
SIEMENS
Ingenuity for life
Realize
LIVE
GREATER CHINA

Realize LIVE GREATER CHINA

The E/E Centric Design Flow – Russ Swanson, AP IES Director

以 E/E 为中心的设计流程

Motivation
动机

Industry Challenged by Disruption
行业面临颠覆性挑战

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Electrification

200+ by 2022

electric / hybrid models +Emerging Start-ups

Source: McKinsey

Autonomous

$21m by 2035

annual sales of autonomous vehicles

Source: IHS

Connected

Shared Services

$6b by 2030

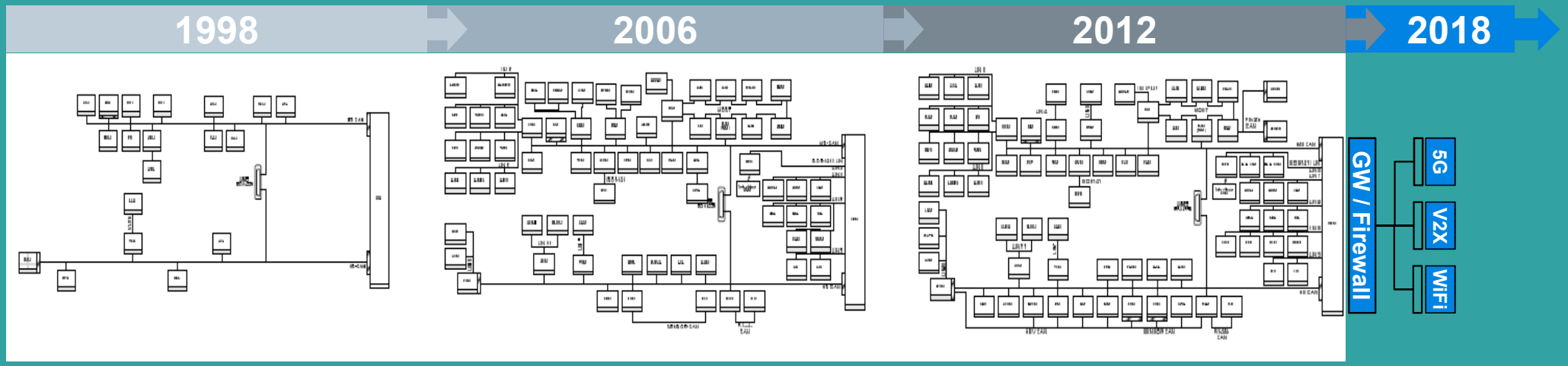
forecasted ride share passenger miles

Source: ReThinkX

Companies need to innovate more then ever creating new business models and services throughout the eco system

Automotive Industry Challenges / 汽车行业挑战

Architecture Evolution – In-Vehicle Communication Networks
架构演进 – 车载通信网络



- Architecture mostly developed for specific car models – not scalable and reusable
- High Bandwidth needs drive Ethernet Adoption
- Software download too long for production and service
- Software with complex dependencies – everything is connected to everything else
- Electrical power consumption is at its physical limit for 12 V → 48V

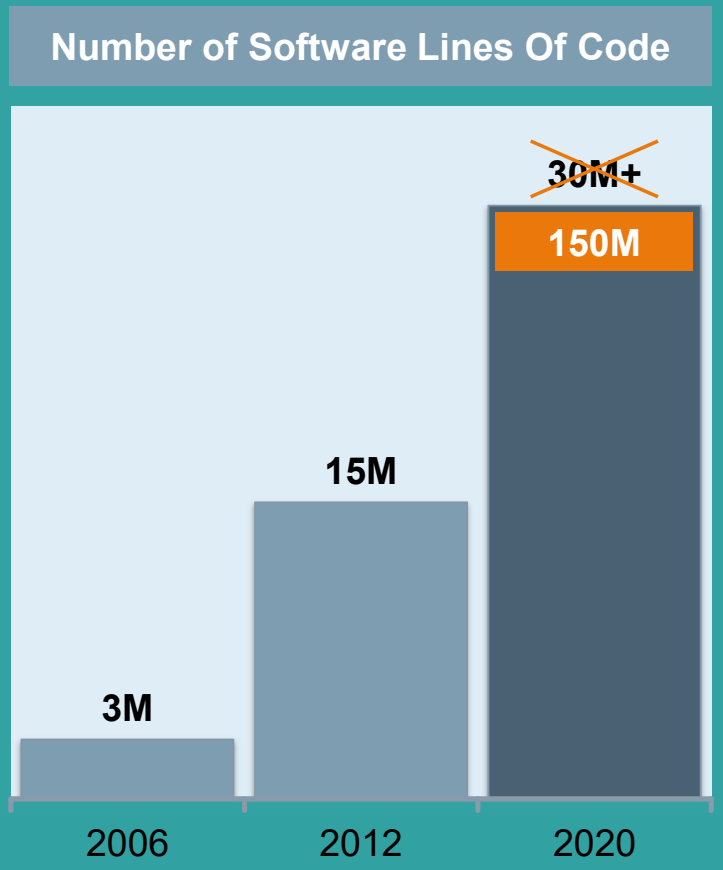
Source: **Designed around You - Volvo's all new EE Architecture and Development Process**

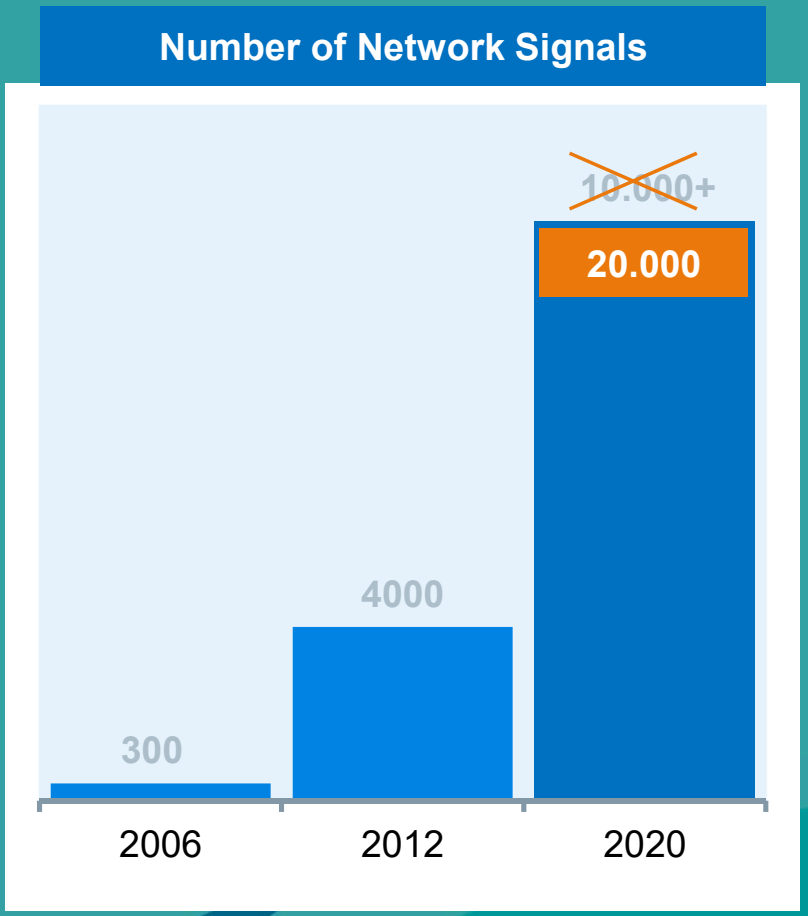
Dr. Thomas M. Müller, Vice President, Electrical & Electronic Systems Engineering,Volvo Car Group

Automobil Elektronik Kongress, July 2013, Ludwigsburg Germany

Automotive Industry Challenges / 汽车行业挑战

Architecture Evolution – Software & Network Metrics
架构演进 – 软件和网络指标





Source: 2014 Deutsche Bank Global Auto Industry Conference (January 14, 2014)

