ANSYS系统事业部产品发展规划及愿景

应中伟

ANSYS SBU

回顾和使命
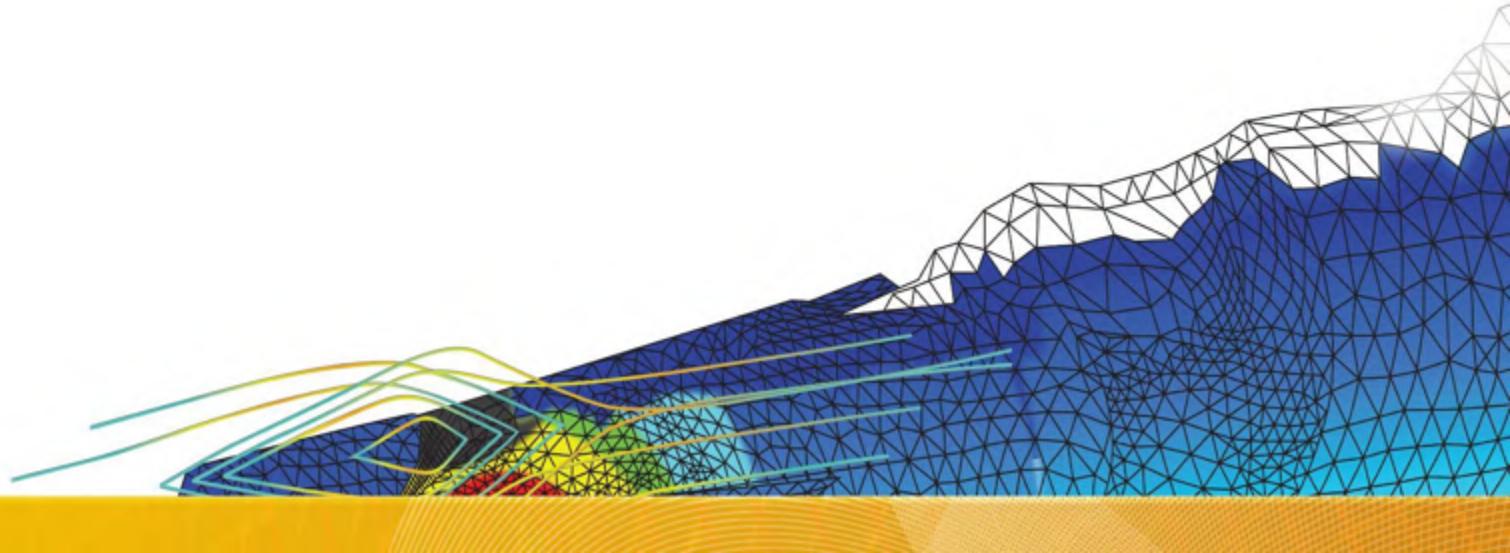
Look Back The Past Thirteen Years (1/2)

HMI Software Design

System/Software Architecture Design

2004
进入中国

2012
SCADE ARINC 661
发布

Control Software Design

2008
SCADE Display发布
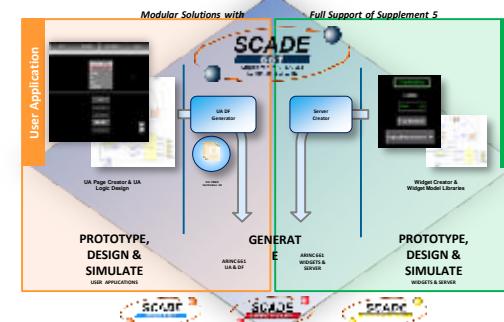
2013
SCADE System
发布

正式加入
ANSYS公司

Look Back The Past Thirteen Years (2/2)
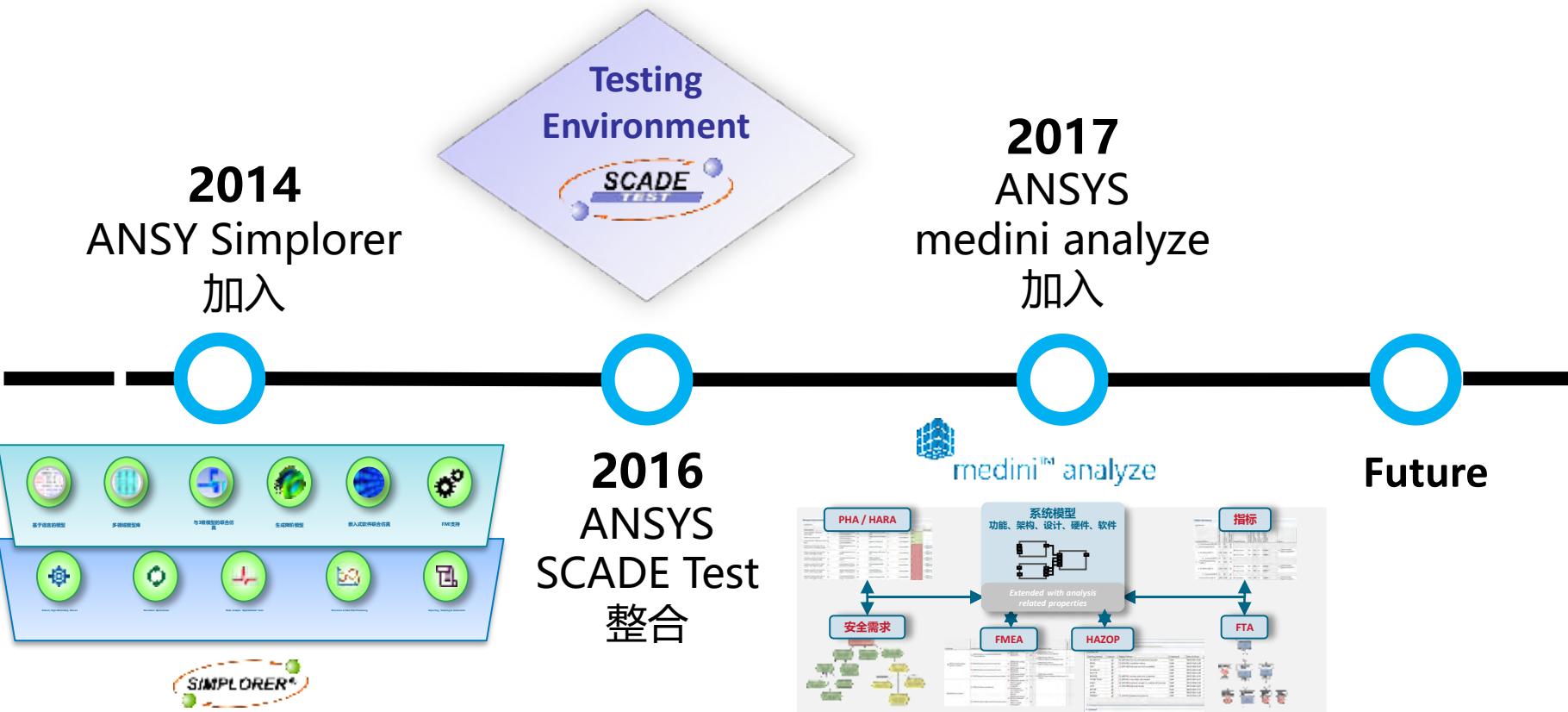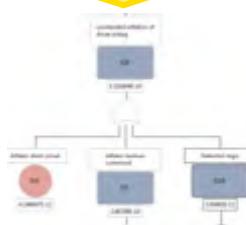
2014
ANSY Simplorer
加入

Testing Environment
SCADE TEST

2017
ANSYS
medini analyze
加入

2016
ANSYS
SCADE Test
整合

medini™ analyze

Future

ANSYS SBU Products Help to Cope
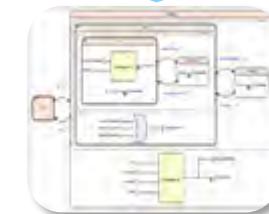
Functional Safety

medini™ analyze

Ensure system safety by providing state-of-the-art safety, quality and reliability *analysis methods* in an integrated model based approach

System Development

Simulate driving scenarios with detailed physics. Virtually test control algorithms, sensor accuracy and vehicle dynamics. Validate safety assumptions by simulation

Embedded Software

Develop qualified, AUTOSAR compliant safety critical control and HMI software with model based development tools. Fulfill ISO 26262 requirements

