Elldiss Software
HOOD, STOOD and AADL

Ada Europe 2013 Berlin

Elldiss
www.ellidiss.com

Mission Critical SW tool developer:

UK based company aka TNI Europe Ltd
Tools sales office

Fr based company
New tools development
R&D center

20 years support to major industrial projects:
• HOOD design tools for Ada and C: CP-Hood and Stood
• Eurofighter Typhoon
• Airbus A340, A380, A350
• Eurocopter Tiger (mission calculator)
• Rafale (engine control)
• Legacy Ada code reverse engineering

10 years investment in AADL technology:
• Contribution to the AADL standardization committee
• AADL graphical modeling tools: Stood for AADL, Adele, TASTE, DSMs
• AADL model processing framework: AADL Inspector
What do we do?

• **Develop and Market Software Tools**
  - Development, Distribution and Support of COTS toolsets
  - Consultancy:
    - Training Course
    - Tool Customization (code generators, ... )
    - Project Assistance

• **Research and Development**
  - Model Driven Engineering & Component Based Architectures
  - Bridging System & Software modeling activities
  - Contribution to R&D programs:
SOFTWARE TOOLS

• CP HOOD
  • Current release 6.2
  • Beta release 7.0

• STOOD
  • Current release 5.3
  • Beta release 5.4

• AADL INSPECTOR
  • Current release 1.0
  • Beta release 1.1

CP-HOOD 7.0

New Features
## Variants

- Variants of a design share some features with it but have some specific features themselves.
- Shared elements could be objects, units, sections of text, parts of a drawing or ODS items such as operations and types.
- When the design is specified, a variant can also be specified.
- If no variant is specified, the basic design is used.

## Sandboxes

- Sandboxes allow changes to a design to be tried out.
- Objects and units can be placed in a sandbox.
- The sandbox is specified in the same way as a variant.
- If no sandbox is specified, changes made in the sandbox are not seen but changes cannot then be made to the units in the sandbox.
Changes to HMW

- New option “Variant Configuration Editor” on the HOOD Tools menu.
- Variant field is hidden if no variants or sandboxes defined

Variant Configuration Editor

- Can specify objects, requirements and units as specific to a variant
- Can specify object as part shared and some elements of it as variant specific
- Items not listed are shared
HMW with Variant

• Variant field visible if any variants defined
• Cannot edit unit which is shared with master design

HSTE with Variant

• Can edit ODS of part shared object
• Edit of shared operation not allowed (modify menu only gives options to show things)
Configuring a Sandbox

- A sandbox is declared in the same way as a variant
- The sandbox can be made into the master design if the changes are acceptable

New Help Facility

- Help pages displayed in web browser format
- Links to help for other tools at top
- Links to key features for tool on right hand side
CP HOOD References

- Eurofighter Typhoon

- Hawk

- Tornado

STOOD 5.4

- **multi-standard software modeling tool:**
  - UML2.0, HOOD 4.0, HRT-HOOD and AADL

- **well defined step-by-step modeling process:**
  - import of functional and non-functional requirements
  - multi-notation graphical design of the architecture
  - multi-language detailed design and coding (Ada, C, C++, ...)
  - static design verification tools and link with AADL Inspector
  - multi-format documentation generators (html, pdf, word, ps, odt)
  - code generators and reverse engineering (i.e. Ada <-> AADL)

- **Deployed on industrial projects:**
  - multi-users, configuration management, requirements traceability
  - Unix-Windows interoperability
  - Currently in use for the A380, A350, Rafale, M346, EH101, Tiger, ...

Download at: http://www.ellidiss.com/
Stood design checker has been qualified as a verification tool for the A380 DO-178B certification.
Static analysis

Stood

Osate

.Saadl file

Schedulability analysis

Stood

Cheddar

.Saadl file

Scheduling simulation. Processor
rma.default.default_processor
- Number of context switches : 103
- Number of preemptions : 20
- Task response time computed from simulation :
  rma.default.rma_process.t1 = 14/worst
  rma.default.rma_process.t2 = 1/worst
  rma.default.rma_process.t3 = 3/worst
- No deadline missed in the computed scheduling : the task set seems to be schedulable.
Reverse Modeling of Ada legacy projects

• **STOOD for HOOD**
  – Designed to support Ada
  – HOOD Graphical editor and Detailed Design
  – Ada code generation
  – Ada code reverse engineering

• **STOOD for AADL**
  – SAE AADL 2.1: Model Driven Engineering for critical systems
  – AADL Graphical editor
  – AADL textual model generation
  – AADL textual model import
  – Advanced verification tools at model level with AADL Inspector

• **Combine both versions of Stood for Ada reverse modeling**
  – Import legacy Ada source files into Stood/HOOD
  – Export AADL textual models with Stood/AADL
  – Analyse resulting models with AADL Inspector
Reverse Modeling of Ada legacy projects

Stood/HOOD

HOOD/AADL mapping

Stood/AADL

AADL Inspector

Roadmap

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AADL Inspector 1.2:
- aadlrev v2.3
- Cheddar v3
- legality rules 2.1

STOOD 5.4:
- AADL 2.1 update

AADL Inspector 1.2:
- ARINC 653 with Cheddar and Ramses
- Enhanced graphical display for Cheddar and Marzhin
- ...