Autonomous & Electrical Increases Complexity
汽车和电气系统提高复杂度

Model Based Engineering is Central to Successful Outcomes
基于模型的工程设计对产品取得成功至关重要

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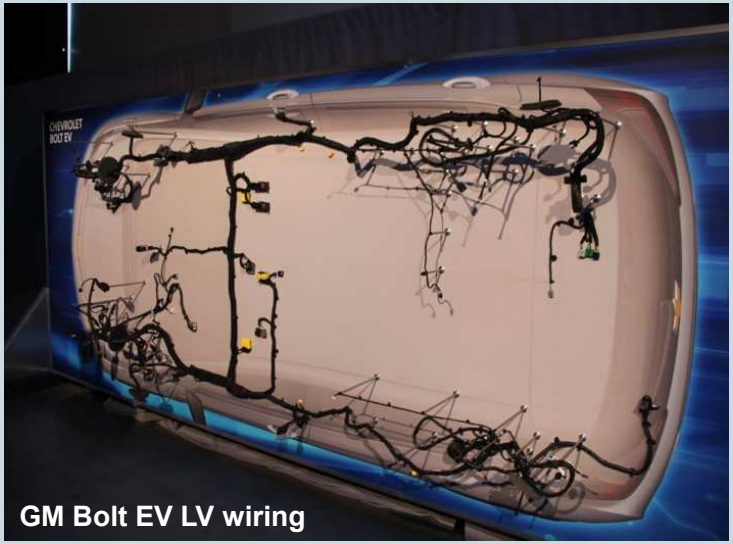
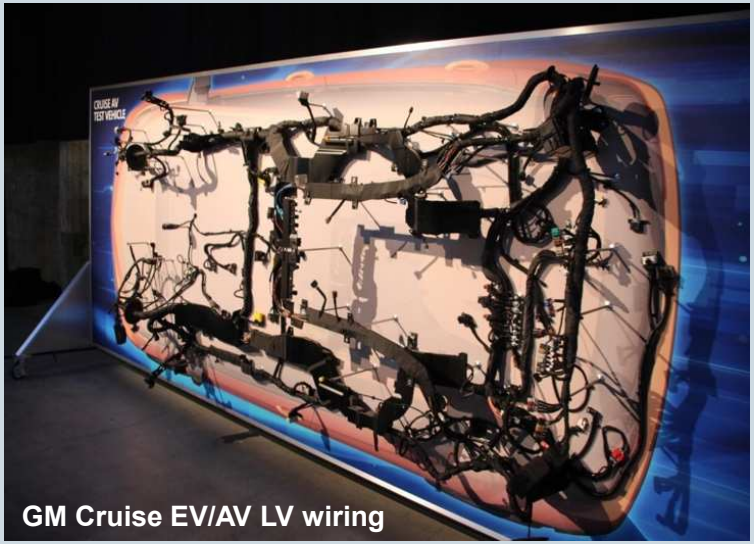
Explosion of Hardware Interconnect

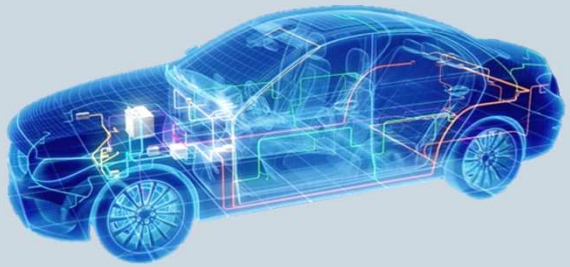
& Data Rates

- New Architectures
- >30 new sensors
- 40% more hardware
- No extra space
- Safety & Security
- Mega to Gigabits
- Power demands


GM Bolt EV LV wiring

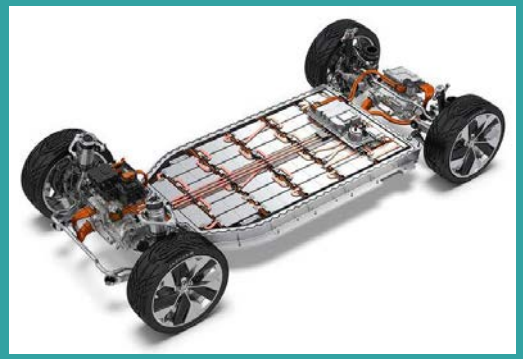

GM Cruise EV/AV LV wiring

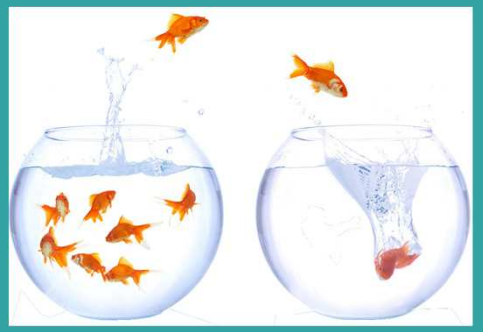
Model based system engineering
required to understand and address system relationships and to optimize packaging



Industry Challenged by Disruption
行业面临颠覆性挑战

Technical, process, organizational, ownership…
技术、流程、组织、所有权…





Electrification

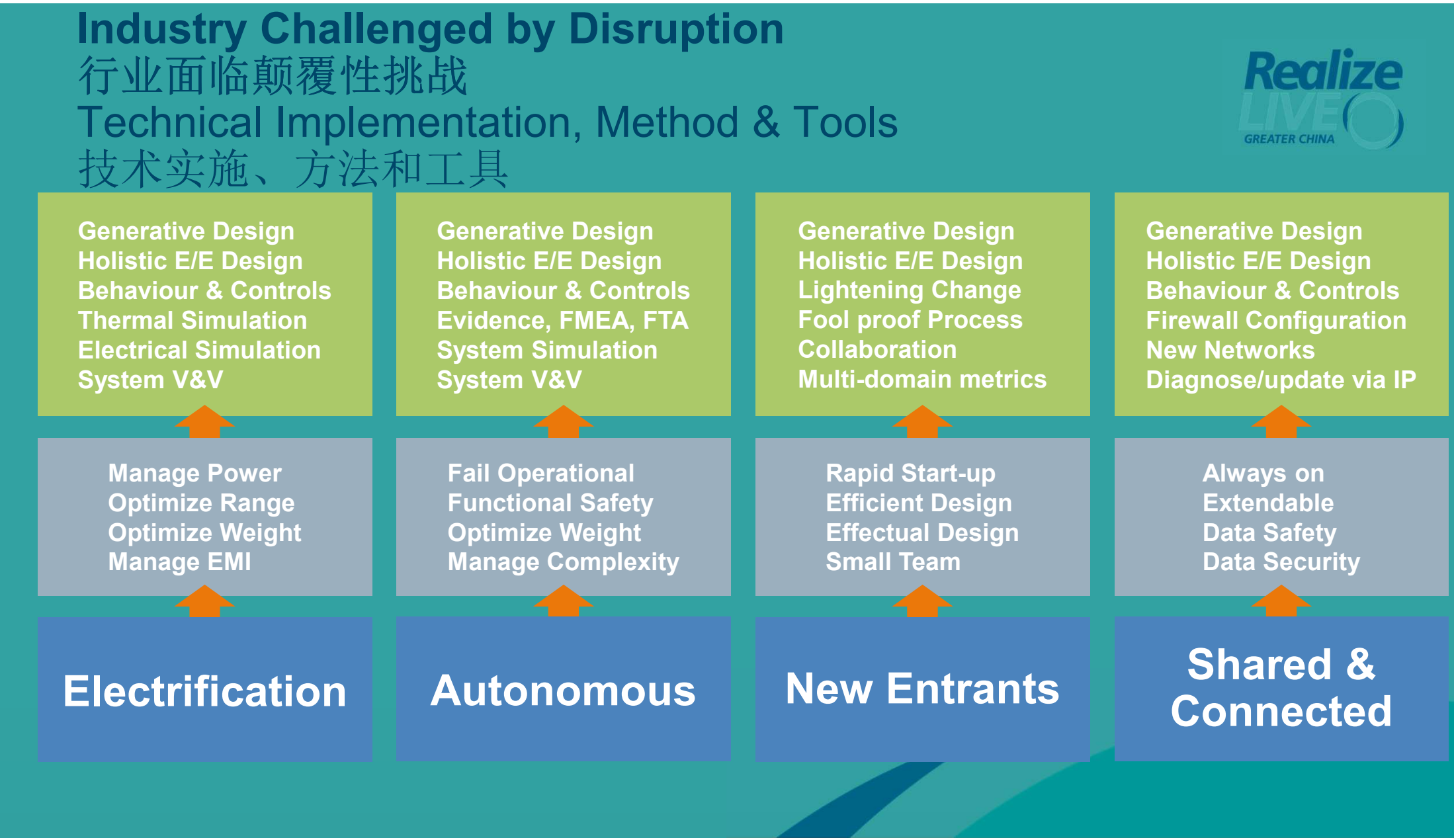
Autonomous

New Entrants

Shared & Connected

Industry Challenged by Disruption
行业面临颠覆性挑战
Technical & Business Goals
技术和业务目标

Industry Challenged by Disruption
行业面临颠覆性挑战
Technical Implementation, Method & Tools
技术实施、方法和工具