ANSYS Big Conception

基于模型的系统工程
Model-Based Engineering

SYSTEMS

PLATFORM

MULTIPHYSICS

SAFETY
medini™ analyze

FLUIDS

STRUCTURES

ELECTRONICS

SEMI CONDUCTORS

EMBEDDED SOFTWARE

仿真驱动的产品研发
Simulation Driven Product Development

August 3, 2017
ANSYS UGM 2017

ANSYS SBU产品发展方向

ANSYS SBU Products Help to Cope

Functional Safety

medini™ analyze

System Development

Embedded Software

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Simulate driving scenarios with detailed physics. Virtually test control algorithms, sensor accuracy and vehicle dynamics. Validate safety assumptions by simulation
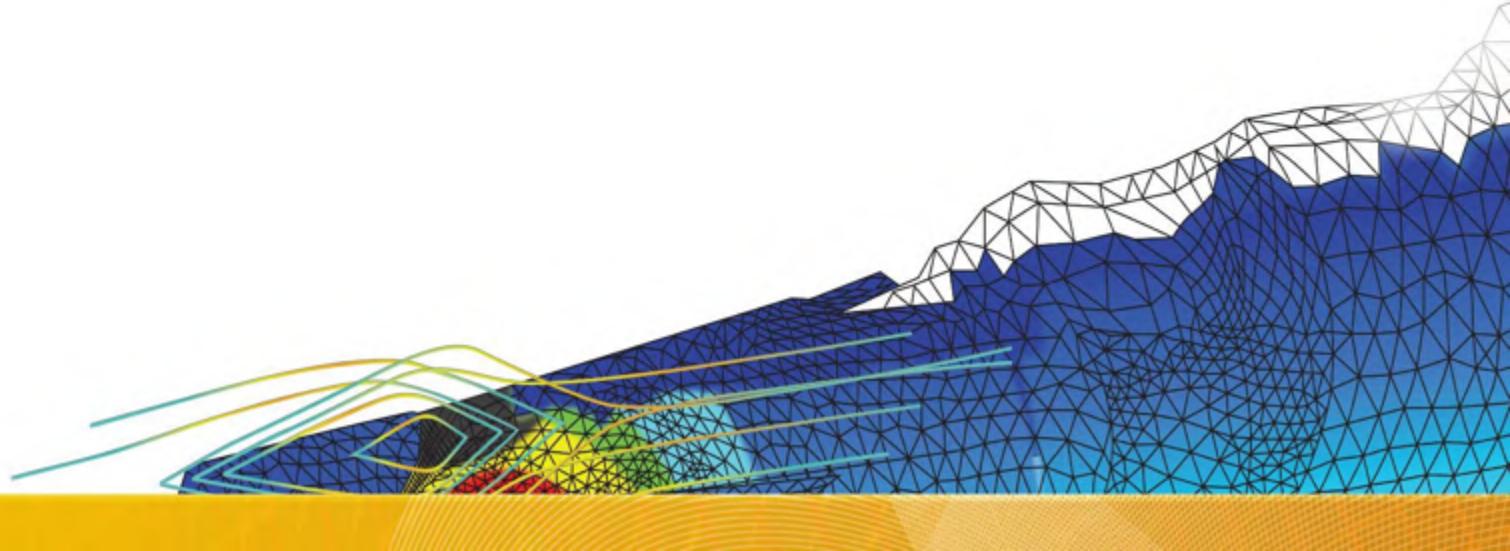
Develop qualified, AUTOSAR compliant safety critical control and HMI software with model based development tools. Fulfill ISO 26262 requirements
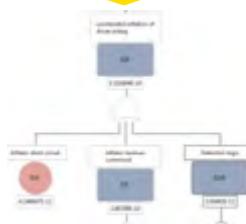
ANSYS

ANSYS SBU Products Help to Cope

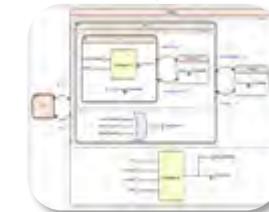## Functional Safety

medini™ analyze

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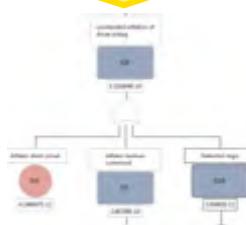
Embedded Software

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ANSYS SBU Products for Functional Safety

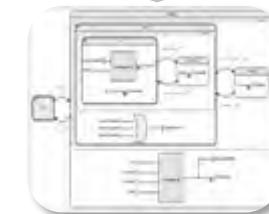**Functional Safety**

medini™ analyze

Ensure system safety by providing state-of-the-art safety, quality and reliability *analysis methods* in an integrated model based approach

- **ANSYS medini™ analyze**

  ❖ 是一款专业的功能安全开发平台工具，完全支持汽车行业标准的功能安全开发全流程。

System Architecture Model

Hazard Analysis & Risk Assessment

HW Architectural Metrics

Extended with analysis related properties

Safety Requirements

FMEA

HAZOP

FTA

ANSYS

Prospect of medini™ analyze (1/3)

Functional Safety
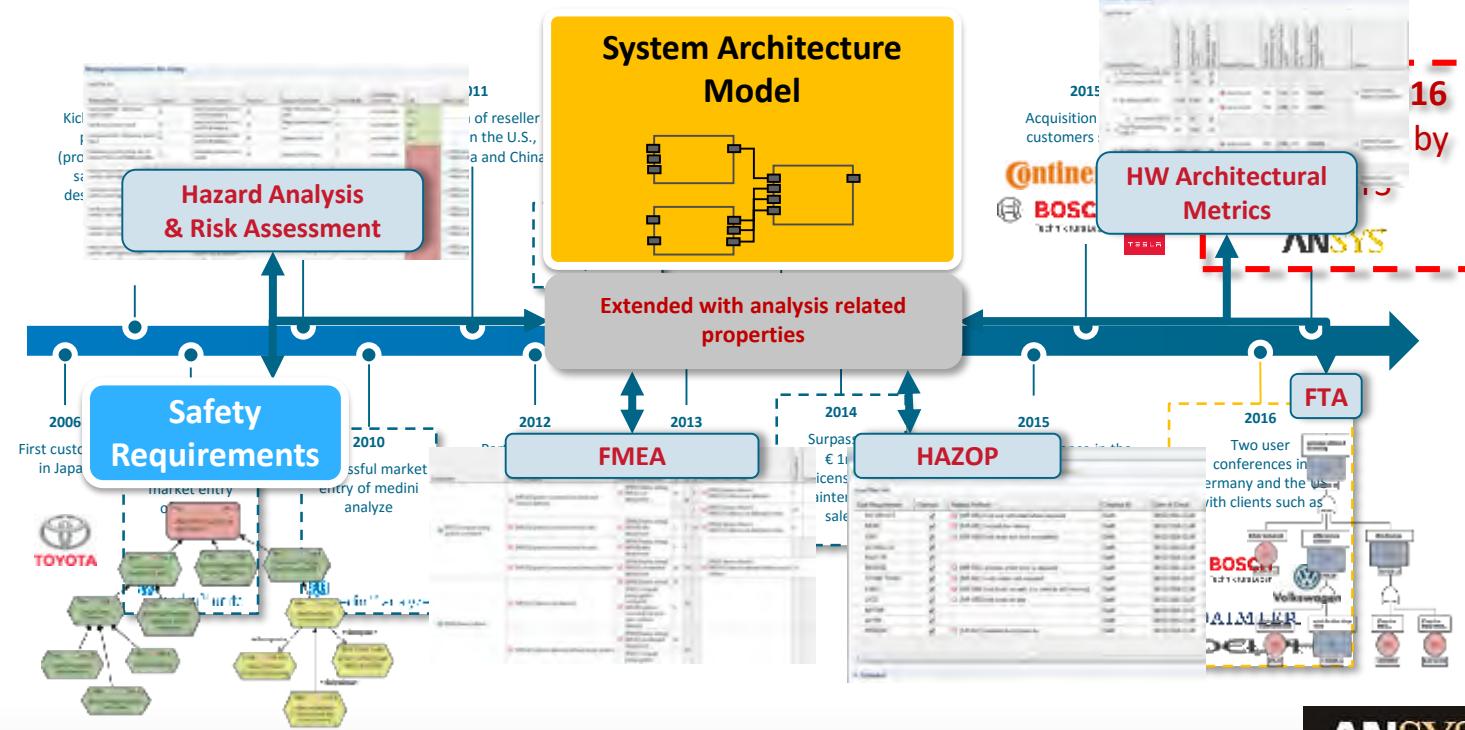
medini™ analyze

Ensure system safety by providing state-of-the-art safety, quality and reliability *analysis methods* in an integrated model based approach

- **ANSYS功能安全分析工具发展愿景**

完成与ANSYS产品的整合，打通应用断层

与第三方工具桥接，完善研发流程的管理

支持更广泛行业的功能安全应用

功能安全分析功能的持续增强

ANSYS®

Prospect of medini™ analyze (2/3)
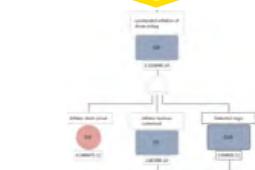
- ## 与SCADE Architect的无缝集成

Functional Safety

medini™ analyze

Ensure system safety by providing state-of-the-art safety, quality and reliability *analysis methods* in an integrated model based approach
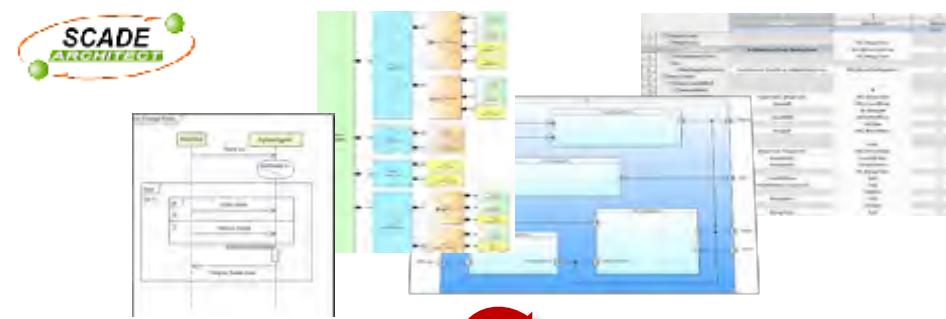
Safety process seamlessly integrated with system development

Safety analysis results always consistent

Safety requirements discovered and considered early in the design process

ANSYS

Prospect of medini™ analyze (3/3)

Functional Safety

medini™ analyze

Ensure system safety by providing state-of-the-art safety, quality and reliability *analysis methods* in an integrated model based approach

