Ellidiss Technologies

www.ellidiss.fr

Methods and Tools for Critical Software development

Ellidiss Software
www.ellidiss.com

UK based company
aka.TNI Europe Ltd
Tools sales office

Ellidiss Technologies
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Fr based company
New tools development
R&D center

HOOD

AADL

LMP

20 years + support to major industrial projects:

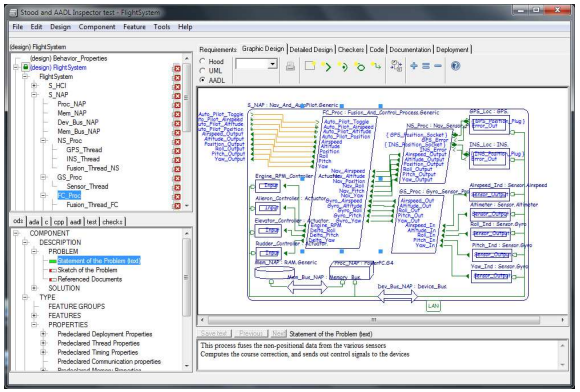
- HOOD Software design tools for Ada and C
- Eurofighter Typhoon
- Airbus A340, A380, A400M, A350
- Tiger Helicopter (mission calculator)
- Rafale (engine control)

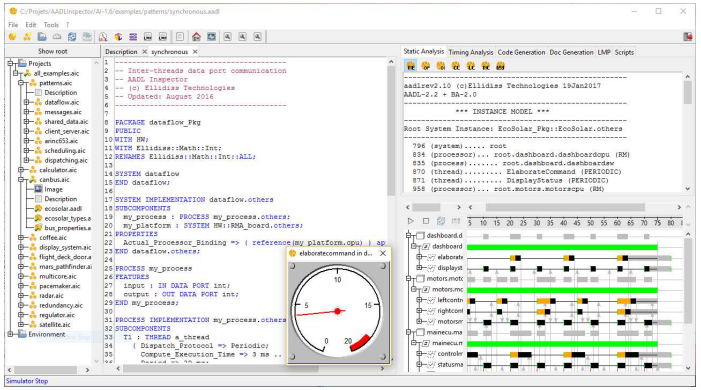
10 years + investement in new technology:

- SAE AS-5506: Architecture Analysis & Design Language
- AADL graphical modeling tools: Stood for AADL
- AADL analysis framework: AADL Inspector
- European Space Agency: TASTE Editors (Space SW development tools)
- European Commission: ERGO Project (Space Robotics)
- Generic model processing technologies: GMP, LMP, LMP Dev Kit

COTS Tools for AADL

- **Design: Stood for AADL**
  - AADL project management
  - AADL Instance Model graphical editor
  - Requirement traceability
  - Documentation generator
  - Export textual AADL
- **Verification: AADL Inspector**
  - Import textual AADL
  - Model processing plugins
    - Static rules checkers
    - Scheduling analysis (Cheddar)
  - Simulation (Marzhin)
  - Pre-processors:
    - Import UML profiles (MARTE, SysML, …)
    - Import Domain Specific Models (XML)
- **Model Processing Toolbox: LMP**
  - Supported languages: AADL, Ada, C, XM* (XML, XMI, ECore)
  - Implementation: parsers + prolog engine and libraries





