A Model Based Toolset for Supporting Rapid Integration and Verification of Spacecraft Electronics

Anand S Madhusoodanan
Brandon Eames
Electrical and Computer Engineering
Utah State University

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Overview

- Motivation: Self-verification in rapidly integrated systems
- Approach: Domain Specific Modeling + Rapid Code Generation
- Modeling Devices, Device Communication
- Generating System Self Test
Rapid Spacecraft System Integration

- Responsive Space Initiative: SPA-U (USB) based plug-n-play electronics
  - Online device discovery and integration
  - "Intelligent" devices
  - xTED: Electronic Data Sheet
  - Middleware for dynamic device integration, data routing

Question: How to verify the integrated system?
- Were the proper devices "plugged in"?
- Does the system have all the necessary components?
Approach

- Visual Modeling
- Virtually capture devices, system prior to building system
- Automatic code generation
  - Communications middleware API
  - On-board self test to check integrated system health
The Generic Modeling Environment

- Tool Infrastructure for implementing Domain-Specific Modeling Languages (DSMLs)
- High-level interfaces for interpreter creation: “compiler” for the visual language
- Translate the captured diagrams into “something useful”
Modeling Device Communication

- Device-specific message sequences
- Facilitate determining health status of device
Modeling Spacecraft Electronics
Test Platform

- Technologic Systems TS 7260
  - ARM based processor
  - Linux

- DLP Sensor
  - Temperature Sensor
  - USB-Serial Interface

- Libusb library
  - User-space device drivers
Summary of Work

- Address the problem to verification of rapidly integrated spacecraft systems
- Visual design tool
- Rapidly generate glue code that acts as middleware
- Generation of test suites
  - Probe each connected device for device health
  - Assure all devices are present