- **支持更多行业的功能安全分析**
  - ❖ 通用的功能安全分析功能
  - ❖ 兼容ARP 4761规范
  - ❖ 通用的失效模式库

- **半导体失效分析**
  - ❖ 瞬时失效 分析的扩展
  - ❖ 故障注入

- **通用性和第三方工具集成**
  - ❖ 与PTC和DOORS的接口
  - ❖ 加强可配置性
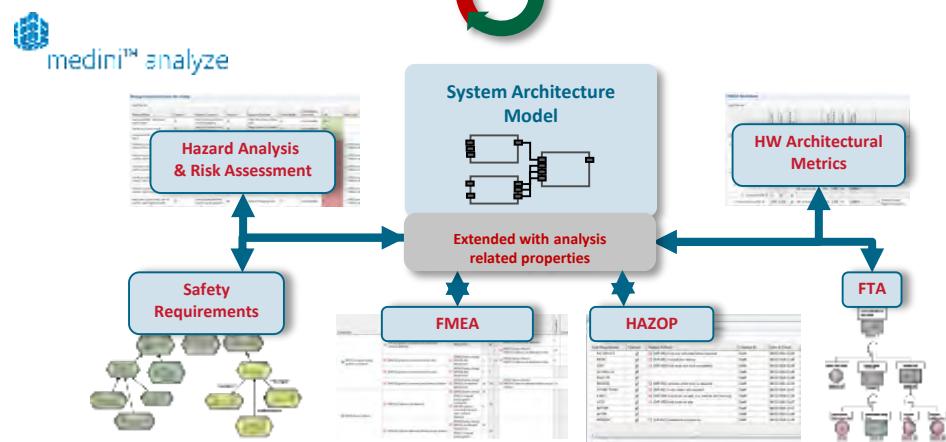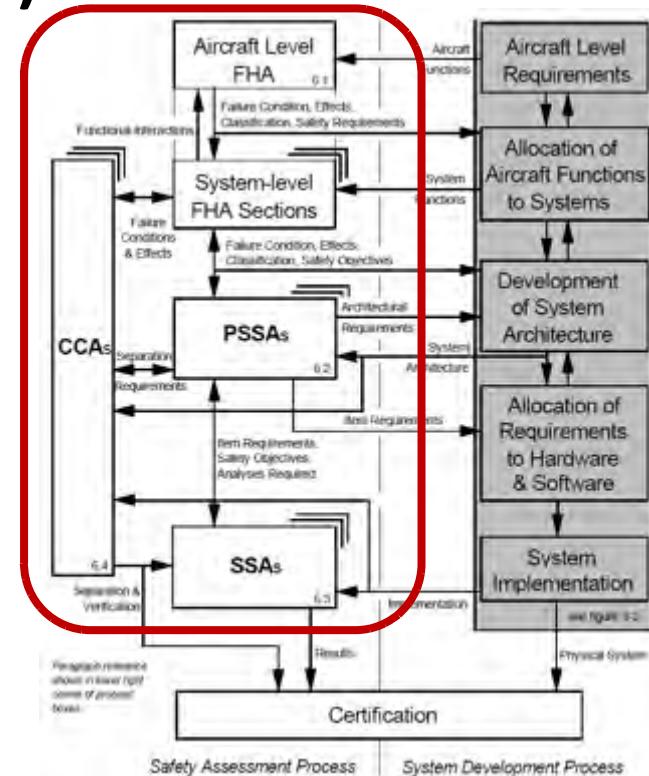
ANSYS
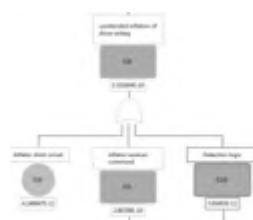
ANSYS SBU Products Help to Cope

Functional Safety

medini™ analyze

Ensure system safety by providing state-of-the-art safety, quality and reliability *analysis methods* in an integrated model based approach

System Development

Simulate driving scenarios with detailed physics. Virtually test control algorithms, sensor accuracy and vehicle dynamics. Validate safety assumptions by simulation

Embedded Software

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ANSYS SBU Products for System Development

System Development

Simulate driving scenarios with detailed physics. Virtually test control algorithms, sensor accuracy and vehicle dynamics. Validate safety assumptions by simulation

- **What do we have for System Development?**
  - ❖ **SCADE Architect**
    - 基于SysML的架构设计工具
  - ❖ **Simplorer**
    - 多学科、多领域系统仿真与分析平台

SCADE ARCHITECT

Embedded System Design

Operational Requirements Analysis

Architecture Design & Data Propagation

System Model Checks

System Model Diff/Merge

System / Software Bi-directional Sync Up

ICD Generation

ANALYZE   **DESIGN**   **VERIFY**   **GENERATE**

CONFIGURE

Language-Based Modeling   Multi-Domain Model Libraries   Co-simulation with 3D Physics   Reduced Order Model Creation   Embedded Software Integration   System Model Interoperabilit

Industry Standards for System Modeling   Thousands of Built-in Component Models   Interfaces with all ANSYS 3D Physics   ANSYS SCADE and More   3rd Party System Modeling Tools
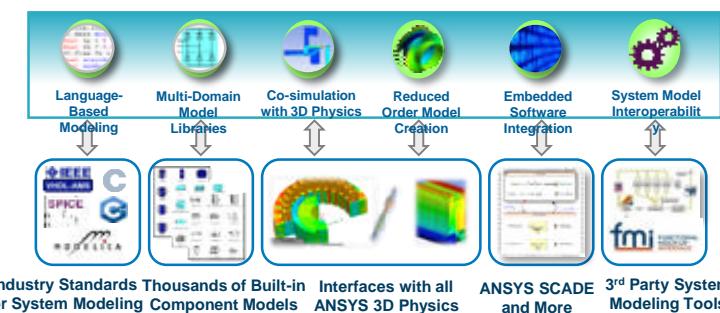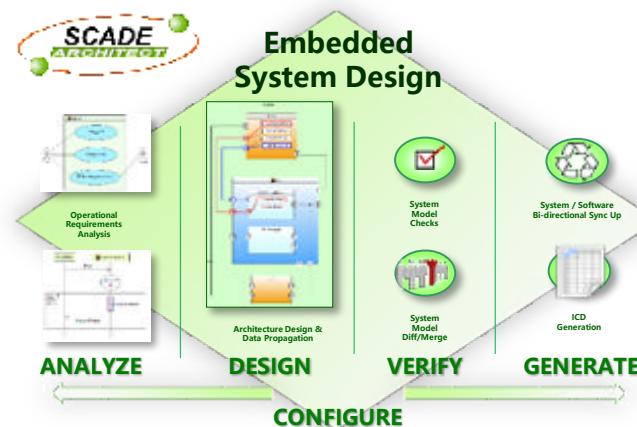
ANSYS

Prospect of System Development

- **ANSYS系统开发与验证工具发展愿景**

System Development

Simulate driving scenarios with detailed physics. Virtually test control algorithms, sensor accuracy and vehicle dynamics. Validate safety assumptions by simulation

结构化系统建模能力的持续增强

支持更多行业的领域模型库

多任务/多速率应用架构设计解决方案

加强产品整合打通应用断层

ANSYS

Prospect of SCADE Architect (1/5)

System Development

Simulate driving scenarios with detailed physics. Virtually test control algorithms, sensor accuracy and vehicle dynamics. Validate safety assumptions by simulation

- **持续增强Software Architect基于SysML的建模能力**
  - ❖ 对SysML 1.4的支持，兼容多个版本的模型
  - ❖ 增强大规模的数据管理；
  - ❖ 增强领域模型的设计能力；
  - ❖ 行为图的仿真。

Graphical styles consistency between blocks and replica

ANSYS
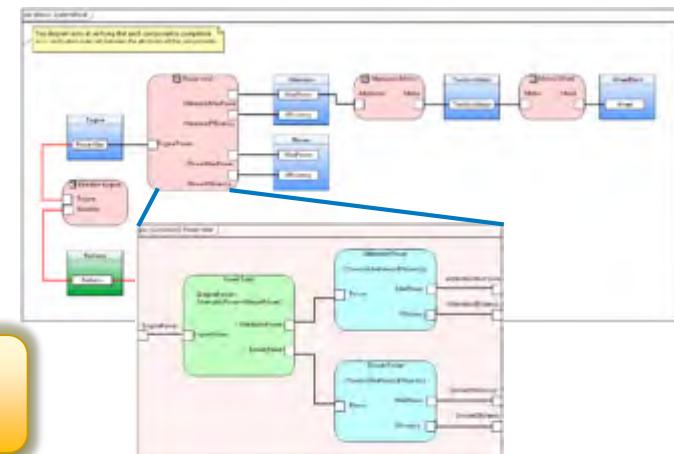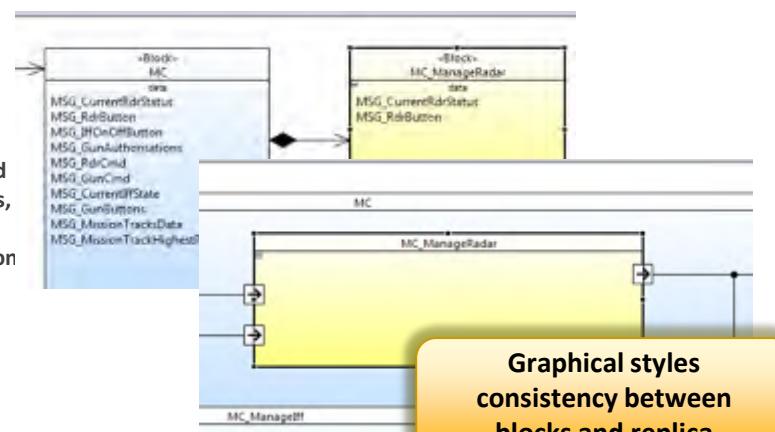
Prospect of SCADE Architect (2/5)