Industry Challenged by Disruption
行业面临颠覆性挑战
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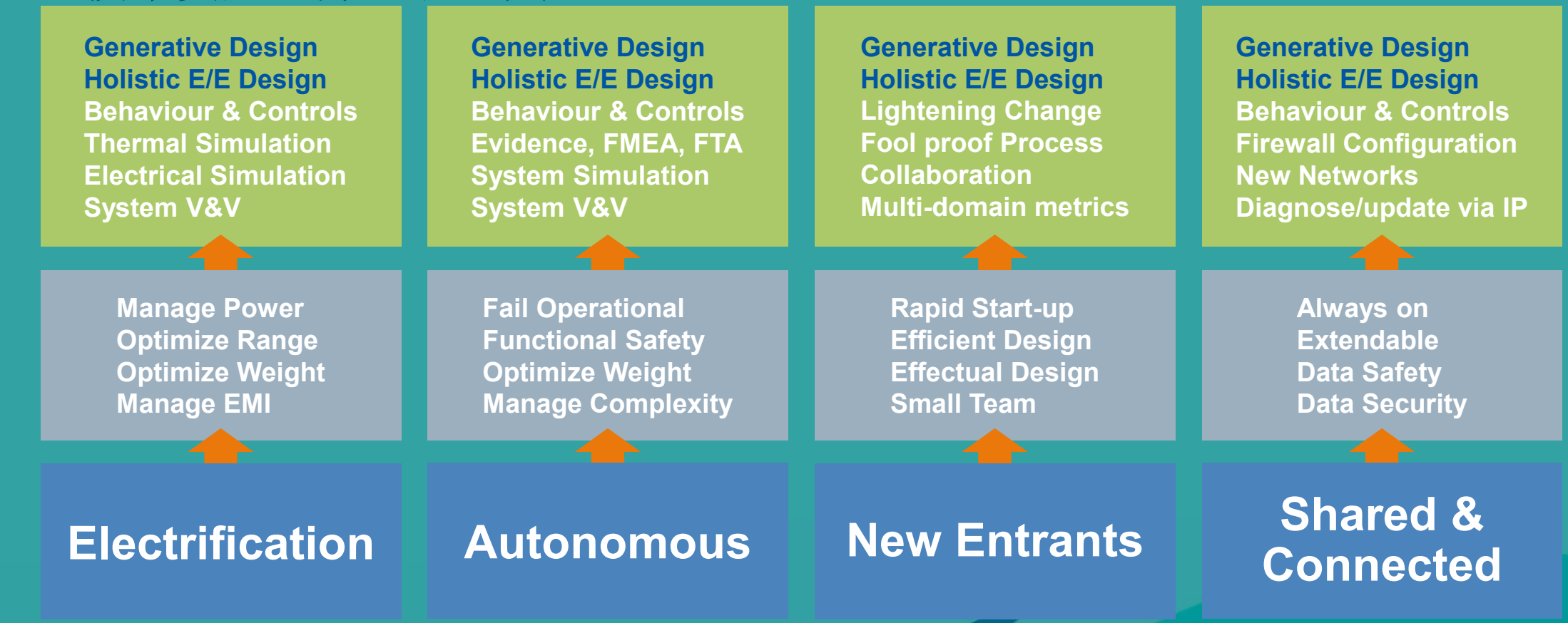

Platform – Level Model Based Engineering

平台级别的基于模型的工程设计

Platform – Level Model Based Engineering
平台级别的基于模型的工程设计
How is it addressed today?
现在如何解决这个问题？

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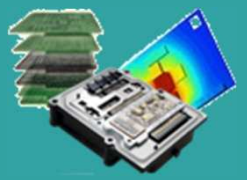
Disconnected domains, **interfaces as text, picture and table based** file exchange.

Individual contributors loosely coupled by “standard interfaces”.

Hardware

Off-Board Components	On-Board Components	Layout	Analysis	
PIN-Out	Logical Schematic	Mechanic Design	Manufacturing Planning	PCB

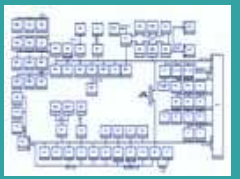


Software

Model Based Design	Diagnostic & Calibration	Basic SW Configuration	Testing	
AUTOSAR SW Architecture	Coding & Code Generation	Profiling		

Network

Network Architecture	Signal Timing	Frame Packing	Testing	
Network Signals	Network Variant Design	Analysis		



EDS

Electrical Signals	Topology	Mechanical Design	Service	
Variants	Electrical Components	Harness Design	Manufacturing Planning	

Platform – Level Model Based Engineering
平台级别的基于模型的工程设计
Connecting domains as elegantly as possible
尽可能轻松地将各个设计领域连接起来

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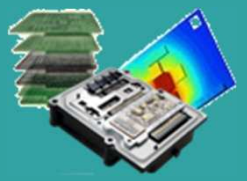
Integrated **functional and architectural design** to feed all connected and targeted domains.

Data Driven solutions provide an early perspective at system of systems level & aids implementation planning

Implementation Proposal

Functional Design Solution

	Off-Board Components	On-Board Components	Layout	Analysis	Hardware
Hardware	PIN-Out	Logical Schematic	Mechanic Design	Manufacturing Planning	PCB
	Model Based Design	Diagnostic & Calibration	Basic SW Configuration	Testing	
Software Architecture	AUTOSAR SW Architecture	Coding & Code Generation	Profiling		Software
	Network Architecture	Signal Timing	Frame Packing	Testing	
Network Architecture	Network Signals	Network Variant Design	Analysis		Network
	Electrical Signals	Topology	Mechanical Design	Service	EDS
Electrical Schematic	Variants	Electrical Components	Harness Design	Manufacturing Planning	



Platform – Level Model Based Engineering
平台级别的基于模型的工程设计
Utilizing an iterative and effective functional flow
利用迭代和有效的功能流程

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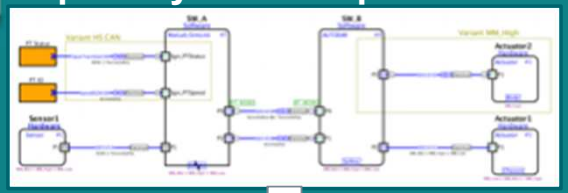
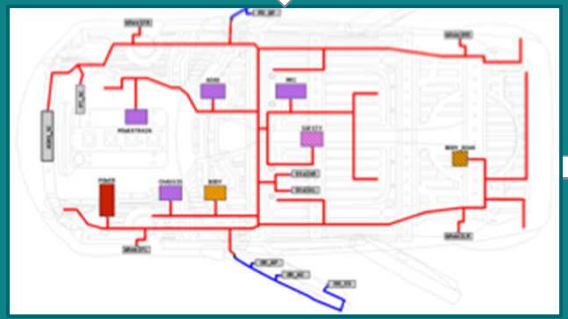
Functions are the drivers - not the implementers - of the **downstream flows**

Capital Systems - Implementation Proposal

Functional Design Solution

Capital Systems Capture





Capital Systems Architect

	Off-Board Components	On-Board Components	Layout	Analysis	Hardware
Hardware	PIN-Out	Logical Schematic	Mechanic Design	Manufacturing Planning	PCB
	Model Based Design	Diagnostic & Calibration	Basic SW Configuration	Testing	
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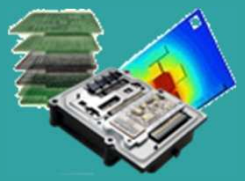
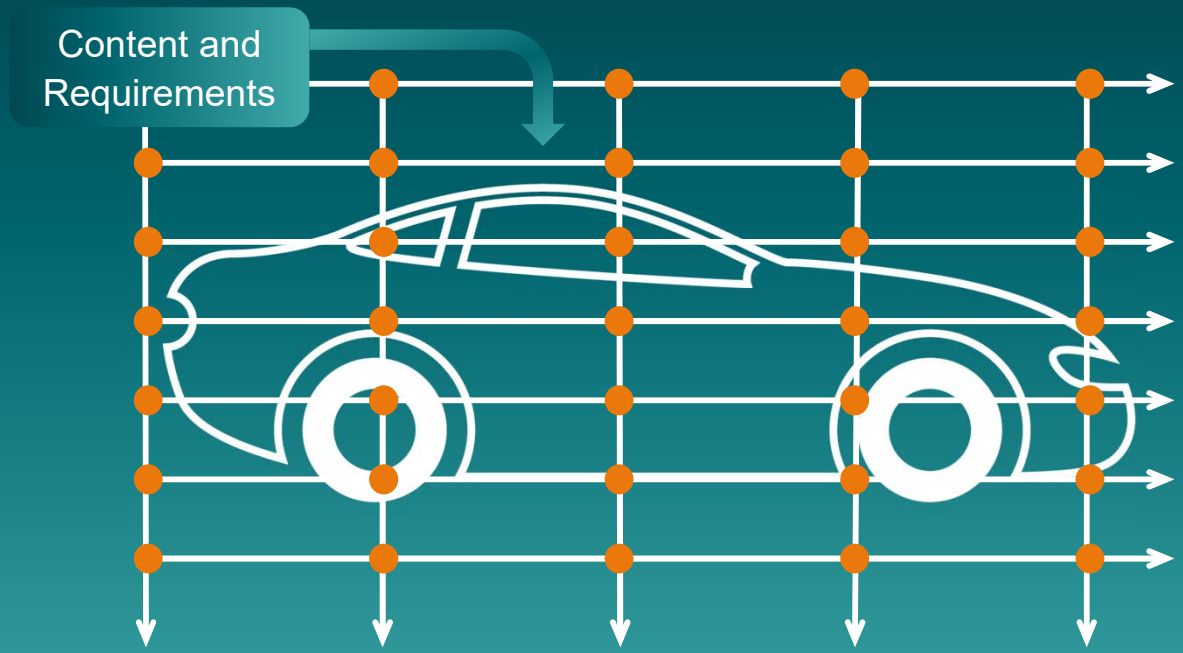


Capital Flow
Capital 流程

Capital – Generative Engineering
Capital – 生成式工程设计
EE Architecture Development / EE 架构开发



Architectural Proposals for Logical, SW, HW & NWs

EE Content Consolidated
Functions & Signals allocated across vehicle

Outcomes Optimized
Performance balanced against multiple costs

Platform Assessment Enabled
Platform level KPI's to support trade studies

Implementations Verified
Correctly & optimally sized components

EE Integrations Validated
Proof integrated systems meet requirements

Capital – Generative Engineering
Capital – 生成式工程设计
EE Architecture Development / EE 架构开发

