A Solution to the TTC’15 Model Execution Case Using the GEMOC Studio

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http://gemoc.org/ttc15/
@gemocinitiative
GEMOC: The Initiative

An open and international initiative to

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

worldwide R&D efforts

on the globalization of modeling languages

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GEMOC: The Events

The GEMOC workshop series co-located with the MODELS conference:

- 3rd International Workshop on the Globalization of Modeling Languages (GEMOC’15)
- 2nd International Workshop on the Globalization of Modeling Languages (GEMOC’14)
- 1st International Workshop on the Globalization of Modeling Languages (GEMOC’13)

- Dagstuhl Seminar #14412 on “Globalizing Domain-Specific Languages”, October, 2014.
  - A book to be published soon (Springer edition)!

- International Workshop on the Globalization of Domain Specific Languages (GlobalDSL’13),
  co-located with ECMFA, ECOOP and ECSA 2013

- Official launch of The GEMOC Initiative at the Research-Project Symposium of
  ECMFA/ECOOP/ECSA’13 (July 1st, 2013)
GEMOC: The Community
GEMOC: The Studio

Design and compose your executable DSMLs

Edit, simulate and animate your heterogeneous models

Language Workbench

Modeling Workbench

http://gemoc.org/studio
GEMOC: The Projects

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](http://gemoc.org/as2011)

ANR INS GEMOC
2012-2016
- A Language Workbench for Heterogeneous Modeling and Analysis of Complex Software-Intensive Systems
- Partners: Inria (DiverSE), I3S (Aoste), IRIT, ENSTA-Bretagne, Thales, Obeo
- Cf. [http://gemoc.org/ins](http://gemoc.org/ins)

CNRS PICS MBSAR
2013-2015
- Travel funds for permanent staff and PhD students
- Partners: IRISA (DiverSE), CSU
- Cf. [http://gemoc.org/mbsar](http://gemoc.org/mbsar)

ICT COST Action
MPM4CPS
2014-2018
- Promote the sharing of foundations, techniques, and tools and to provide educational resources, to both academia and industry
- Cf. [http://www.cost.eu/COST_Actions/ict/Actions/IC1404](http://www.cost.eu/COST_Actions/ict/Actions/IC1404)
Concurrent execution of heterogeneous models (ANR Project, #ANR-12-INSE-0011)

Breakthroughs:

• modular and explicit definition of the behavioral semantics of modeling languages, incl. concurrency [APSEC’12, SLE’12, SLE’13]
• dedicated meta-languages [DATE’15]
• explicit behavioral interface of modeling languages [GEMOC’13]
• integration of modeling languages for heterogeneous model coordination [Computer’14, Dagstuhl #14412]

Visit http://gemoc.org/ins
The GEMOC Studio

A Journey Through MDE, DSL and SLE - Benoît Combemale (INRIA and Univ. Rennes 1) - July 2nd, 2015
Proposed Approach: three variants

- **Version #1:** `executionOnly`. Interpreter defined with Kermeta only

- **Version #2:** `withAnimationAndTrace`. Execution within the GEMOC modeling workbench, with support of the animation and the trace management for omniscient debugging

- **Version #3:** `withConcurrency`. Execution within the GEMOC modeling workbench, with support of omniscient debugging and the concurrency analysis
Proposed Approach: Language workbench

- **(version #1) Kermeta**, which offers specific annotations for Xtend to support the modular implementation of an operational semantics (both runtime concepts and steps of computation) and its weaving into an EMF-based metamodel (i.e., an Ecore model).

- **(version #2) Melange**, to build the overall language runtime seamlessly integrated to EMF and to ensure interoperability between the legacy metamodel without the operational semantics, and the metamodel extended with the operational semantics.

- **(version #2) Sirius Animator**, an extension of the model editor designer Sirius to create graphical animators for xDSMLs.

- **(version #3) MoCCML**, a tool-supported meta-language to specify a Model of Concurrency and Communication (MoCC) and its mapping to a specific metamodel and associated operational semantics of a xDSML.
Proposed Approach: Modeling workbench

- A Java-based **execution engine** (parameterized with the specification of the operational semantics), possibly coupled with TimeSquare (parameterized with the MoCC), to support the concurrent execution and analysis of any conforming models.

- A **model animator** parameterized by the graphical representation defined with Sirius Animator to animate executable models.

- A generic **trace manager**, which allows a system designer to visualize, save, replay, and explore different execution traces of their models, as well as navigating step-by-step in a given execution trace (incl., breakpoint, step forward and step backward).

- A generic **event manager**, which provides a user interface for injecting external stimuli in the form of events during the simulation (e.g., to simulate the environment).
Proposed Approach: Evaluation

- Correctness
  - Based on trace comparison obtained with the models provided by the case
  - All the three variants provide correct results

- Understandability and Conciseness
  - Seamless extension of the provided legacy metamodel
  - Kermeta, based on Xtend, provide a powerful Java-like imperative and statically typed metalanguage
  - Static introduction: modular design and efficient runtime
  - Model debugger useful both for system engineer and language designer
  - 441 LOC (version #1, "executionOnly")

- Performance

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Table 1: Execution time (in ms) of the performance tests
Activity Diagram Debugger

- Graphical animation
- Breakpoint definition on model element
- Multi-dimensional and efficient trace management
- Model debugging facilities (incl., timeline, step backward, stimuli management, etc.)
- Concurrency simulation and formal analysis

https://github.com/gemoc/activitydiagram
Farming System Modeling

https://github.com/gemoc/farmingmodeling
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