- **支持更多行业的领域模型库**

System Development

Simulate driving scenarios with detailed physics. Virtually test control algorithms, sensor accuracy and vehicle dynamics. Validate safety assumptions by simulation

未来机载能力环境（FACE 3.0）

AUTOSAR Model   **SCADE Architect**   **SCADE Suite**

ANSYS

Prospect of SCADE Architect (3/5)

- **支持更多行业的领域模型库**

  ❖ 支持基于AADL (ver. 2.2)的建模

System Development

Simulate driving scenarios with detailed physics. Virtually test control algorithms, sensor accuracy and vehicle dynamics. Validate safety assumptions by simulation

Prospect of SCADE Architect (4/5)

System Development

Simulate driving scenarios with detailed physics. Virtually test control algorithms, sensor accuracy and vehicle dynamics. Validate safety assumptions by simulation
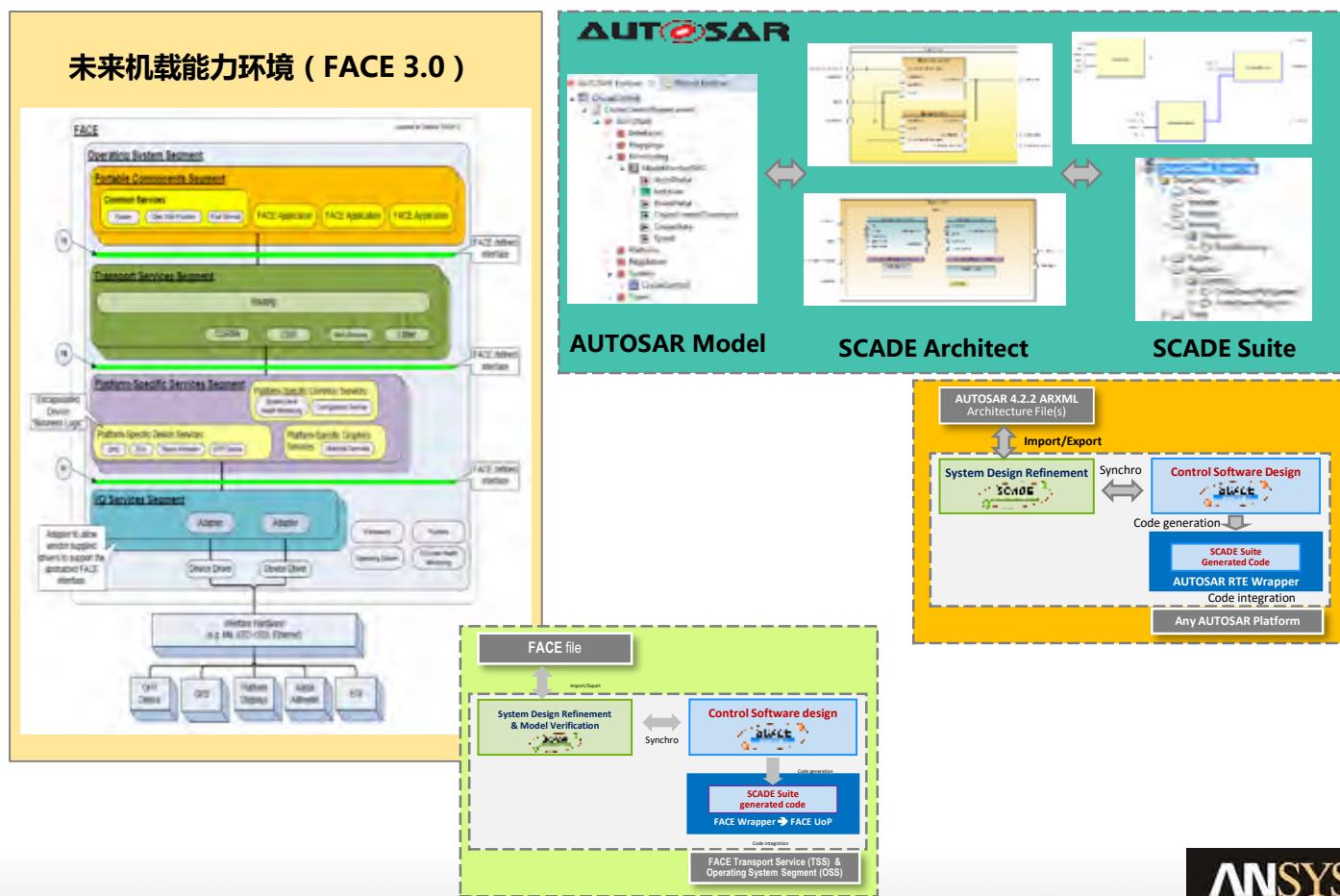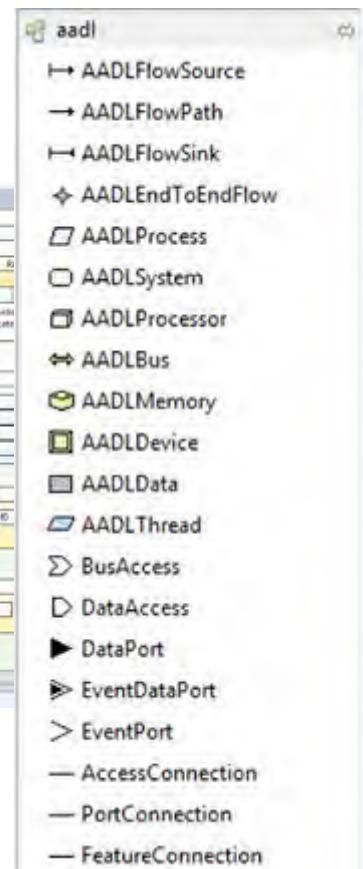
- **多任务/多速率应用的设计**

  ❖ 基于SCADE Architect进行应用架构的设计；

  ❖ 桥接Krono-Safe (S3P) 工具进行调度和数据的分析；

  ❖ SCADE Suite开发应用逻辑和代码生成；

  ❖ 桥接Krono-Safe (S3P) 工具进行最终的集成。

Synchronized Architecture/Design

Independent Exchange Format
(topology, rates)

Code Generator & Integration Toolbox

WCET info (WCET Tool)

Generated code

ASTERIOS

Integrated Code OS

App

Freq #1   Freq #2   Freq #3

- **与Simplorer、SCADE Suite和SCADE Display的无缝同步**

System Development

Simulate driving scenarios with detailed physics. Virtually test control algorithms, sensor accuracy and vehicle dynamics. Validate safety assumptions by simulation
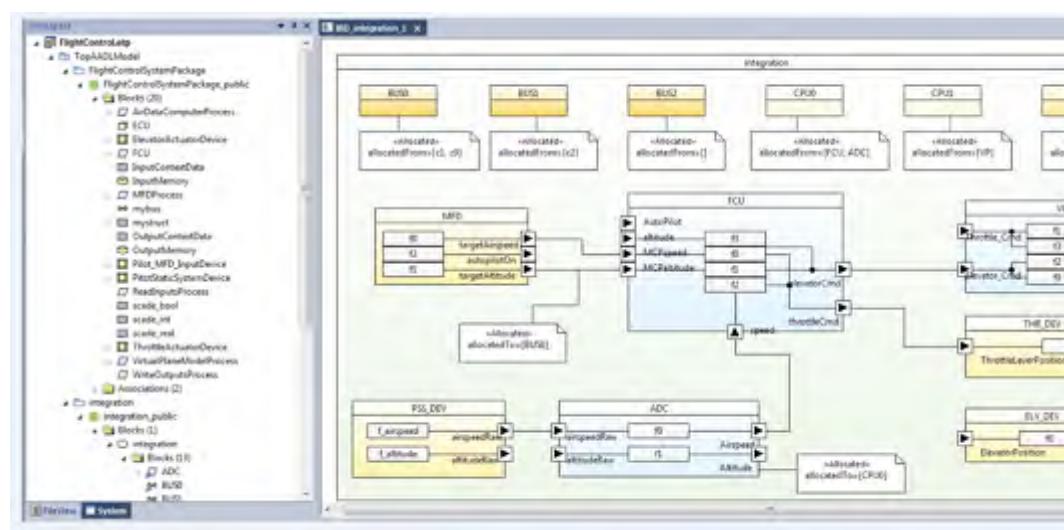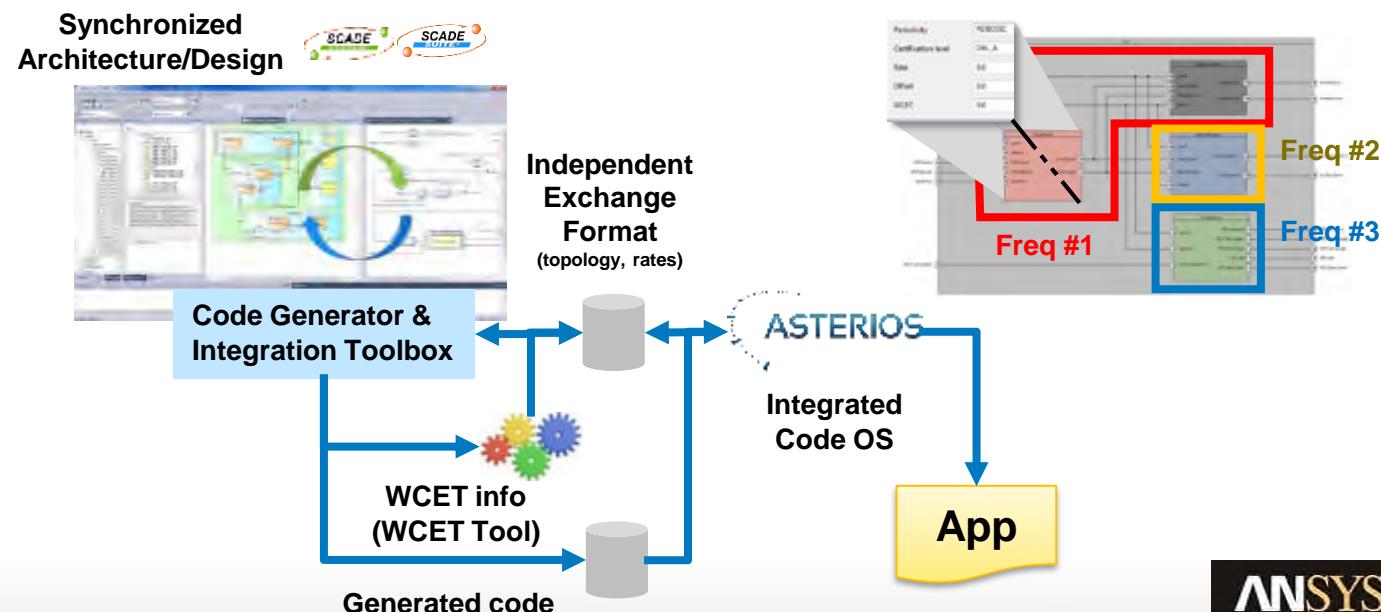

