributions

Complex Software-Intensive Systems



The GEMOC Initiative



FIU
FLORIDA
INTERNATIONAL
UNIVERSITY

Atos



Supélec



TATA
TATA CONSULTANCY SERVICES

An open and international initiative to

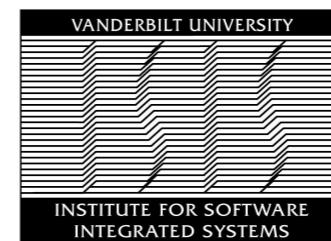
- coordinate (between members)
- disseminate (on behalf the members)

worldwide R&D efforts on the globalization of modeling languages

<http://gemoc.org>



AIRBUS



VANDERBILT UNIVERSITY
INSTITUTE FOR SOFTWARE
INTEGRATED SYSTEMS



UNT
UNIVERSITY OF
NORTH TEXAS™
Discover the power of ideas

Dissemination and outreach activities

- **Joint publications** from the project
APSEC'12, SLE'12, SLE'13, GEMOC'13, Génie Logiciel'13, IEEE Computer'14, FESCA'14
- 8 **other publications** from the project
- **Invited talks**
Conference CIEL, Conference Neptune (*2), CNRS DevLog days, Workshop PMDE, Workshop AOM, Model and verification driven engineering '14
- **Organizations of workshop**
GlobalDSL'13, GEMOC'13, GEMOC'14, Dagstuhl Seminar #14412.
- **Organization of summer school**
MDD4DRES'14
- **Posters**
ECOOP'13, EclipseCon'14 Fr.
- **Research project symposium** at ECOOP'13
- **Conference sponsoring:** SLE'14
- **Project proposals:** SoDSL (H2020, MSCA ITN), Clarity (LEOC)

Management

- **Consortium agreement**
 - approved on November, 2013
- **Activity reports**
 - T0+6: <http://gemoc.org/ins-pub/midtermreview/gemoc-anr-cr-M6.pdf>
 - T0+12 (D0.1.2): <http://gemoc.org/ins-pub/midtermreview/gemoc-anr-cr-M12.pdf>
 - T0+18: <http://gemoc.org/ins-pub/midtermreview/gemoc-anr-cr-M18.pdf>
- **Consortium meeting**
 - Visio-conferences (biweekly)
 - Physical technical meeting (quarterly, each including a board meeting)
 - Physical project management meeting (yearly, co-located with the last technical meeting)
- **Collaborative platform**
 - CMS, mailing lists: <https://gforge.inria.fr/projects/gemoc>
 - Development server: <https://gforge.inria.fr/projects/gemoc-dev>
 - Continuous integration server: <https://ci.inria.fr/gemoc>
- **Website and social medias**
 - <http://gemoc.org/ins>
 - <https://twitter.com/gemocinitiative>

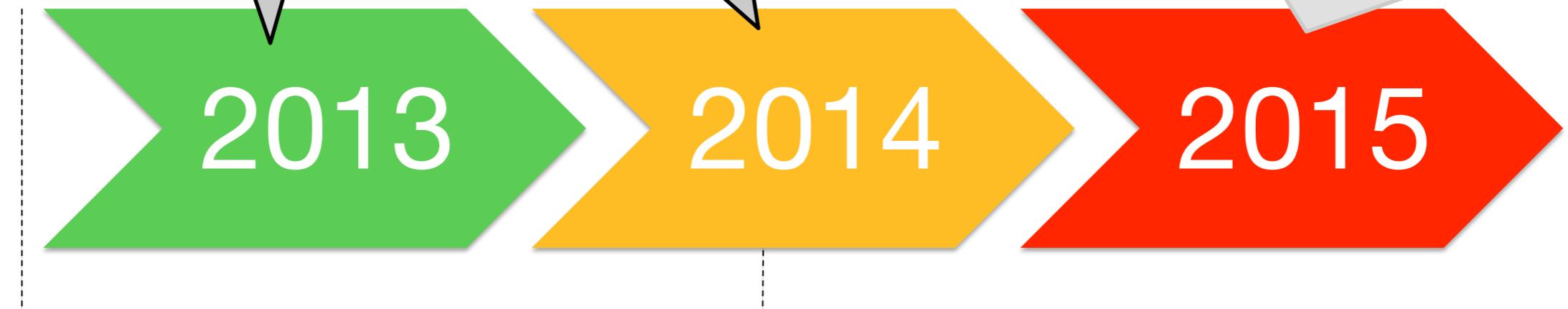
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- Validation of the challenges [Génie Logiciel'13, Computer'14] and the vision [APSEC'12, SLE'12, SLE'13]
- Integrated studio: the GEMOC Studio
- Launch of the international GEMOC initiative
- International dissemination (GlobalDSL@ECOOP'13 and GEMOC@MoDELS'13)

- Development of the solution (K3, GEL, MoccML, Sirius Animation, B-COol)
- First experiments with the GEMOC studio and first official release v0.1
- International dissemination (EclipseCon France, MDD4DRES'14, SLE'14, GEMOC@MoDELS'14 and Dagstuhl Seminar #14412)

- Consolidation and evaluation of the solution*
- Advanced scenarios with the GEMOC studio. Releases v1 and v2*
- Establishment of the exploitation plan*
- Exploration of the perspectives: V&V, optimizing compilers, software adaptation, cybersecurity.*



Dec., 2012
T0
(project kickoff)

June, 2014
T0+18
(mid-term review)

March, 2016
T0+40
(project end)

Materials: <http://gemoc.org/ins-midtermreview>



Gemoc

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