TTool
An Open-Source Simulator for Real-Time SysML Models

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Rationale

• Real-time systems capture complex engineering problems that stimulate research work on model-based engineering
  – Early detection of design errors using model simulation

• Experience in joint use of UML (Unified Modeling Language) and formal methods (timed automata, timed process algebras)
  – TURTLE (Timed UML and RT-LOTOS Environment)
  – Open source toolkit TTool

• SysML (System Modeling Language) is the emerging modeling language for systems engineers
  – AVATAR (Automated Verification of reAl Time softwARe)
  – Open source toolkit TTool
Method

- Requirement Capture
- Modeling Assumptions
- Analysis
- Design - Architecture
- Properties To Verify
- Design - Behaviors
- Prototyping

AVATAR

- Requirement Diagrams
- Use-Case Diagrams
- Activity Diagrams
- Sequence Diagrams
- Block Instance Diagrams
- Parametric Diagram
- State Machines Diagrams

TTool

- Editor
- Editor
- Editor
- Simulator
- Emulation platform
- C Code Generator
- UPPAAL
- ProVerif
AVATAR and TTool by example

Future Air Navigation System

Connection Set Up
Real-Size Case Study

Autopilot
Conclusions and Future Work

• AVATAR
  – Real-Time and distributed systems modeling
  – Compliant with OMG’s SysML
  – Formal semantics

• TTool
  – Open-source
  – Google “TTool” or download from ttool.telecom-paristech.fr/
  – Simulator
  – Formal verification: safety (UPPAAL) and security (ProVerif)
  – Code generation → emulation

• Ongoing work
  – Methodological assistant
  – Case studies (protocols, aerospace engineering, medical systems)
  – Tutorials and training material
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