SCADE ARCHITECT

SW Architecture

Bi-directional

SCADE SUITE

SW Design

Seamless workflow from system architecture down to SW code generation

Reuse legacy SCADE Suite components in new architectures

Ensure design consistency with concurrent work & engineering iterations

Prospect of System Development
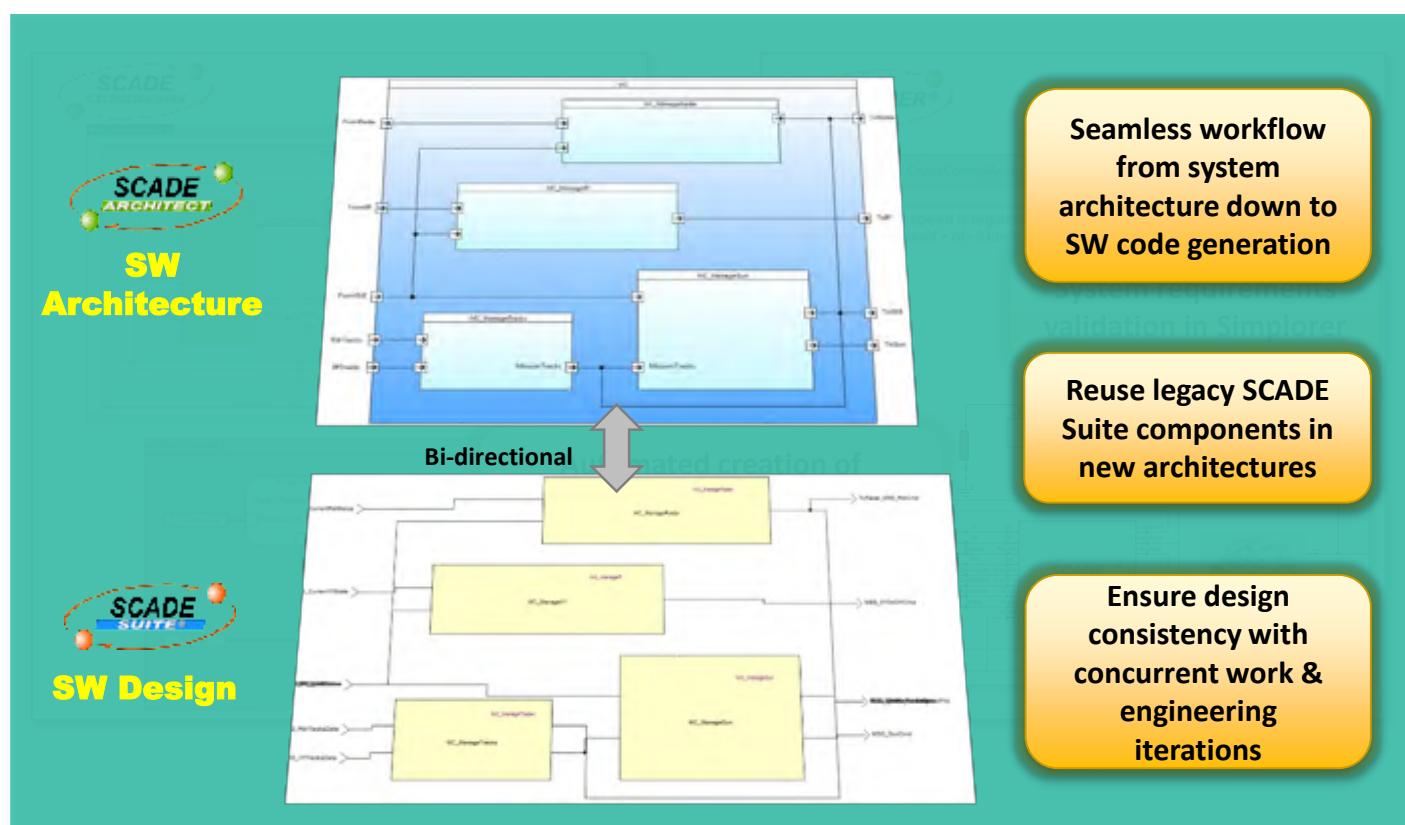
System Development

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- **ANSYS系统开发与验证工具发展愿景**

结构化系统建模能力的持续增强

支持更多行业的领域模型库

多任务/多速率应用架构设计解决方案

加强产品整合打通应用断层

丰富行业部件模型库

完善机电一体化的系统仿真方案

ANSYS

Prospect of Simplorer (1/2)
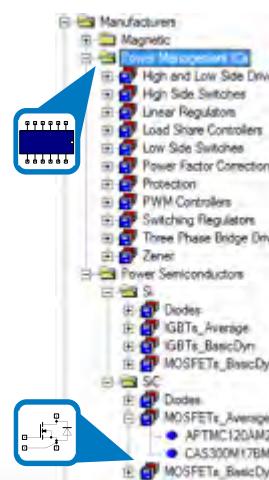
System Development

Simulate driving scenarios with detailed physics. Virtually test control algorithms, sensor accuracy and vehicle dynamics. Validate safety assumptions by simulation

- **兼容Modelon模型库**
  - ❖ Environmental Control Library
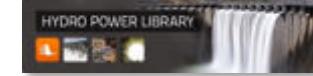 - ❖ Fuel Systems Library
  - ❖ Electric Power Library
  - ❖ ......
- **电力电子系统的建模和仿真**
  - ❖ 超过100个组件和应用实例

New Power Management ICs from
TEXAS INSTRUMENTS   LT LINEAR TECHNOLOGY

New SiC Average MOSFET devices from
Microsemi   CREE

ENGINE DYNAMICS LIBRARY V6
FUEL CELL LIBRARY
HEAT EXCHANGER LIBRARY
HYDRAULICS LIBRARY
HYDRO POWER LIBRARY

LIQUID COOLING LIBRARY
PNEUMATICS LIBRARY
THERMAL POWER LIBRARY
VAPOR CYCLE LIBRARY
VEHICLE DYNAMICS LIBRARY

ANSYS

Prospect of Simplorer (2/2)

- **完善加强机电一体化的系统仿真**
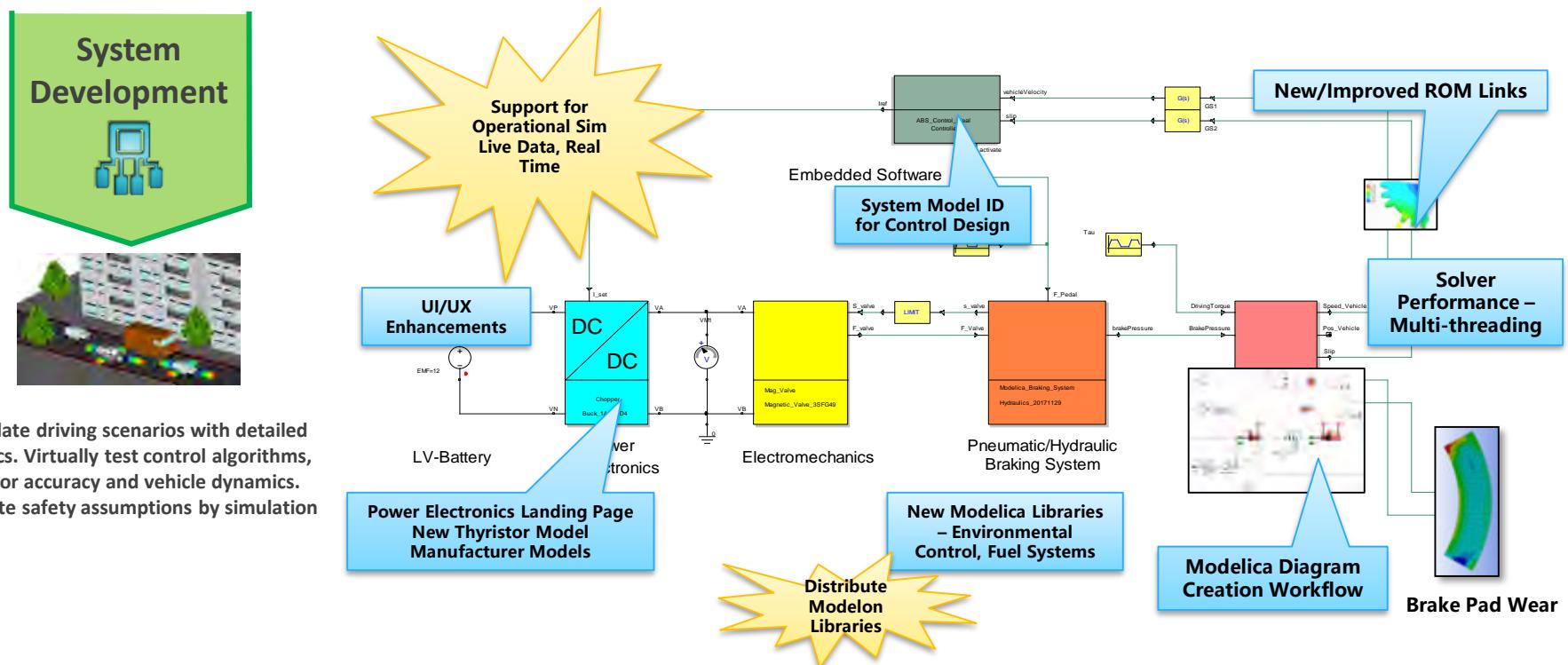
System Development

Simulate driving scenarios with detailed physics. Virtually test control algorithms, sensor accuracy and vehicle dynamics. Validate safety assumptions by simulation

