The GEMOC Initiative

On the Globalization of Modeling Languages

http://www.gemoc.org

Contact: Benoit Combemale

benoit.combemale@irisa.fr

Version: June, 2013
Context

Software intensive systems
Complex Software-Intensive Systems

• deal with multiple concerns  
  ⇒ require *global analysis and execution*

• integrate heterogeneous parts  
  ⇒ require *global service*

• manage evolution of concerns and the emergence of new concerns  
  ⇒ require evolution and creation of tools and methods for software development
Aerodynamics
Avionics
Mechanical Structure
Airlines
Human-Machine Interaction
Environmental Impact
Safety Regulations
Authorities
Propulsion System
Communications
Navigation
Heterogeneous Modeling Languages
Heterogeneous Modeling in Global Software Engineering
Model Driven Engineering…

Distribution

Security

Fault tolerance

Functional behavior

Use case model

Platform Model

Design Model

Code Model

Change one Aspect and Automatically Re-Weave: From AORE, SPL to DAS
=> 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**

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
On the Globalization of Modeling Languages!
An Initiative…

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

"On the Globalization of Modeling Languages" [GEMOC]
... 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)

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

http://gemoc.org/ins
Model Composition
Many possible interactions between models (structural vs. behavioral, flat vs. hierarchical, refinement…)

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

"UML vs. Classical vs. Rhapsody Statecharts: Not All Models are Created Equal", Michelle Crane, Juergen Dingel
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 (concurrence, 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

Models of Computation

Metamodelling

Global Software Engineering

[Winskel’87]
[Jantsch'04]
[Schmidt'06]
[Karsai’03]
[Lee and Sangiovanni’98]
[Eker et al.’03]
[Clarke'02]
[Lédeczi'01]
[Straw’04]
[Conway’68]
[Boehm’84]
[Herbsleb'01]
[Atkinson'06]
[Lédeczi'01]
[Souza'04]
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 worbench
  - A language coordination and execution engine
  - A workbench for viewpoint definition and animation over heterogeneous models
ANR INS GEMOC: Expected Studio

GeMoC Studio (from WP4)

- eXecutable Modeling Tools (reflexive editors, VM and compilers: EMF, Kermeta, and OBEO Designer)
- Reflexive Model Animators (OBEO Designer)

Execution Engine for Heterogeneous Models (from WP4)

Language Definition Tools
DSML (from WP1), MoCC (from WP2), Graphical Animation (from WP4), and their Composition (from WP3 and WP4)

Domain Designers (from WP5)

Domain Experts (from WP5)

Eclipse Modeling

Eclipse
Cross Road Traffic Light

http://youtu.be/gT1QUUmFkLM
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 ECSA 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](http://gemoc.org/globaldsl2013)
GEMOC 2013

International Workshop on
The Globalization of Modeling Languages
September 29th, 2013, Miami, Florida, USA
colocated 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