MASIW Project: Modular Avionics System Integrator Workplace

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- **Main Departments**
  - Compiler Technology
  - Information Systems
  - Software Engineering
    - Model checking, analytical verification, static analysis
    - Model-based testing technologies
    - Requirements management, model driven development

- **Industrial Partners**
  - Hewlett Packard, IBM, Intel, Linux Foundation, Nokia, Samsung, Vympelcom
Background - GosNIIAS

State Research Institute of Aviation Systems

- **Research Programs**
  - leads Russian IMA research program
  - represents Russia in European SCARLETT program

- **Industrial Programs**
  - participate in
    - system design of avionics for Irkut MS-21
    - modernization of avionics for IL-96

- **Industrial Partners**
  - Rocwell Collins, Sextant Avionique, GE Aviation
MASIW Project

IDE for System Design and System Integration

- System Architecture Validation
  - resource allocation
  - safety analysis
- System Architecture Optimization
- System Virtual Integration and Simulation
- Configuration Table Generation
  - ARINC-653 systems
  - device drivers and middleware
  - AFDX network nodes
  - integration test stand
MASIW Pilot Stage

- Objectives
  - Evaluation of possible approaches
  - Prototyping of the selected architecture
- Timeframe: 2010
ICD DB – Network-centered formal model of system architecture

- Buses and messages/signals (for digital and analogue field buses, ARINC-429, CAN)
- Hardware components
- Software partitions

Generation of configuration tables for integration test stand

Schedulability analysis

Eclipse-based GUI
Proprietary vs Open

- Extend ICD DB
  - Add required attributes (e.g. AFDX networks)
  - Develop required tools on top of ICD DB
- Use one of standardized architecture description languages
  - AADL
  - MARTE
  - SysML
  - ...

AADL-based Approach
AADL Open Source Tools

- OSATE
- ADELE
- OCARINA
Combining MASIW and OSATE
Combining MASIW and OSATE
MASIW v1 (Pilot)

- Partial OSATE v1 reuse
  - AADL model
  - AADL parser
  - AADL textual editor
- ICD DB as a repository backend
  - Universal extension for AADL components
- Eclipse-based GUI
MASIW v1 Plugin Architecture

1. WORKSPACE
2. AADL
3. ICD DB
4. SCHEDULE

CONFIGURATION

MAFI Network Configurations

SCHEDULING ALGORITHM

NetWorks 653 Schedule

ICD DB
MS SQL Server

thread driveMediologic
features
BreathingPressed : in data port Bool_Type,

DriverMediologic : out data port Bool_Type,

Cancel : in data port Bool_Type,

Outputs : in data port Bool_Type,

CrudeActive : out data port Bool_Type,

end DriverMediologic

-- Two implementations whose source texts use:
-- their source native ports

thread implementation DriverMediologic.simulation

CrudeActive, ref in out data port bool,

end DriverMediologic.simulation

properties

DriverMediologic.simulation;

end DriverMediologic.simulation;

thread implementation DriverMediologic.C
System Design & Integration in IMA

Avionics System Development Process

- ARP-4754
- ARP-4761
- DO-254
- DO-178B
- ATA-XX

Virtual System Integration

- Incremental AADL-model development
- Model refinement
- Architecture evaluation:
  - safety analysis
  - resource allocation analysis
- Validation
- Optimization
- Schedulability analysis
- Simulation
- Generate config tables:
  - ARINC-653 systems
  - device drivers
  - middleware
  - AFDX network
  - simulation mode
  - integration test stand

Virtual System Integration on Base of AADL-models
AADLv2 and ARINC-653 annex
Graphical editor
Integration with open-source tools such as REAL, OCARINA, CHEDDAR, MAST, AADL2Fiacre, OSATE checkers
Support for requirements traceability
More flexible AFDX simulation
Ready for partial qualification
- Redesign of OSATEv2 components
  - Textual AADL as a first class citizen
    - Keep textual AADL formatting unchanged
      - AST stores exact position in textual specification for each element
      - AADL unparser restore textual specification if possible
    - Postpone reference resolution
- AFDX simulator redesign
- Multi-level graphical editor (prototyping)
Multi-level graphical editor
Multi-level graphical editor
Current Status

MASIW SDK

ru.ispras.masiw.plugin.libs
- auxiliary java-libraries (antlr-v3, JAXB, etc.)

ru.ispras.masiw.plugin.aadl
- AST model of AADL-specification
- AADL parser
- auxiliary functions for AST

ru.ispras.masiw.plugin.aadl.semantic
- AADL semantic checker

r.i.m.plugin.aadl.text.editor
- AADL textual editor

r.i.m.plugin.aadl.instance
- AADL instance builder
- AADL prototype resolver
- processing for contained property association, arrays and modes

r.i.m.plugin.aadl.properties
- default properties set

r.i.m.plugin.aadl.diagram.editor
- AADL graphical editor

r.i.m.plugin.workspace
- MASIW workspace
- MASIW project creation and management

ru.ispras.masiw.plugin.ui
- MASIW project view
- MASIW project wizard and properties editor
- AADL specification wizard

ru.ispras.masiw.plugin.icd
- ICD DB connector

Analysis tools
- Periodic thread schedule
  - schedulability analysis
  - schedule generation

Prototyping
- in development

V&V
Questions to the Subcommittee

- What is a policy regulating usage of excerpts from AADL specification for documentation and error messages?
- What is a process of handling AADL specification bug reports/clarification requests?
Thank you!

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