Support for Operational Sim Live Data, Real Time

New/Improved ROM Links

Embedded Software

System Model ID for Control Design

UI/UX Enhancements

Solver Performance – Multi-threading

LV-Battery

Power Electronics

Electromechanics

Pneumatic/Hydraulic Braking System

Power Electronics Landing Page New Thyristor Model Manufacturer Models

New Modelica Libraries – Environmental Control, Fuel Systems

Distribute Modelon Libraries

Modelica Diagram Creation Workflow
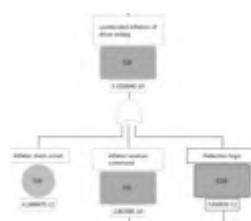
Brake Pad Wear

ANSYS

ANSYS SBU Products Help to Cope
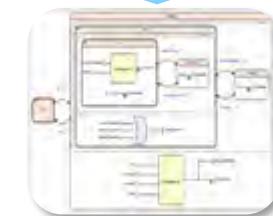
Functional Safety

medini™ analyze

Ensure system safety by providing state-of-the-art safety, quality and reliability *analysis methods* in an integrated model based approach

System Development

Simulate driving scenarios with detailed physics. Virtually test control algorithms, sensor accuracy and vehicle dynamics. Validate safety assumptions by simulation

Embeded Software

Develop qualified, AUTOSAR compliant safety critical control and HMI software with model based development tools. Fulfill ISO 26262 requirements

ANSYS SBU Products for Embeded Software

- **基于MBD软件开发方法**
  - ❖ SCADE定位于安全关键领域的嵌入式软件开发

Embeded Software

Develop qualified, AUTOSAR compliant safety critical control and HMI software with model based development tools. Fulfill ISO 26262 requirements

架构设计
SCADE

控制软件设计
SCADE
SUITE

人机交互界面设计
SCADE
DISPLAY

测试验证环境
SCADE

嵌入式系统和软件

全生命周期管理

SCADE
SUPERVISOR

S afety
C ritical
A pplication
D evelopment
E nvironment

Aerospace & Defence   Rail Transportation   Automotive   Industry & Energy   Nuclear   Medical

Prospect of Embeded Software Development

- **ANSYS嵌入式软件开发与验证工具发展愿景**

Embeded Software

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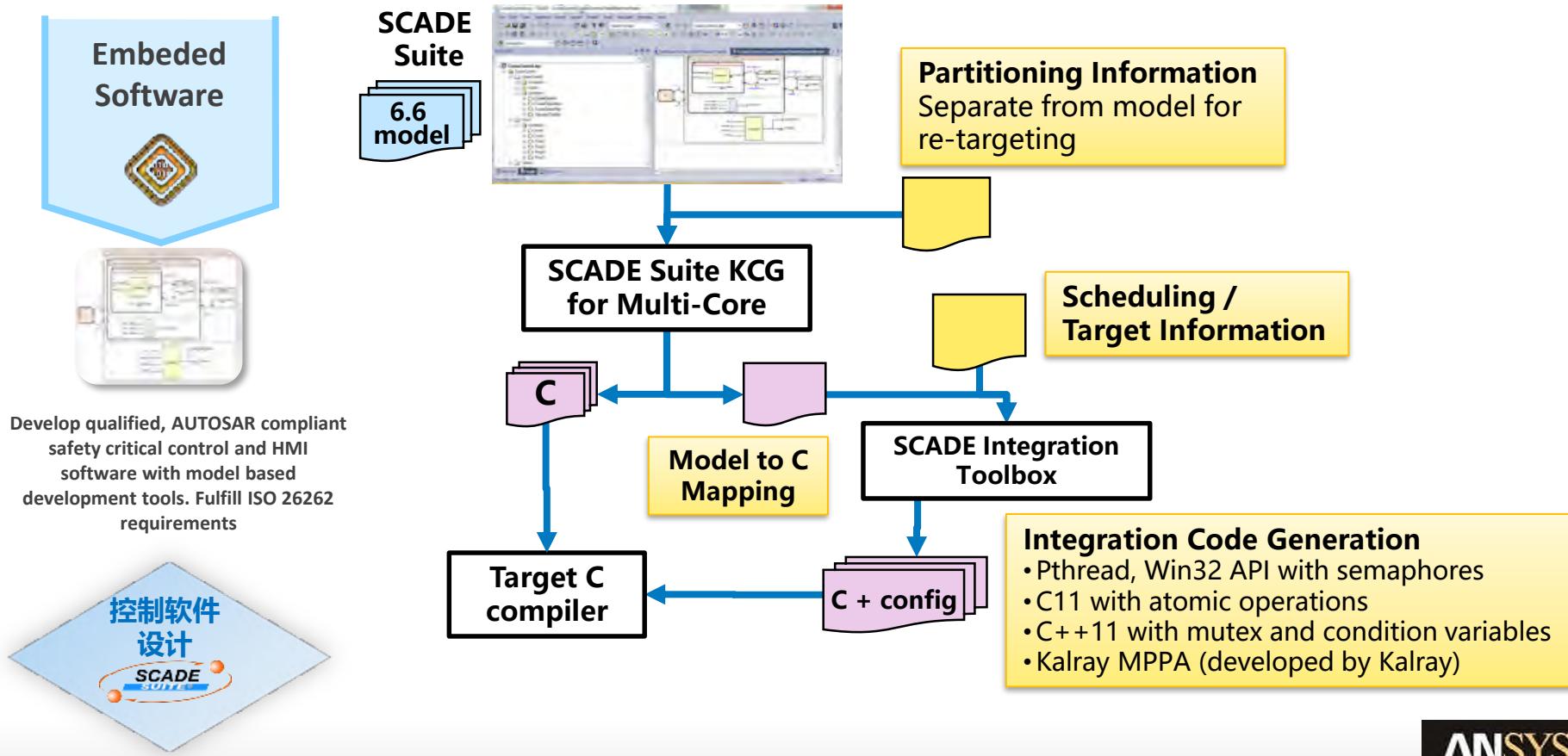
控制软件设计