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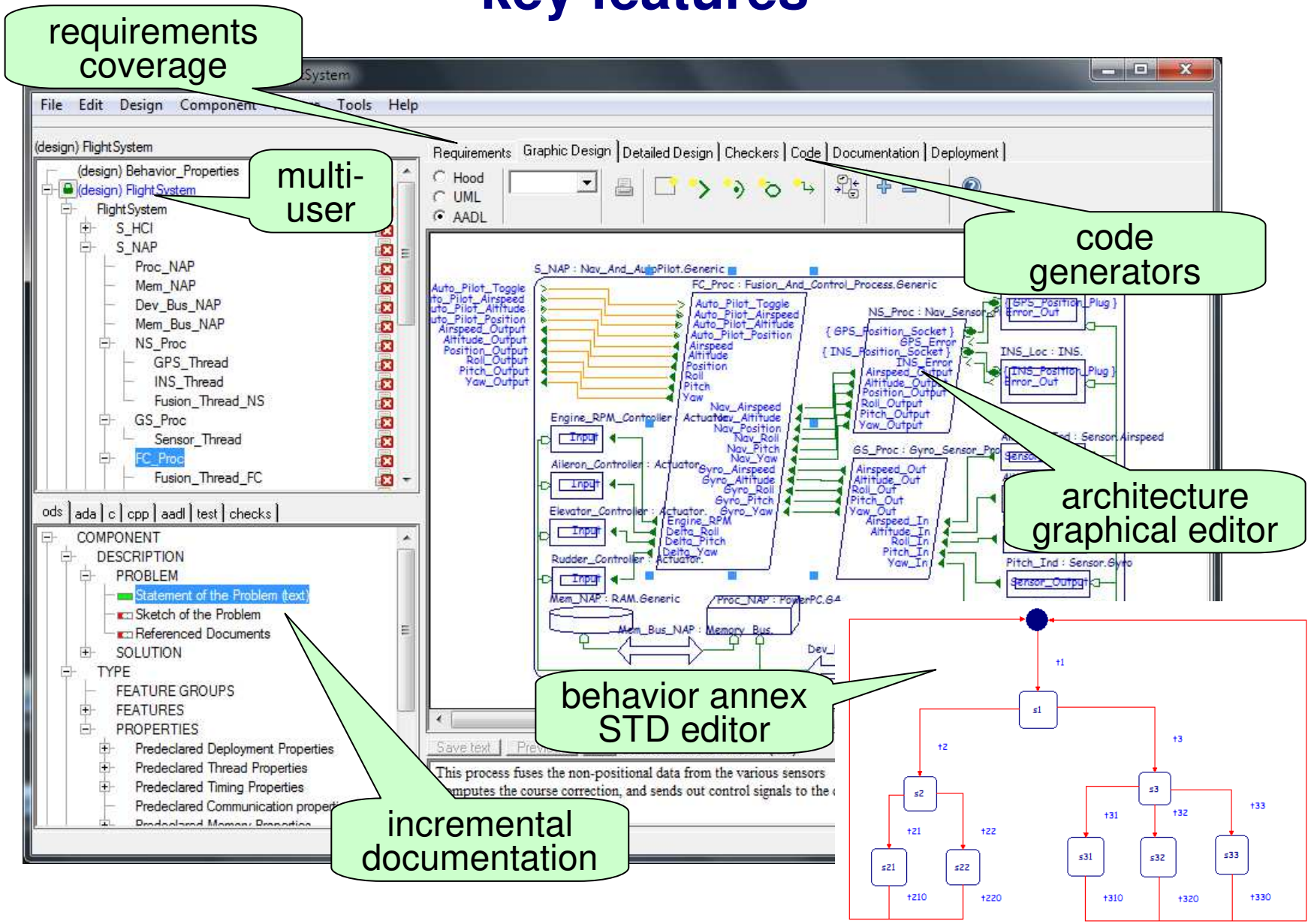
Stood for AADL key features