AADL Inspector 1.3:
- UML/MARTE reader
- ...

2013 | 2014
Mission critical systems

A complete range of aircraft

Safety oriented systems
Availability oriented systems
Reliability oriented systems
Ground technology oriented systems
Cost oriented systems

R&D projects
Overview

Collaborative projects:

- **SPICES** (Europe: 2006-2009) Airbus, Thales, Barco, …
- **QUARTEFT** (France: 2009-2012) Airbus and Universities
- **GLASSES** (Brittany: 2010-2012) UBS, Inpixal
- **PARSEC** (France: 2010-2013) Thales, Alstom, Telecom Paris, …
- **I&R-SMART** (Brittany: 2012-2014) UBO, Virtualys

**ESA projects:**

- **Labassert** (2008)
- **Taste** (2009-2010)
- **Gnomon** (2009-2010) Gnomon Informatics in Greece
- **Compass** (2011) University of Aachen in Germany
- **Frame contract for Taste enhancements** (2012):
  Ellidiss is prime contractor for Spacebel, Semantix, ISAE, Pragmadev

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AADL Centric tool strategy

**STOOD**
- graphical editors
  - HOOD-AADL-UML

**ADELE**
- graphical editor
  - TOPCASED/SPICES

**AADL Builder**
- graphical editor

**UML/MARTE**
- bridge to AADL
  - TOPCASED/LAMBDA

**TASTE**
- graphical editor
  - ASSERT

**DSM tools**: Domain Specific graphical editors
  - Ex: GLASSES

**CHEDDAR**
- real-time analysis

**SIMULATION**
- multi-agent model animation

**PROOF**
- bridge to FIACRE

**SAFETY ANALYSIS**
- bridge to COMPASS

**CODE GENERATOR**
- Bridge to RAMSES

**static rules checkers**:
  - AADL Legality rules
  - AADL Naming rules
  - AADL Consistency rules
  - Metrics
  - Project specific rules

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**Modelling** → **Analysis and Production**
Adele:
Eclipse based graphical editor for AADL

- **AADL Package Diagrams editors**
  - Declarative models (classifiers)
  - Single-layer hierarchy
  - Bottom-up modeling approach

- **AADL System Diagrams editors**
  - Instance models (system instance)
  - Multi-layer hierarchy
  - Top-down modeling approach

- **What’s new?**
  - AADL Behavior Annex graphical editor
  - AADL v2.1 code generator
  - AADL code import (declarative models)
  - AADL properties customization (ODS)

Download Topcased 5.2: http://www.topcased.org/
Add the Ellidiss update site: aadl.ellidiss.fr:
  - Last versions of Adele plugins
  - Osate2 plugin
Domain specific graphical front-ends for AADL

Technology in use:
- GMP for the graphical editors
- LMP for the model transformations
- AADL for the integration in the TASTE toolchain

Download at: http://assert-project.net/-TASTE_Download-

AADL Inspector

Static rules analysis

Real-time performance analysis: Cheddar

AADL syntactic analysis

AADL runtime simulation: Marzhin
AADL Inspector

• **Contents (v1.0):**
  - textual AADL parser (aadlrev)
    - AADL v1, v2, v2.1 and Behavior Annex
  - extendable set of static rules analysers:
    - metrics, naming rules, legality rules, consistency rules, « plug and check » rules
  - schedulability analysis with a subset of Cheddar
  - dynamic simulation with Marzhin

  Download at: http://www.ellidiss.com/
  and ask for an evaluation key

• **Development in progress:**
  - Update of AADL rules checker to v2.1
  - Integration of Cheddar v3 (in collaboration with UBO)
  - Integration of AADL patterns analysis (in collaboration with UBO)
  - AADL to FIACRE (QUARTEFT project)
  - Multi processor support for the Marzhin simulator (SMART project)
  - Import of UML/MARTE models (SMART project)
  - Export of SLIM specifications for the COMPASS toolset
The SMART project
« Simulation Multi-Agents d’aRchitectures Temps-réel »

• Regional collaborative project:
  - University of Brest, Virtualys, Ellidiss Technologies
  - 2 year long started in June 2012

• Goals: improve the Marzhin simulator embedded in AADL Inspector
  - Support multi cores and multi processors architectures
  - Support of modes and data-dependant computations (BA)
  - Add a UML/Marte model input
  - Compare Marzhin and Cheddar results
  - Improve simulation outputs (timelines, AADL diagrams animation)
  - Interact with 3D system model animations

• Case studies
  - ARINC 653 with Leon 3 processor architecture
  - Solar Electric Car: the EcoSolarBreizh project…

The EcoSolarBreizh project

World Solar Challenge
October 2013

Ellidiss Technologies official sponsor

http://www.ecosolarbreizh-adoptacell.com/
Conclusion: Our AADL centric environment

Products:
- Stood
- Adele
- Taste
- AADL
- Inspector
- AADL Builder

Technology:
- « home-made » lightweight frameworks:
  - GMP: for graphical tools
  - LMP: for model processing

Projects:
- ASSERT
- SPICES
- GLASSES
- QUARTEFT
- PARSEC
- CHEDDAR
- SMART
- ECOSOLARBZH
- ADELE/OSATE

Service:
- Tool support
- Custom Tool development (DSM)