SCADE SUITE

支持多核CPU架构

扩展不同平台和行业规范的自动化集成能力
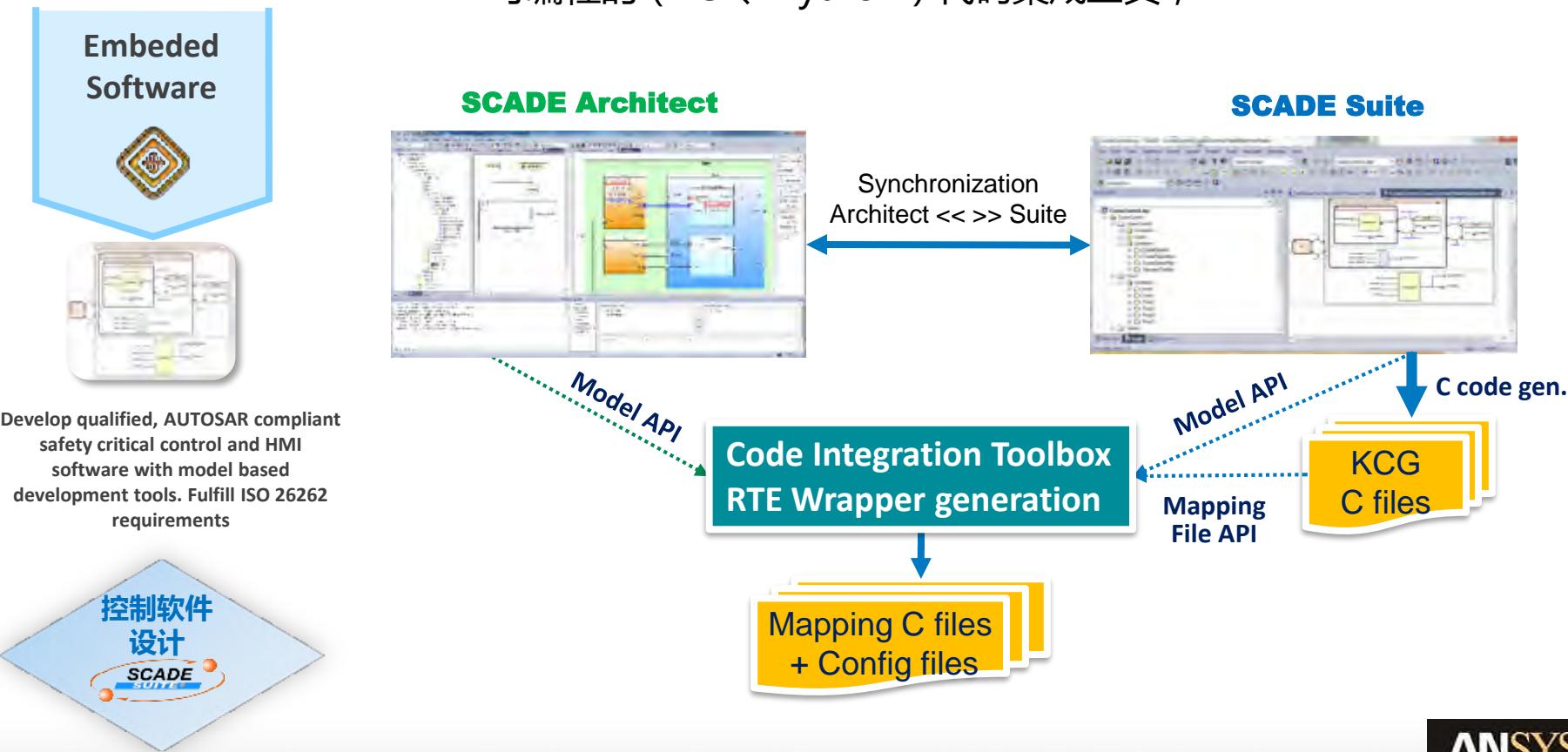
完善基于模型的实物半实物的仿真

ANSYS
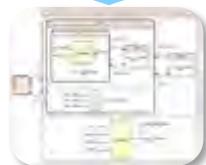
Prospect of SCADE Suite (1/3)

- **支持多核CPU架构**

Embeded Software

Develop qualified, AUTOSAR compliant safety critical control and HMI software with model based development tools. Fulfill ISO 26262 requirements

控制软件
设计

SCADE SUITE

SCADE Suite

6.6 model

Partitioning Information
Separate from model for re-targeting

SCADE Suite KCG for Multi-Core

C

Scheduling / Target Information

Model to C Mapping

SCADE Integration Toolbox

Target C compiler

C + config

Integration Code Generation
- Pthread, Win32 API with semaphores
- C11 with atomic operations
- C++11 with mutex and condition variables
- Kalray MPPA (developed by Kalray)

Prospect of SCADE Suite (2/3)

- ## SCADE代码集成工具箱

  ❖ 可编程的（TCL、Python）代码集成工具；

Embeded Software

Develop qualified, AUTOSAR compliant safety critical control and HMI software with model based development tools. Fulfill ISO 26262 requirements

控制软件
设计
SCADE SUITE

SCADE Architect

SCADE Suite

Synchronization
Architect << >> Suite

Model API

Model API

C code gen.

**Code Integration Toolbox
RTE Wrapper generation**

KCG
C files

Mapping
File API

Mapping C files
+ Config files

ANSYS

Prospect of SCADE Suite (3/3)

Embeded Software

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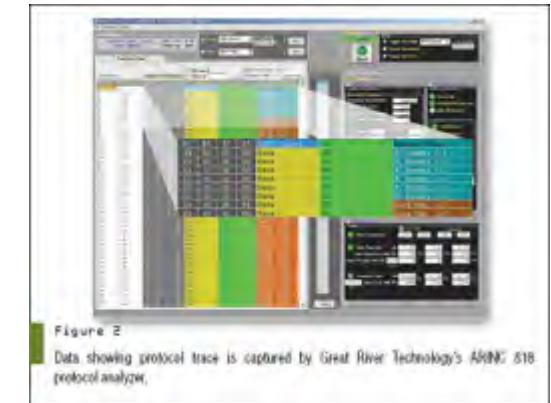
控制软件
设计
SCADE
SUITE

- **完善基于模型的实物半实物的仿真**
  - ❖ **Model In The Loop**
    - ▪ 基于Simplorer的联合仿真；
  - ❖ **Rapid Control Prototyping**
    - ▪ 基于NI Veristand的联合仿真；
    - ▪ 基于dSPACE的联合仿真；
  - ❖ **Processor-In-the-Loop**
    - ▪ 基于WindRiver Simics的联合仿真；
    - ▪ 基于dSPACE的联合仿真；
  - ❖ **Hardware-In-the-Loop**
    - ▪ 基于NI Veristand的联合仿真；

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Prospect of Embeded Software Development

- **ANSYS嵌入式软件开发与验证工具发展愿景**

Embeded Software

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人机交互
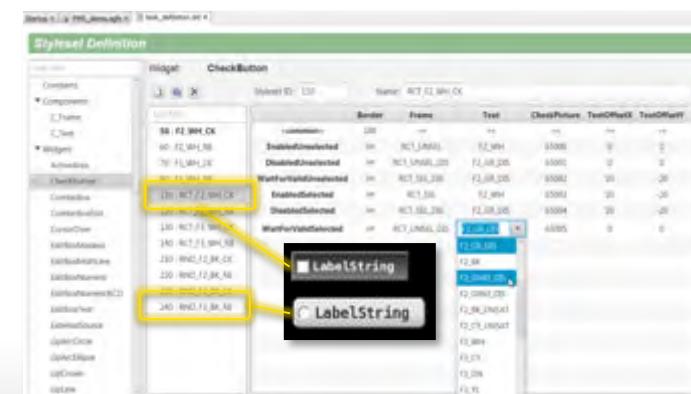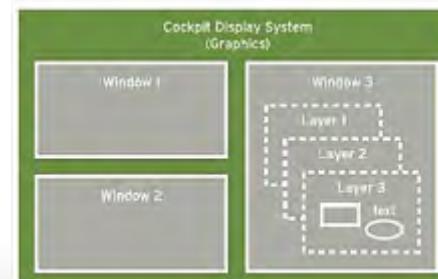界面设计
SCADE

支持多核
CPU架构

扩展不同平台和行业规范的自动化集成能力

完善基于模型的实物半实物的仿真

加强显示应用建模能力和行业应用

ARINC 661
新版本支持
和新特性
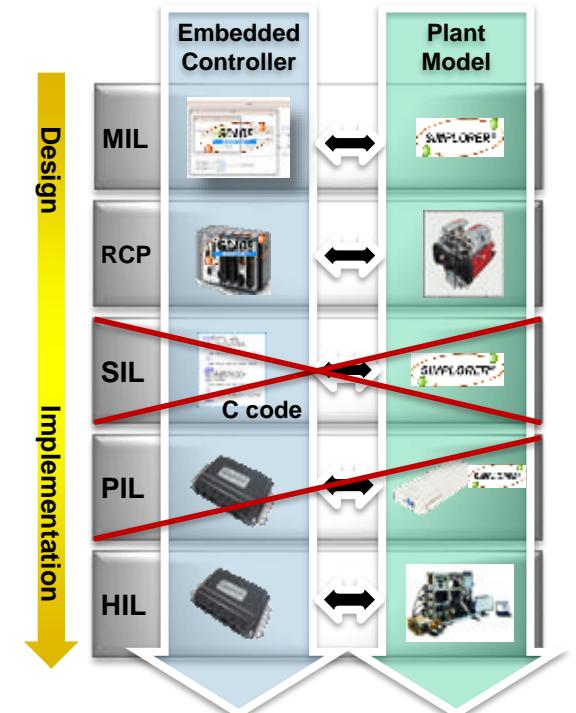
ANSYS

Prospect of SCADE Display

Embeded Software

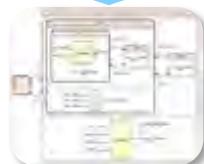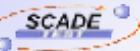Develop qualified, AUTOSAR compliant safety critical control and HMI software with model based development tools. Fulfill ISO 26262 requirements

人机交互界面设计

- **SCADE Display加强建模和应用能力**
  - ❖ 新的几何建模能力（渐变元素、路径、遮障容器等）；
  - ❖ 拓展表达式语法（结构体、枚举类型，全局常量，类型表）；
  - ❖ 支持SVG（Scalable Vector Graphics）文件的导入；
  - ❖ 支持WebGL用于HTML5框架；
  - ❖ 集成第三方Digital Mapping和SVS应用；
  - ❖ 增强的多点触摸支持和仿真；
  - ❖ 国际化和本地化的支持；
  - ❖ 加强控件库（轨道ERTMS标准库）；
  - ❖ 图形模型比较和合并工具。
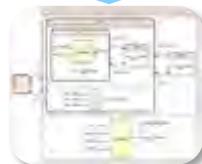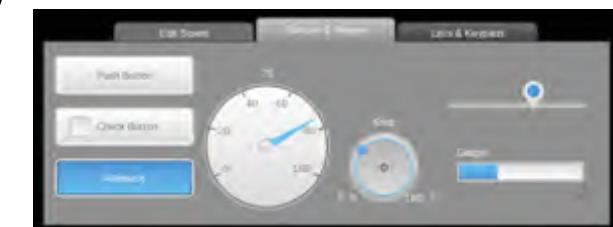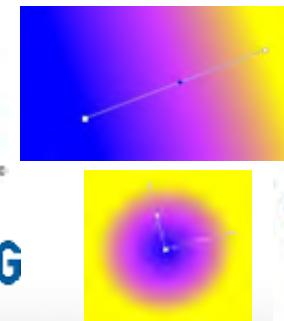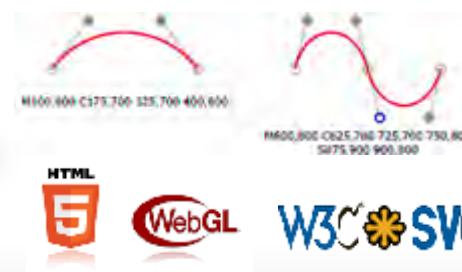
Prospect of SCADE ARINC 661 Solution

Embeded Software

Develop qualified, AUTOSAR compliant safety critical control and HMI software with model based development tools. Fulfill ISO 26262 requirements

- **SCADE ARINC 661加强新版本和新特性的支持**

  ❖ 完善对第五版中附录Look Modeling的支持，提供图形化的定义工具；

  ❖ 图形化的Widget配置文件编辑工具；

  ❖ 改进增强缺省Widget外观；

  ❖ 基于模型的A661 UA和CDS测试环境。

  ❖ 支持第六版规范；

  ❖ 支持第七版规范和ARINC 661 Part 2 ；

  ❖ A661消息协议记录和分析工具；

  ❖ 座舱画面布局设计工具；

  ❖ 增强项目文档。

Figure 2
Data showing protocol trace is captured by Great River Technology's ARINC 818 protocol analyzer.