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Input Models → **Automated Transformation** → **Deterministic Outcomes**

Function Designs

Platform Topology

.. Carryover
.. Variability
.. Product Plans
.. Requirements
.. System Models

Corporate IP

Metrics

Generative Engineering
EE Architecture Development

Model Based Systems Engineering

System Logic
For EDS Design

Software Architecture
ECU Extracts | App SWC Models

Network Architecture
ECUs | Clusters | Signals | Event Chains

Validated EE Platform

Capital – Generative Engineering
Capital – 生成式工程设计
Example: Logical architecture / 示例：逻辑架构

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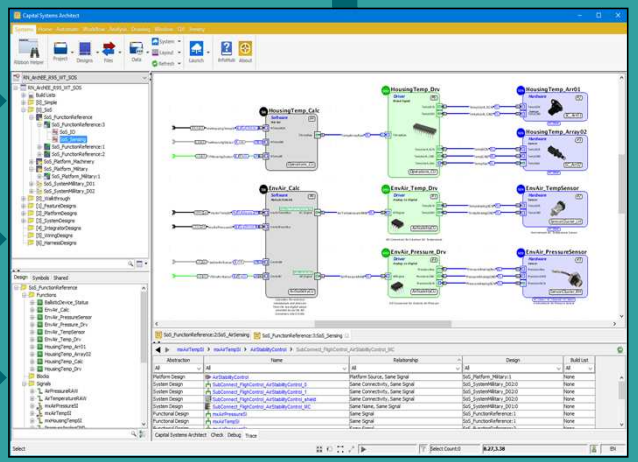
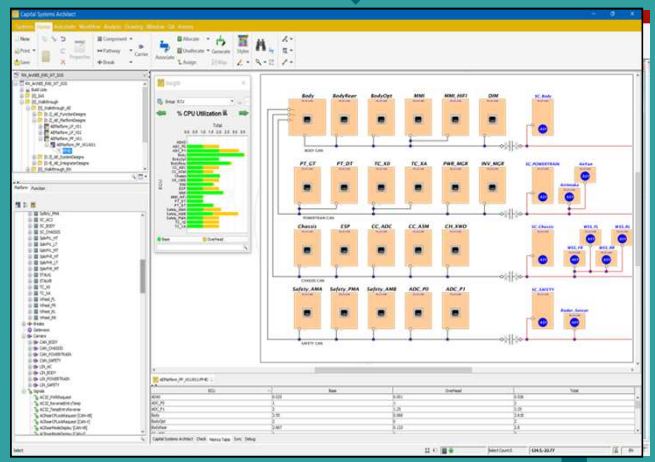
Model based transformations deterministic outcomes

absorb, synthesize, optimize

Requirements & Features

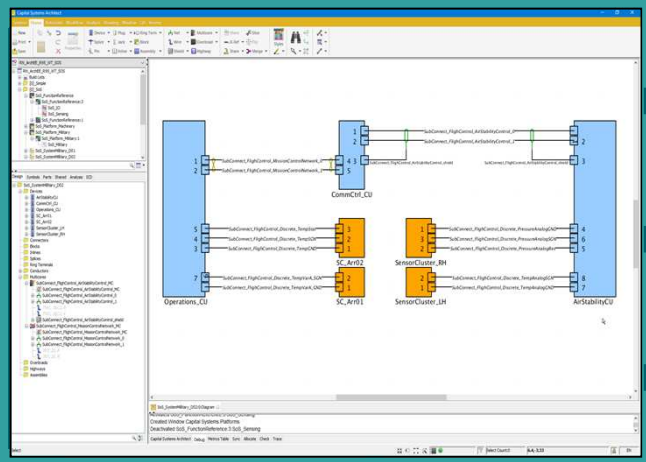


Functional Models



Platform Level Design

extract



Logical System Designs

Downstream Engineering

Platform – Level Model Based Engineering
平台级别的基于模型的工程设计
Seamless flow across Design Domains
跨越多个设计领域的无缝流程

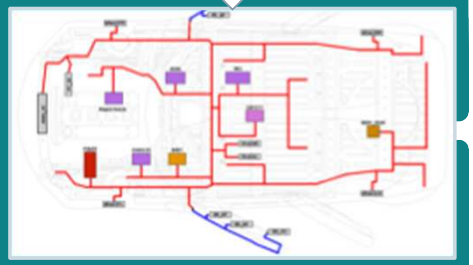
Realize LIVE GREATER CHINA

Capital Systems - Implementation Proposals

Network & Software Implementation

Functional Design Solution

Capital Systems Capture



Capital Systems Architect

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	Network Signals	Network Variant Design	Analysis	
Electrical Schematic	Electrical Signals	Topology	Mechanical Design	Service
	Variants	Electrical Components	Harness Design	Manufacturing Planning

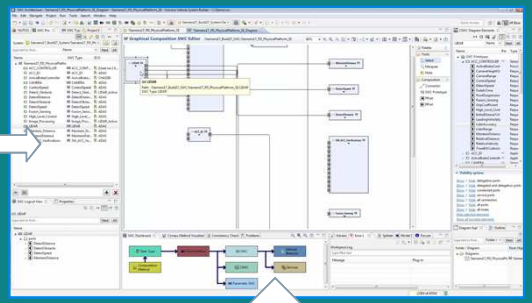
Hardware PCB

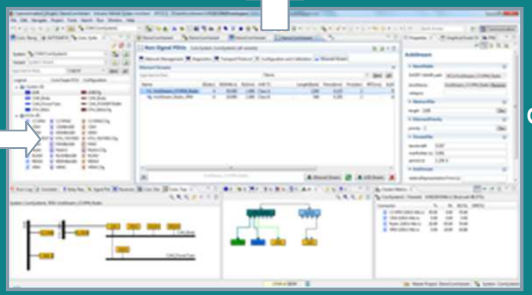
Software

Network

EDS

Volcano VSB, VSTAR & VSI





Capital Networks

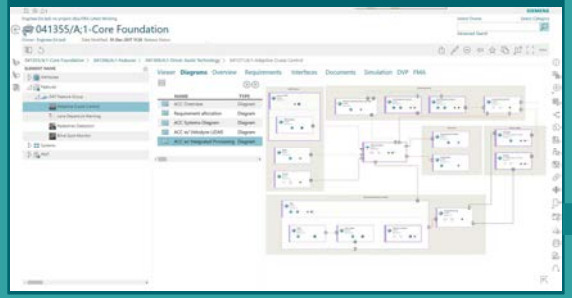
Software and Network Design Solution

Capital Flow
Capital 流程
A closer look
深入了解

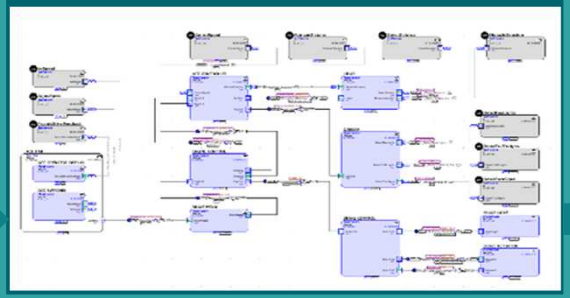
Capital – Generative Engineering
Capital – 生成式工程设计
The “Front-End” of the flow / 流程的“前端”

Realize LIVE GREATER CHINA

Multi-Domain System Model



E/E Function Architecture



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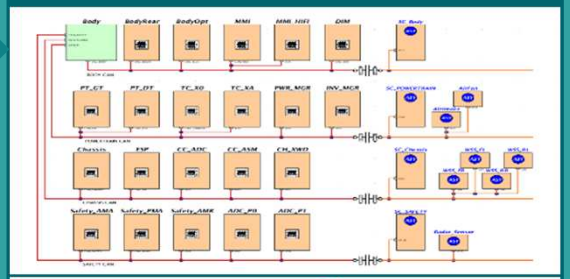
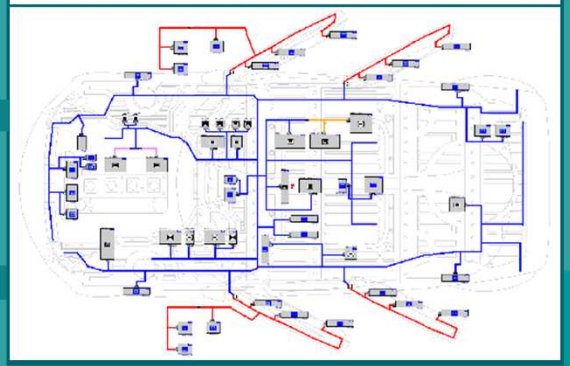
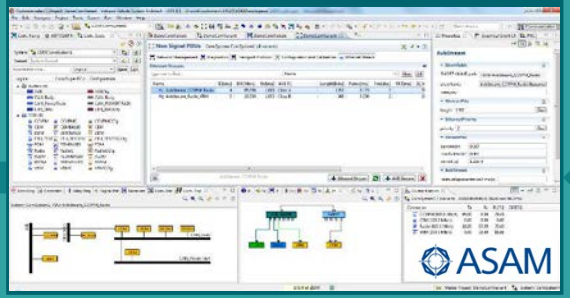