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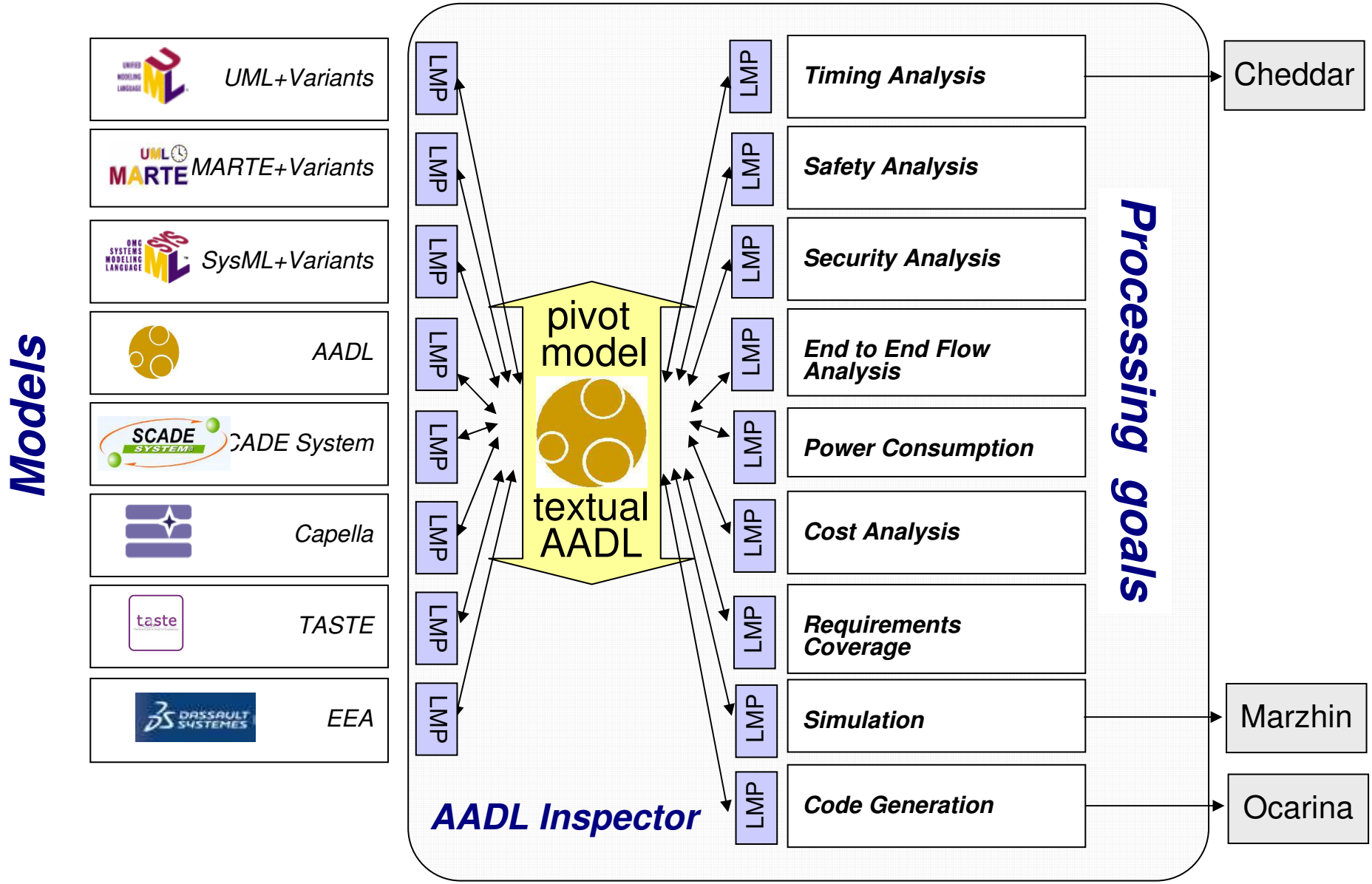
Top-Down modeling process for AADL

- Offers an industry proven practical modeling process to AADL designers
- Hierarchical Object Oriented Design (HOOD)
  - Inherits 20 years usage for the biggest European avionics projects (Airbus, Eurofighter)
  - Architectural Design (diagrams):
    - promotes SW engineering good practices
    - hierarchy of components with rigorous visibility rules (low coupling):
    - enable safe subcontracting (sub-trees)
    - ease testing, integration and maintenance
    - prevent from producing "spaghettiware"
  - Detailed Design (structured text):
    - keep track of design decisions
    - requirements coverage
    - supporting framework for design documentation, coding and testing
- Benefits for the AADL user (Stood for AADL)
  - Graphical editor of the AADL Instance Model (what you design is what you get)
  - Data Hiding enforcement (visibility rules, no provides data access)
  - AADL Declarative Model generator (textual AADL) for early verification activities
  - Complement AADL design activities with detailed design (documentation and coding)

