



# Interpreting the world on a different plane

Robert Bosch Engineering and Business Solutions

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Lean Automotive E/E-Design Using AUTOSAR Methodology



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# Lean Automotive E/E-Design Outline

Automotive Domain

Changing Paradigm

Methodology Workflows

Open Source Frameworks

Summary

# Lean Automotive E/E-Design Motivation

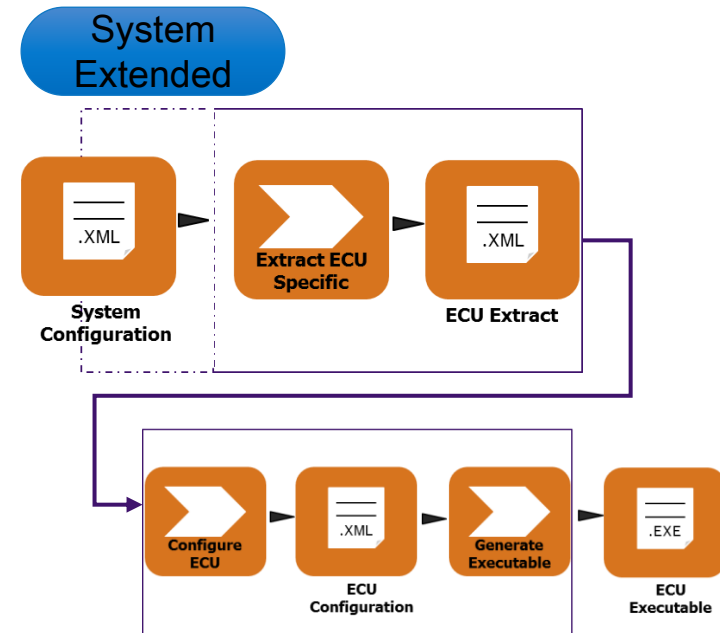
Automotive Domain

- Paradigm shift from ECU to System Engineering
- Variability of the configuration
- Exploiting benefits of common language
- Different Business models
- Embedded system complexities (DCU, ADAS, MBSE...)
- Impact on Tooling

# Lean Automotive E/E-Design ECU to System engineering

- Moving Complexity from ECU to System
  - Generation of Complete ECU Configuration from Extended System, “**ZeroConfiguraion**”
  - Provide provision to address OEM/Vendor Extension
- Communication network design (CAN, Flexray, Eth)
  - Gateway, Partial Networking
- Extend to support generation of variant rich and resolved data model

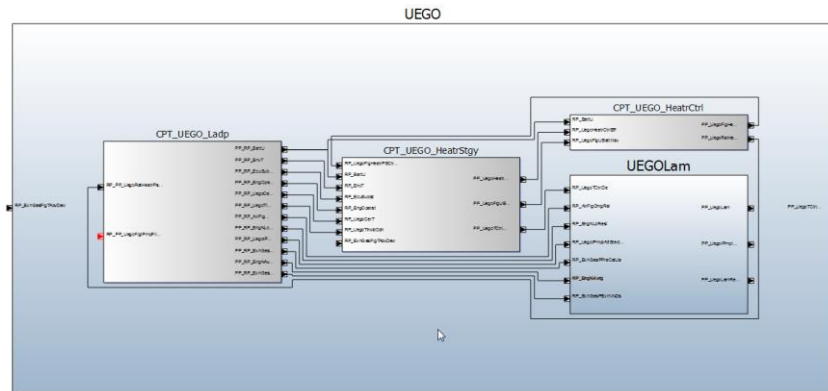
## Changing Paradigm



# Lean Automotive E/E-Design

## ECU to System engineering- use cases

- Interface Analysis at System level for the inconsistency
  - Early recognition of Anti-patterns
  - Cluster decisions
- ECU Partitioning
  - Functions to ECUs and Effect Chain
  - Timing requirements
  - Distributable across cores



# Lean Automotive E/E-Design

## Feature modeling

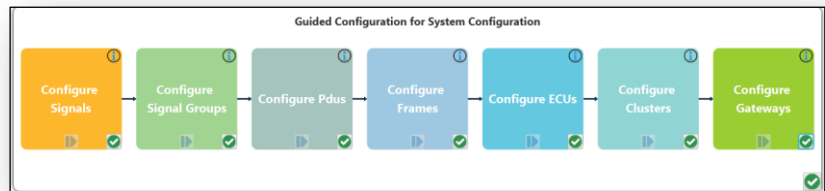
- Feature modeling
  - Unifying view in multiple view SPL
- Feature Based Impact Analysis
  - Impact of optional/alternative features on interaction diagrams and statecharts..
- Feature dependent state transition
  - Use feature condition as guard on state transition
  - Event [Feature Condition]
  - Feature condition is True if feature Selected



# Lean Automotive E/E-Design Workflow support

## Methodology Workflows

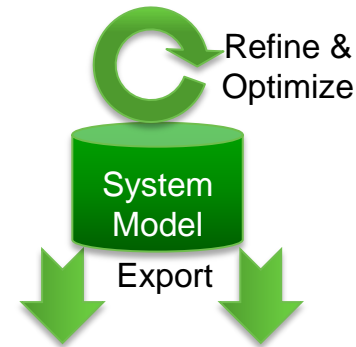
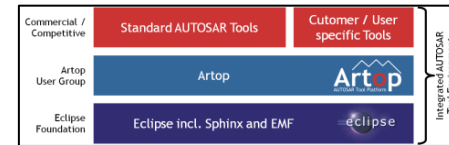
- Increase the development efficiency by providing seamless workflow
- Each step has pre-post validation to make sure that developer/integrator is not struck at build
- Customizable workflows for user needs, Aligned to AUTOSAR methodology
- Learnings during implementation



# Lean Automotive E/E-Design Open Source Frameworks

- **Extensibility** of the M2 Meta-model allows us to enrich the System template
- One model as reference across the AUTOSAR release, "**Gautosar**"
- **Model integration** support to hook the other meta-models
- Avoidance of unnecessary migration
- **Adaptation to AUTOSAR releases**

## Open Source Frameworks





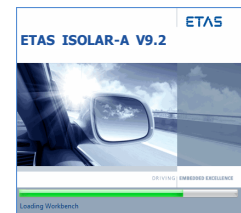
# Lean Automotive E/E-Design

## ISOLAR-A

### High-level Features of ISOLAR-A

- Support of AUTOSAR and other Standards
  - AUTOSAR R4.x (incl. 4.2.2); auto-migrate R3.x → R4.x
  - Import of DBC (incl. J1939, ISOBUS), FIBEX 4.0, and LDF 2.2 (incl. J2602)
  - Import of ODX 2.0.1
- Use via GUI, Command Line (automation), Scripts (customization), mixed
- Support of iterative developments by model-based Diff/Merge
- Workflows support out-of-the-box
- Interoperable with other tools, in (m)any user environments
  - Builds on Eclipse (4.5 Mars), Artop, Auto-IWG platform, and Java 1.8
  - Support of SVN, Git, Doors, ...
  - Integrates with ISOLAR-EVE supporting Test / Validation use cases
- Avoidance of unnecessary migration efforts and waiting times
  - No project migration needed when using later product versions
  - No need to wait for updated AR import/export filters, or converters

**AUTOSAR**



# Lean Automotive E/E-Design Summary

- AUTOSAR System helps the integrator to validate the vehicle configuration upfront
- Feature modelling and Architecture Variability provides the big picture
- Flexible configuration advanced concepts with minimum clicks, Post-Build, Gateways etc
- Using AUTOSAR architecture as base for design new ECU
- Its all about the tool landscape....



THANK  
YOU