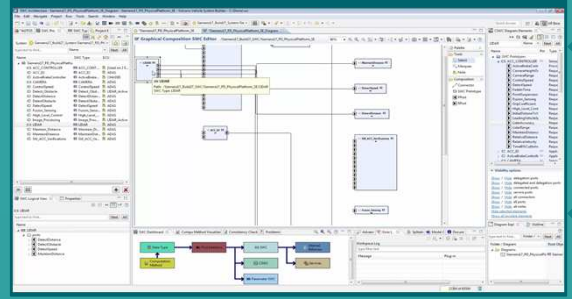


Network Design



AUTOSAR

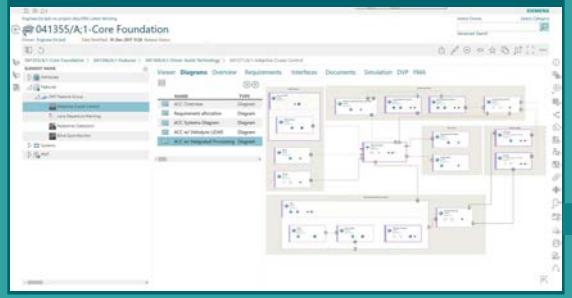
ECU SW Design



Capital – Generative Engineering
Capital – 生成式工程设计
E/E Architecture Development / E/E 架构开发

Realize LIVE GREATER CHINA

Multi-Domain System Model



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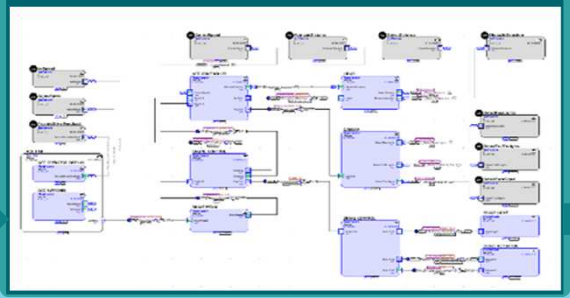
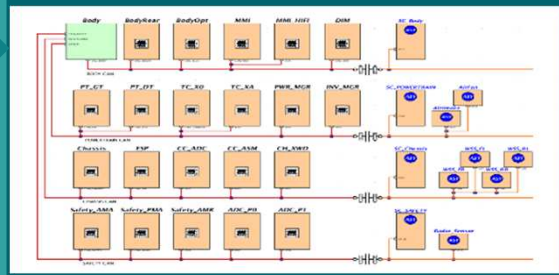
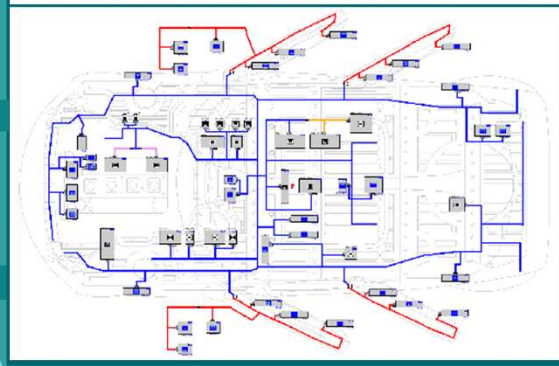
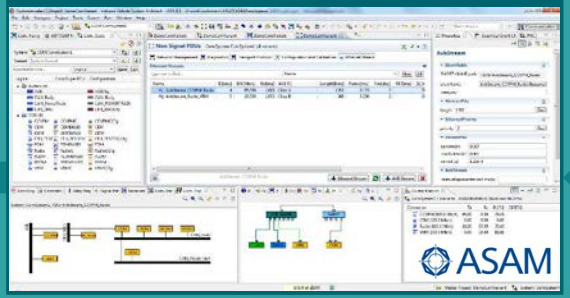


E/E Platform Architecture



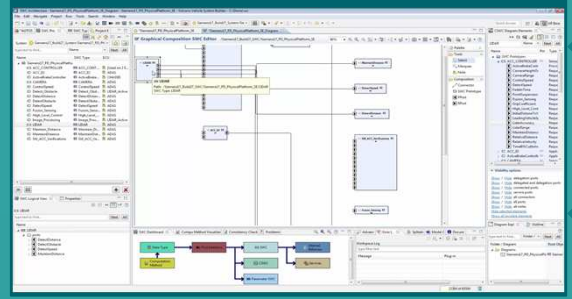


Network Design



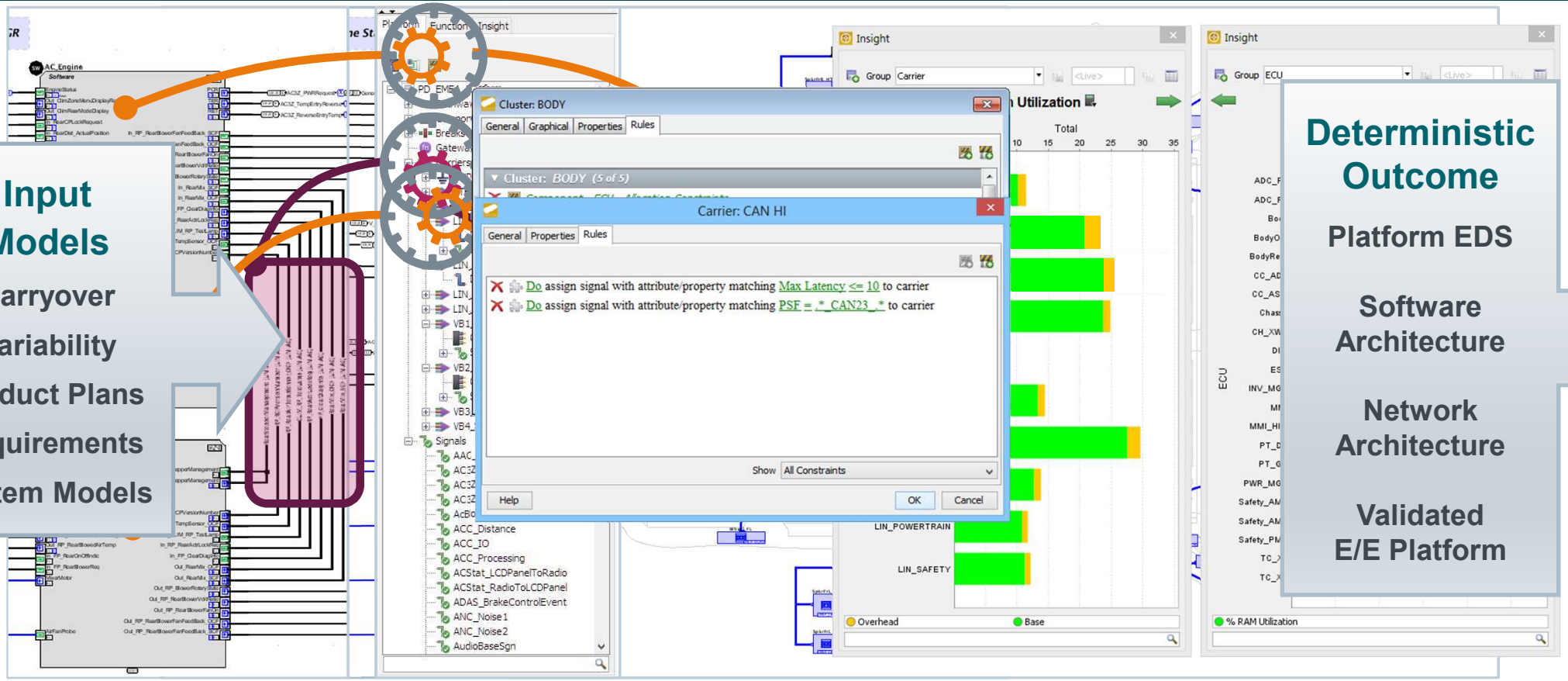
AUTOSAR

ECU SW Design



Capital – Generative Engineering
Capital – 生成式工程设计
EE Architecture Development / EE 架构开发

Realize LIVE GREATER CHINA



Capital – Generative Engineering
Capital – 生成式工程设计
EE Architecture Development / EE 架构开发

Realize LIVE GREATER CHINA

Input Models

- Carryover
- Variability
- Product Plans
- Requirements
- System Models

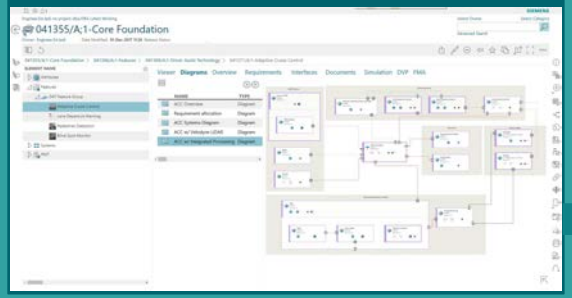
Deterministic Outcome

- Platform EDS
- Software Architecture
- Network Architecture
- Validated E/E Platform

Capital – Generative Engineering
Capital – 生成式工程设计
Capital Networks – Network Design
Capital Networks – 网络设计