Modular Analysis Framework



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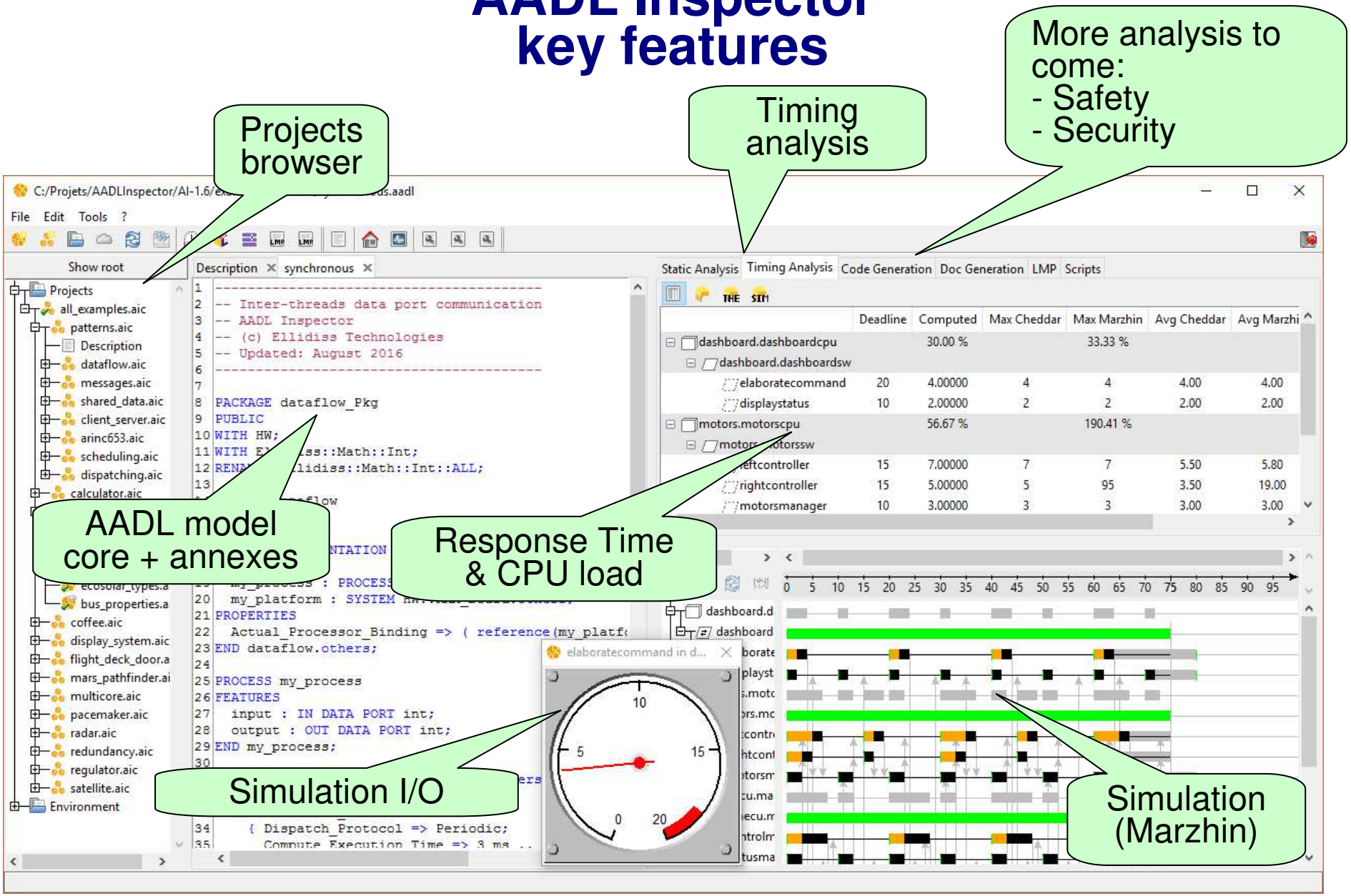
AADL Inspector key features



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Products & Services Summary

- **Critical software development tools**
  - An industry proven SW design process: HOOD
  - Stood for AADL:
    - architectural design and AADL generator:
    - v 5.5 to be released soon
  - AADL Inspector 1.6:
    - early verification of AADL models
    - v 1.7 in development (more analysis plugins)
- **Tool development/integration technologies**
  - LMP Dev Kit: model processing toolbox (prolog)
  - GMP: DSL graphical editor framework
- **Services**
  - COTS tools sales support
  - Tools development, integration and support
  - AADL consulting and training
  - R&D partnerships

