Vertical AUTOSAR System Development at John Deere

Jim Sachs
System Engineering Manager
Enterprise Electronics Group
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System Engineering Manager
Enterprise Electronics Group
11 years at John Deere

25 Years of Experience
• System Engineering
• Program Management
• Agriculture & Automotive

Education - University of Notre Dame
• BA Economics
• BS Electrical Engineering
• MS Electrical Engineering

Infrastructure Delivery
• Model Based System Engineering
• Model Based S/W Design
• Network Architecture and Management
• Diagnostic Architecture and Management
• Reprogramming Infrastructure
• MIL/SIL/HIL Testing Infrastructure
Electrical Complexity

- ~2300 electrical signals
- ~800 pins of I/O
- 20 controllers
- ~400 Features
- Vehicle + Factory
- Electric Hydraulic Control
Challenges

Customer
- New Features
  - Most have an electrical component
  - Data and Connectivity
  - Greater Automation

Technology
- Complexity Increasing Exponentially
- Networks Growing

Business
- Get to Market Faster
- Shorter Design Cycles
- Expectation of High Quality
How to Optimize Software Development

“Software is now the long lead and the majority of the development cost. Not Hardware!”

How to provide better requirements, context, and direction?

Agile S/W Development Teams

Application Model & Simulation

Application Code

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How to Optimize Software Development

“Software is now the long lead and the majority of the development cost. Not Hardware!”

S/W Architecture
• Feature/Function Based
• Provides Context
• Focused on Interfaces

Agile S/W Development Teams

Application Model & Simulation

Application Code

Application Code
Drive Efficiency in System / Software Development

Reuse
- Design it Once
- Define it Once
- Applicable at different levels

System Engineering
- Requirements
- Functional Decomposition
- Logical Architecture
  - Drives S/W and H/W Architectures
Vertical Value Chain

• Primarily development is in house
• H/W and S/W are separate
• Families of electronic controllers
• Communication is informal and flexible

A vertically integrated tool chain enables:
- Error proofing
- Process acceleration
- Integrated data interfaces
- Automation
Workflow and Tool Chain

Product Line - 150% Model
- Function/Feature Decomposition
- System Requirements
- Logical Architecture
- PREEvision
- Reuse Asset Base

System Architecture
- S/W Architecture
- Diagnostic Architecture
- Network Architecture
- H/W Architecture

Above RTE
- ARXML – Composition Extract
- Algorithm Design
- Simulation (MIL)
- Generate App Code

Below RTE
- ARXML – Diagnostic Extract
- ARXML – ECU Extract
- Generate BSW Code

Autosar Configuration
- Configuration & Integration
- Generate BSW Code

DaVinci Configurator

System Model and Simulation
- MATLAB, Simulink, Embedded Coder

Build Target
- Virtual
- Physical
- HIL

Test
- SIL

Workflow and Tool Chain Diagram:
- Algorithm Design
- Simulation (MIL)
- Generate App Code
- Generate BSW Code
- Virtual
- Physical
- HIL
- SIL