Realize LIVE GREATER CHINA

Multi-Domain System Model



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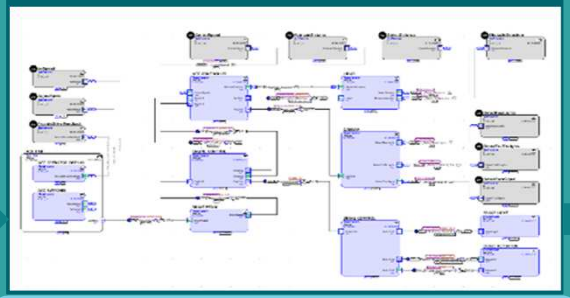
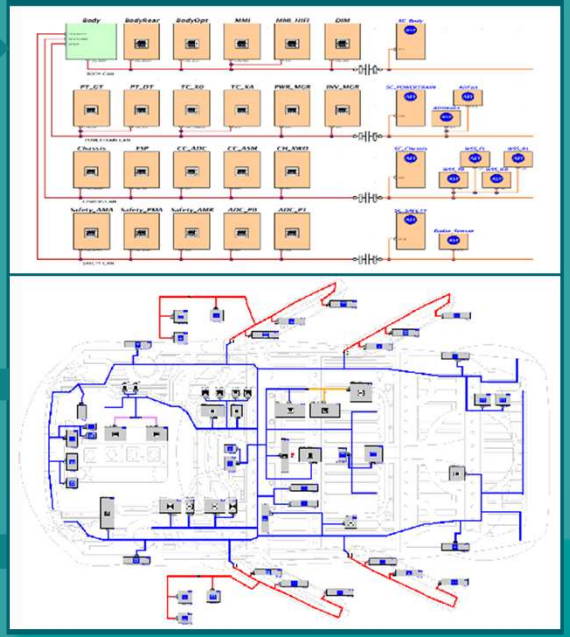
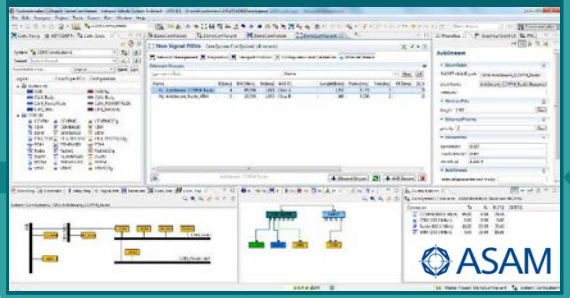


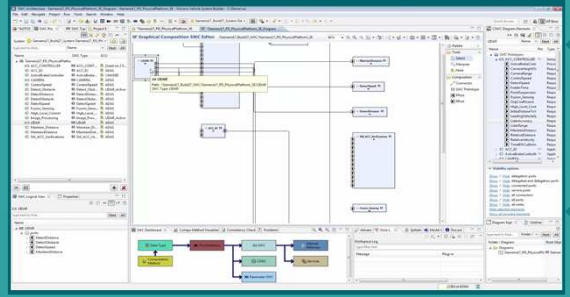
E/E Platform Architecture



Network Design



ECU SW Design



Capital – Generative Engineering
Capital – 生成式工程设计
Capital Networks – Accelerating Network Design
Capital Networks – 加快网络设计

