TOPCASED
Toolkit In OPen source for Critical Applications & SystEms Development

• General presentation of the project
• A meta-modeling toolset
• The toolset architecture
• Services & Formats
• Demo / screenshots
• Conclusion
The creation of industrial systems relies on numerous tools on which it is essential to capitalize in order to optimize development costs.

The lifetime of aerospace products is often as long as 10 to 30 years, and today, no software editor is able to commit for such long time at an acceptable cost.
Project Goals

• Perpetuate methods & tools for system and software development
• Minimize ownership costs
• Ensure the independence of development platforms
• Integrate as soon as possible, advances made in the academic world, and methodological changes
• Be able to adapt the tools to the process, and not the opposite
• Take into account qualification constraints
Project Perimeter

Requirements to code/implementation phases

- Requirements
- Design
- Coding
- Integration
- Validation
- UML
- AADL
- Generating
- Managing
- Implementing
- Verifying/Testing
Open Source?

- Ensure the availability of the tools even on a long period
- It is possible to keep control on the tools' life
- Costs are not directly dependent on the number of users, but on the development effort
- Development costs can be shared
- There is already a lot of valuable tools in open source: GCC, GDB, ...
But...

- Licensing plans have to be carefully studied
- The maintenance mechanism has to be defined to ensure efficiency
- The current business model has to evolve
Partnerships
Collaborations

- IST Modelware: Meta-modeling language & ModelBus (http://www.modelware-ist.org)
- Eclipse iMDD: a project supported by the Eclipse foundation aiming to distribute model oriented Eclipse features
- The TopModL initiative (http://www.topmodl.org): generation of editors using meta models, semantic informations and meta modeling languages
- SAE AS-2C, SEI and IST ASSERT: AADL tools
- Use of finished projects NEPTUNE & COTRE: static & dynamic model verifications
Work packages

- WP1 – Processus
- WP2 – Modelling
- WP3 – Verification & simulation
- WP4 – Coding
- WP5 – Transformations
- WP6 – Interoperability
- WP7 – Infrastructure
- WP8 – Safety
Development & Maintenance Means

- A Gforge server is hosted by the ENSEEIHT (engineers school in Toulouse, France)
- The web site is hosted by the CNRS-LAAS in Toulouse
- A leading committee has been defined
- Fundings: private funds at this time, but public research projects are also targeted (Aerospace Valley French competitiveness pole, ITEA, IST, ...)

implémenter  modéliser  vérifier  TOPCASED
Atelier Développement Open Source  tester  gérer  réaliser
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Numerous Formalisms

Scade/LUSTRE, MatLab/Simulink, ESTEREL, SDL, Structured analysis, Software real time architectures (ARINC653, bare hardware), Mealy machines, HOOD, UML, SysML, AADL, experimental languages...
Meta modeling Technique

- A model type or a language can be described using a meta model or a meta language
- The Open Modeling Group (OMG) defined a 4-layers point of view

M0 – Real Object

M1 – Model

M2 – Metamodel

M3 – Metamodelling language

Software, hydraulic or electronic system, etc.

UML model, finite state machine, hydraulic or electronic schema, ...

UML metamodel, finite state machine metamodel, hydraulic or electronic schemas metamodels

EMOF, CMOF, ECORE, ...
Meta Object Facility

• MOF is the meta modeling language standardized by the OMG.
• TOPCASED uses ECORE, which is the EMF variant of MOF.
Example of meta model

A home-made finite automaton meta model
Required Operators

- Comparison of models
- Merge of models
- Meta-model update for a model
Existing Meta-modeling Tools

- DoME from Honeywell
- OpenTool from TNI-Valiosys
- GME from the Vanderbilt University
- EMF from the Eclipse Foundation
- TopModL, a research project leaded by the Université de Haute Alsace
- ...

...
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Eclipse, EMF & GEF

- A Java based multi-platform IDE
- Fully open source (CPL/EPL)
- Several major industrial use and develop it (IBM, Thales, ...)
- GEF : Graphical Editing Framework
- EMF : Eclipse Modeling Framework
Workbench Architecture

- Services distributed as Eclipse plug-ins and features
- Services can be found and used through the bus
- External tools can also be plugged (useful to avoid licenses conflicts)
Development of graphical editors

- Partially generated
- From meta-models and a specific graphical configuration model
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Transformations & Formats

- through EMF, models are read and written in the XMI 2.0 format
- Others formats are possible (e.g. aaxl from AADL/OSATE)
- ATL (INRIA AMMA project, released in Eclipse/GMT) is used for import/export
- It is of course always possible to use more general languages to implement transformations (Java, C, C++, etc.)
Verifying Models

- Simple semantic rules: static checkers (OCL, ...)
- A posteriori: when the designer decides to do so
- A priori: during edition
- Behavioral checks: requires powerful tools
- Display the check result at the graphical level
Simulation

• A good tool to ensure the understanding of projects particularities, and to validate models behaviors

• Can be used to implement non-regression tests on models

• First studies are going to start
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ECORE
Functional split & Automata
AADL/COTRE
AADL 1.0
UML 2.0
To Conclude

- The software developed is of course freely available (current release: 0.5.0)
- First experiments will begin shortly
- The partnership is open to every goodwills
- Keep in touch with TOPCASED at

http://www.topcased.org/