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Demo:

Response Time based End to End Flow Latency analysis

- **Graphical design with Stood for AADL**
  - Building the Instance Model with Top-Down approach
  - Specifying End to End Flows with port annotations
  - Generating the AADL Declarative model from the Stood model
  - End to End Flow generation will be available with Stood 5.5

- **Timing analysis with AADL Inspector**
  - Loading the Declarative AADL model
  - Running Response Time Analysis with Cheddar and Marzhin

- **Response Time based Flow Latency analysis**
  - More accurate than usual WCET/Deadline based analysis
  - Adding the Response Time of each Thread involved in the Flow
  - Use the Bus Messages/Thread analogy to compute bus communication latency
  - Response Time based Flow latency is not integrated yet (planned for AI 1.7)

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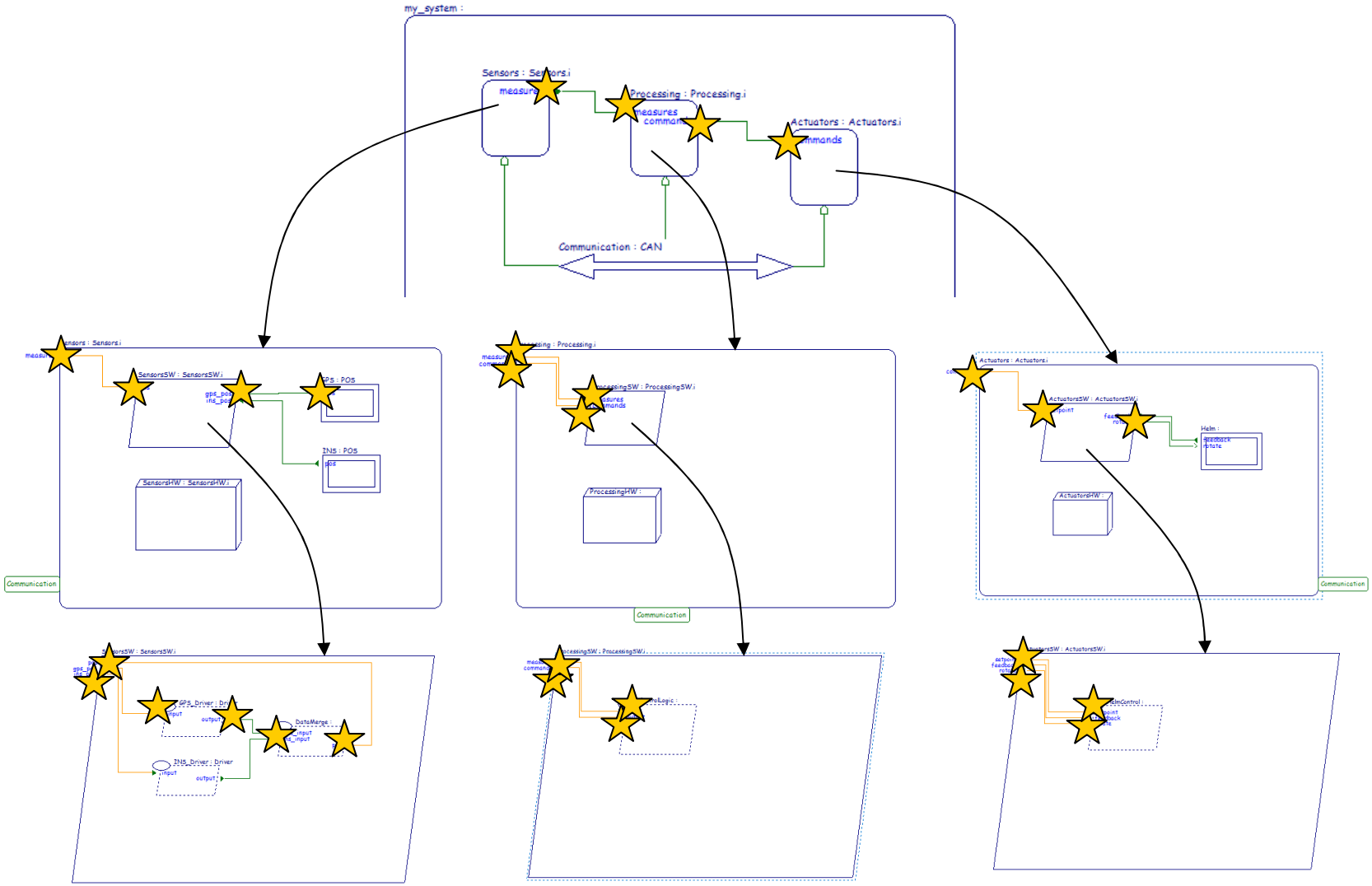
AADL Instance Graphical Design