Realize LIVE GREATER CHINA

Logical Architecture
ECUs | Clusters | Signals

Communication Needs
Published / Subscribed Signals

Timing Requirements
Delivery time | Allowed Delays | Jitter

Synthesis Settings
Id Ranges, Repacking Rules

Synthesis

Frame Packing
PDUs | Frames | Triggering

Schedule
Job list | Schedule Table

ECU Configuration
Transmission Settings

Cluster Configuration
Triggering | Settings

Generative Approach

Speeds Up Design Process

Consistent Implementation Proposals Fulfilling Requirements

Capital Networks

Network Cluster Configuration

网络集群配置

Realize LIVE GREATER CHINA

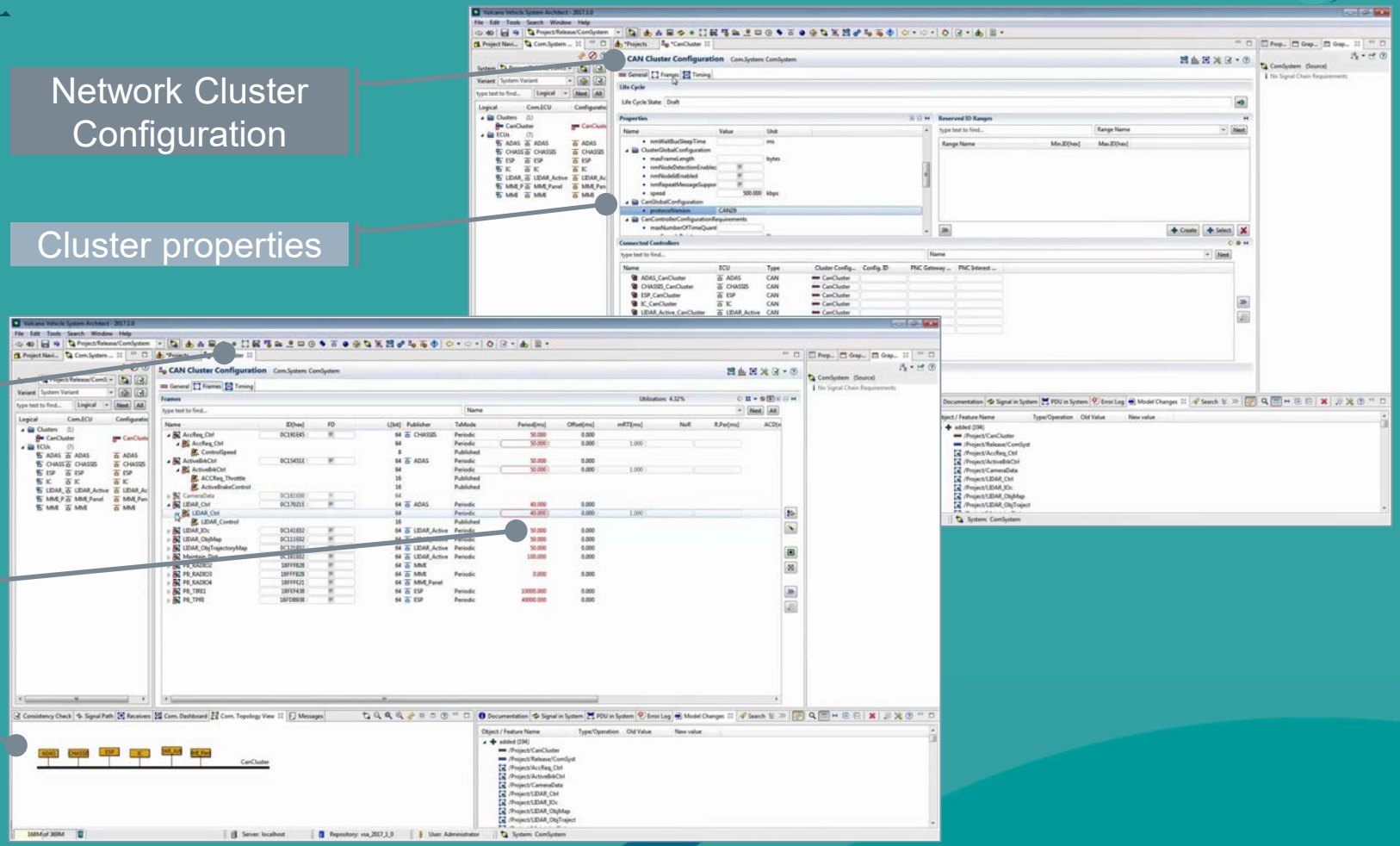
Network Cluster Configuration

Cluster properties

Task focused perspectives

Highlighting area's needing attention

Com Topology View



Capital Networks

Timing Analysis & Generative Frame Packing

时序分析和生成式帧封装

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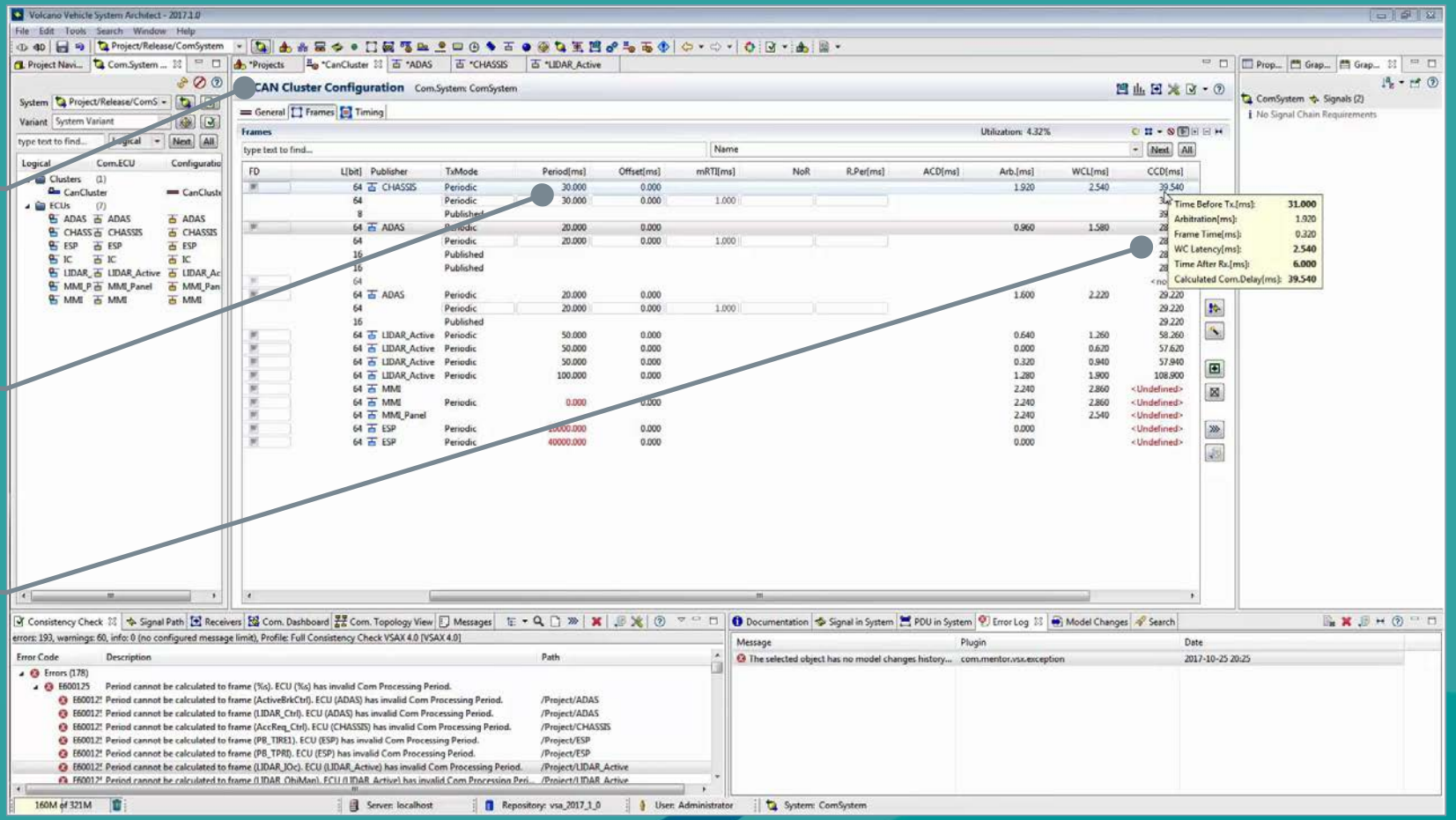
Network Cluster Configuration

Frame Periods adjusted

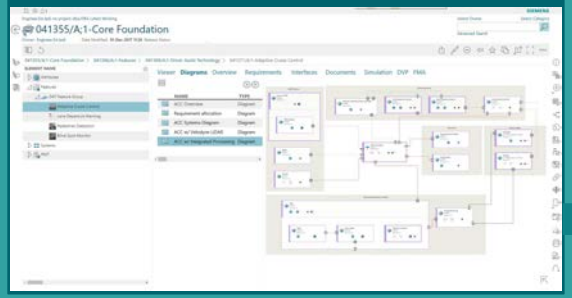
Timing now meets required Maximum Age



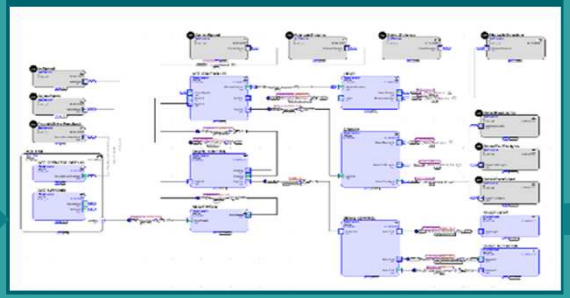
Capital – Generative Engineering
Capital – 生成式工程设计
Volcano – Software Design / Volcano – 软件设计