Prospect of Embeded Software Development

- **ANSYS嵌入式软件开发与验证工具发展愿景**

Embedded Software

Develop qualified, AUTOSAR compliant safety critical control and HMI software with model based development tools. Fulfill ISO 26262 requirements
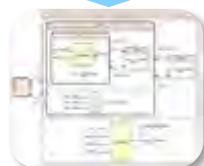
测试验证环境

SCADE

支持多核CPU架构

加强显示应用建模能力和行业应用

扩展不同平台和行业规范的自动化集成能力

ARINC 661新版本支持和新特性

完善基于模型的实物半实物的仿真

完善图形应用和系统级的自动化和一体化测试

基于需求的测试脚本生成

ANSYS

Prospect of Embeded Software Development

- **ANSYS嵌入式软件开发与验证工具发展愿景**

Embeded Software

Develop qualified, AUTOSAR compliant safety critical control and HMI software with model based development tools. Fulfill ISO 26262 requirements

全生命周期管理

SCADE

支持多核CPU架构

扩展不同平台和行业规范的自动化集成能力

完善基于模型的实物半实物的仿真

完善图形应用和系统级的自动化和一体化测试

基于需求的测试脚本生成

加强显示应用建模能力和行业应用

ARINC 661新版本支持和新特性

完善基于模型的追踪管理、变更管理和配置管理解决方案

产品线工程的支持与第三方工具的桥接

ANSYS

Prospect of SCADE Lifecycle (1/2)

Embeded Software

Develop qualified, AUTOSAR compliant safety critical control and HMI software with model based development tools. Fulfill ISO 26262 requirements

全生命周期管理

SCADE

- **ALM Gateway接口拓展**
  - ❖ 与以下工具平台的接口，用于需求的管理：
    - Reqtify；
    - DOORS；
    - Siemens Teamcenter；
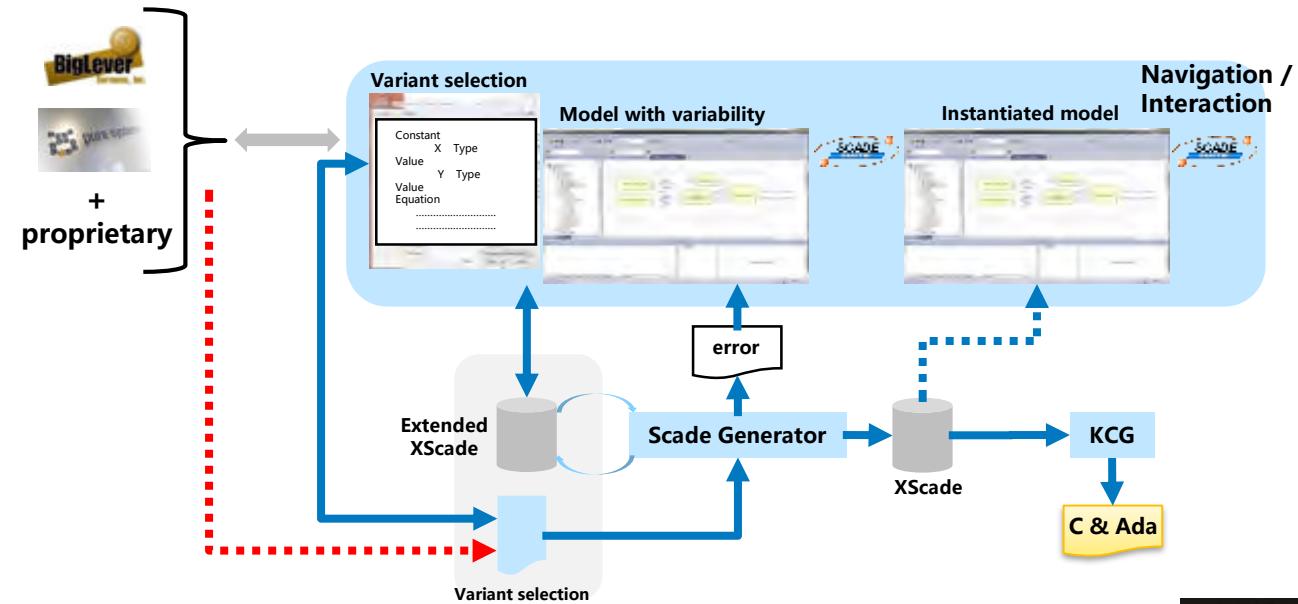   - Siemens Polarion；
    - PTC Integrity；

- **基于模型的变更管理和配置管理解决方案**
  - ❖ 集成的功能方案或与第三方工具的接口，如PTC Integrity, IBM Design Manager, IBM Quality Manager, Siemens Polarion, Siemens Teamcenter, Git等支持OSLC的工具。

ANSYS

Prospect of SCADE Lifecycle (2/2)

Embeded Software

Develop qualified, AUTOSAR compliant safety critical control and HMI software with model based development tools. Fulfill ISO 26262 requirements
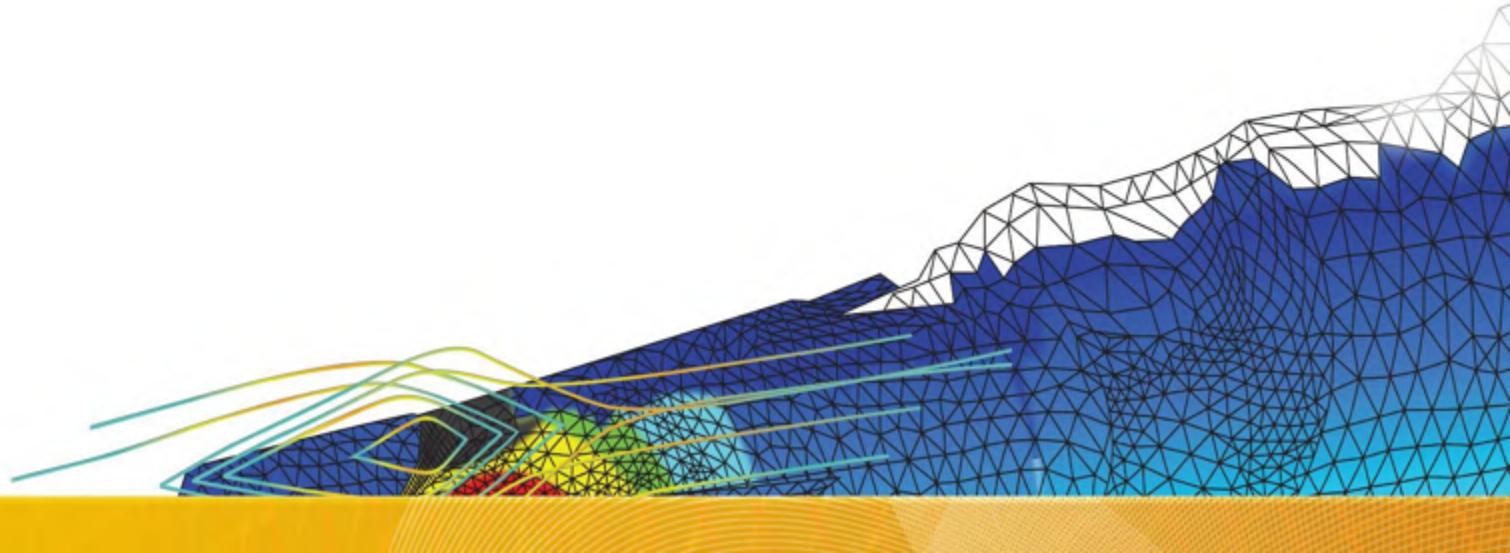
全生命周期管理

SCADE

- **产品线工程的支持**
  - ❖ 支持基于SCADE模型的可变性管理；
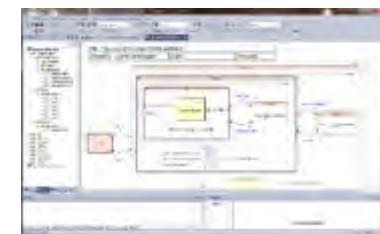 - ❖ 链接第三方工具中的特征模型；
  - ❖ 与第三方产品线管理工具/平台的接口；

总结

总结 ——加强行业应用、完善MBD研制体系

- 整合功能安全分析能力
- 扩展行业应用

- 完善MBD工具体系
- 支持最新应用技术和规范要求

- 完善系统/软件的功能分析与架构设计能力
- 构建多层次、多领域的系统仿真能力

- 完善图形应用的自动化测试能力
- 完善基于模型的实物半实物的仿真
- 构建基于需求的测试脚本生成

- 完善基于模型的追踪管理、变更管理和配置管理解决方案
- 建设基于模型的产品线工程方案

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感谢聆听