Flow annotation

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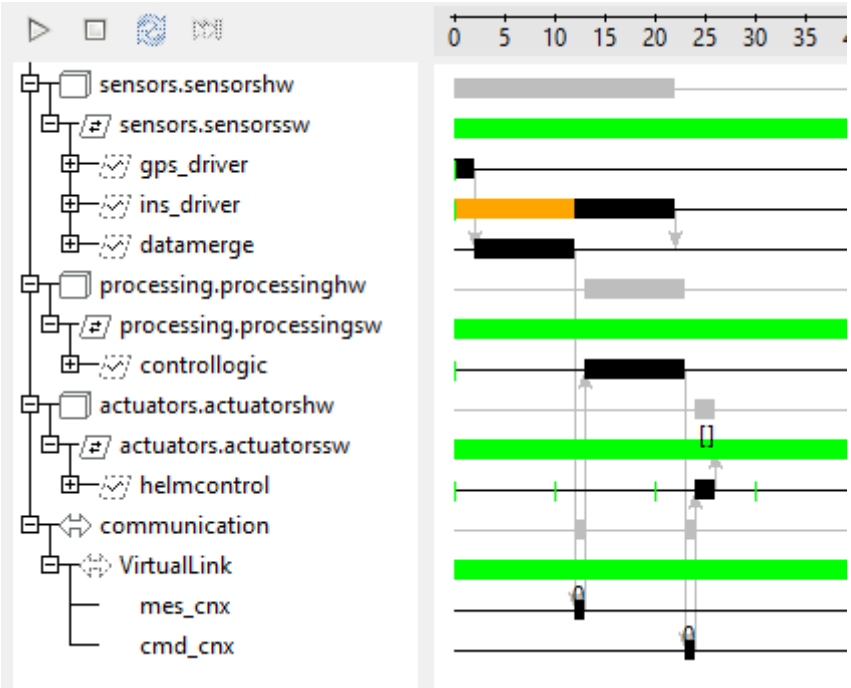
AADL Declarative Text generation

```
SYSTEM IMPLEMENTATION my_system.others
SUBCOMPONENTS
  Sensors : SYSTEM Sensors.i;
  Processing : SYSTEM Processing.i;
  Actuators : SYSTEM Actuators.i;
  Communication : BUS CAN;
CONNECTIONS
  mes_cnx : PORT Sensors.measures -> Processing.measures;
  cmd_cnx : PORT Processing.commands -> Actuators.commands;
FLOWS
  fl : END TO END FLOW Sensors.fl -> mes_cnx -> Processing.fl -> cmd_cnx -> Actuators.fl;
PROPERTIES
  Actual_Connection_Binding => ( reference(Communication) ) applies to mes_cnx, cmd_cnx;
END my_system.others;
```

Scheduling aware
End to End Flow latency analysis



	Deadline	Computed	Max Cheddar
sensors.sensorshw		24.00 %	
sensors.sensorssw			
gps_driver	100	14.00000	4
ins_driver	100	24.00000	14
datamerge	100	10.00000	24
processing.processinghw		20.00 %	
processing.processingsw			
controllogic	50	10.00000	0
actuators.actuatorshw		20.00 %	
actuators.actuatorssw			
helmcontrol	10	2.00000	0

Response Time based flow latency computation:

Rt(gps_driver) + Rt(mes_cnx) + Rt(controllogic) + Rt(cmd_cnx) + Rt(helmcontrol)