Realize LIVE GREATER CHINA

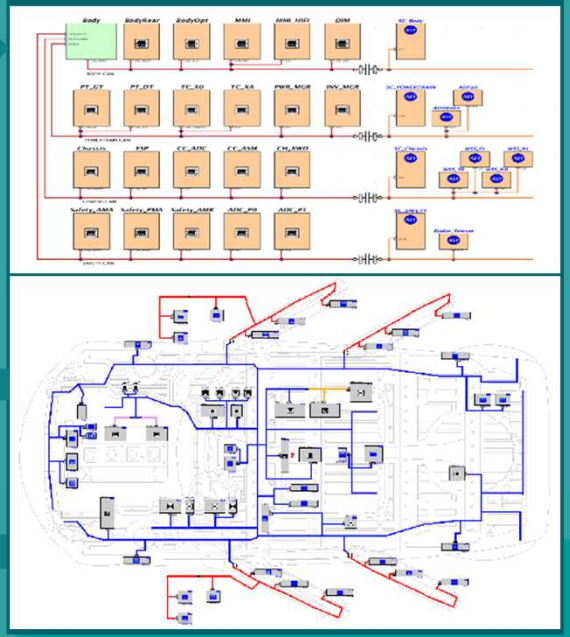
Multi-Domain System Model



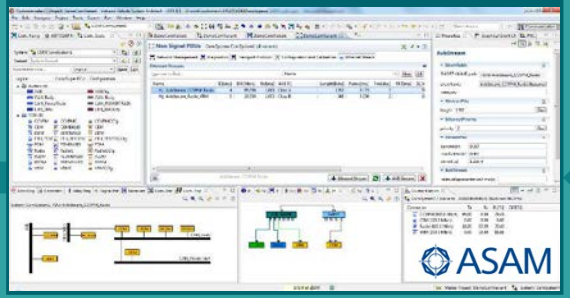
E/E Function Architecture



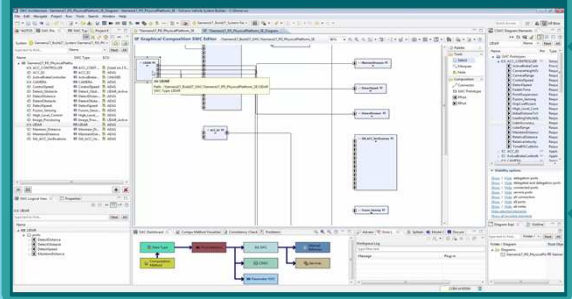
E/E Platform Architecture



Network Design



ECU SW Design



Volcano Virtual System Builder
System Editor
系统编辑工具

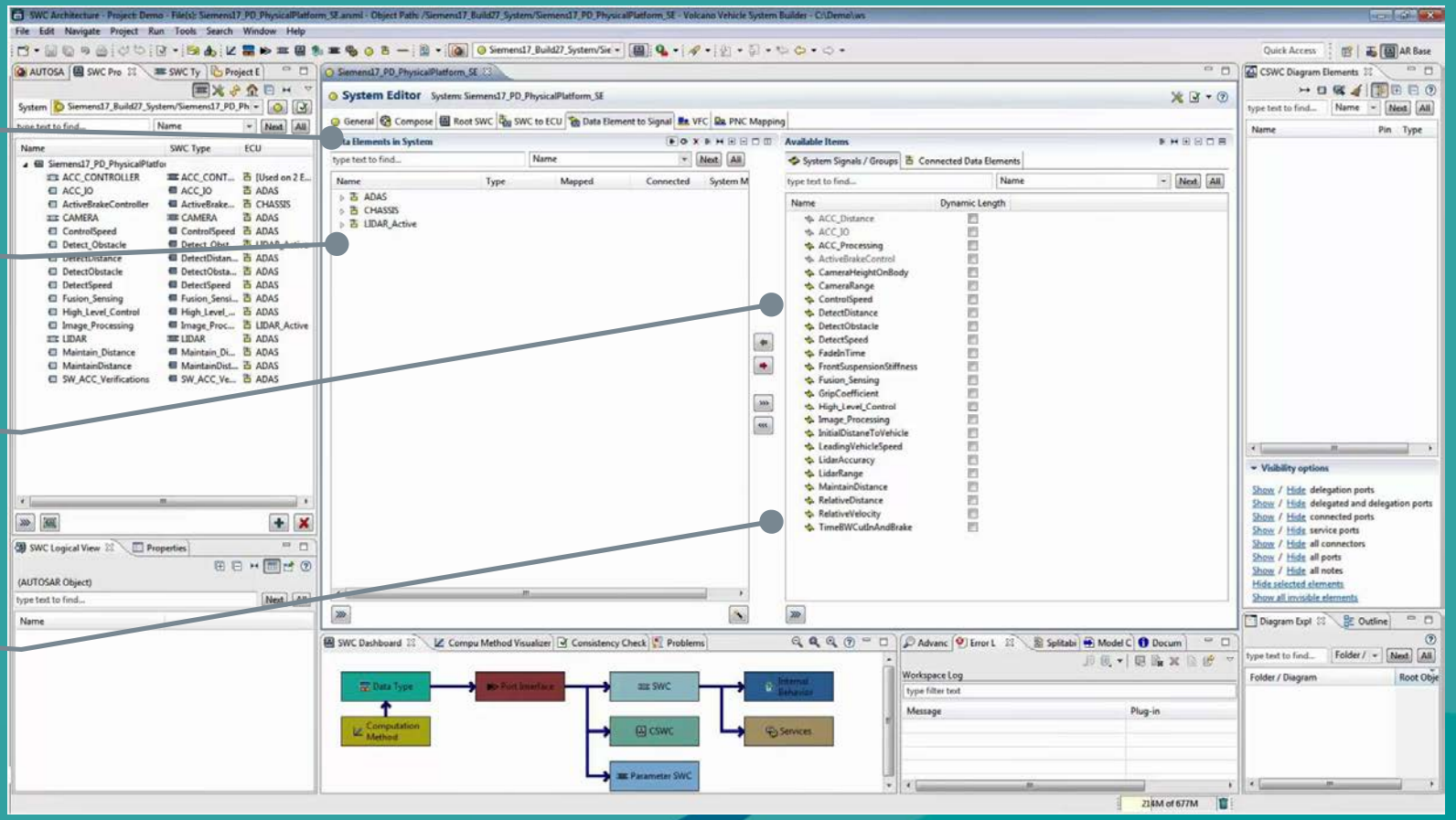
Realize LIVE GREATER CHINA

System Editor

Data Elements in System

Available Elements can be added/removed from this System

Ease of configurability with pre-populated default values



Volcano Virtual System Builder

Generate template .h and .c files

生成模板 .h 和 .c 文件

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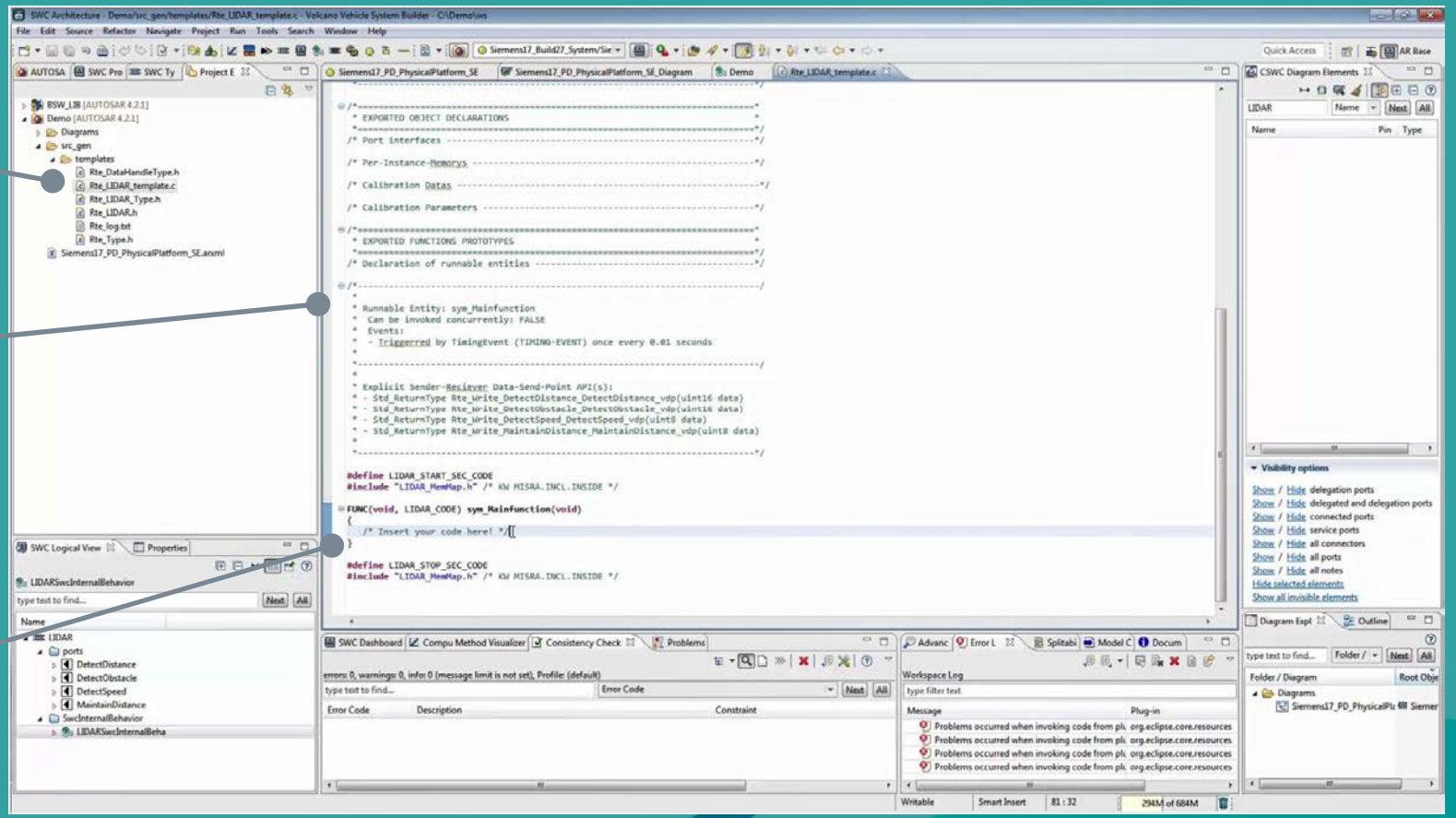
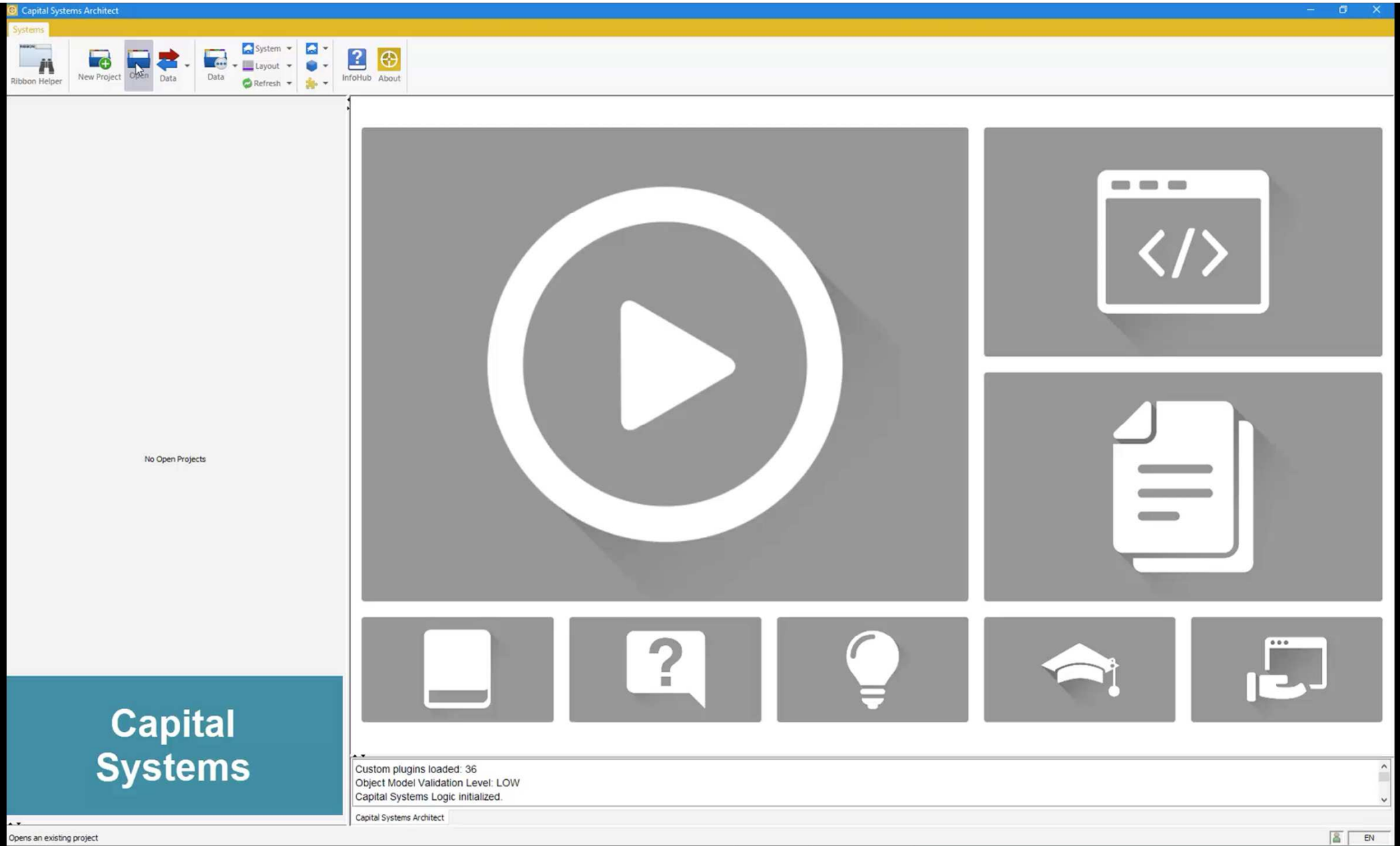
Output template .h & .c

Ready to compile and run on target ECU

Add application code



Capital Flow
Capital 流程
Demonstration
演示


Capital Systems Architect
Systems
Ribbon Helper
New Project
Open
Data
Data
System
Layout
Refresh
InfoHub
About
No Open Projects
Capital Systems
Custom plugins loaded: 36
Object Model Validation Level: LOW
Capital Systems Logic initialized.
Capital Systems Architect
Opens an existing project
EN

Summary & Conclusion
总结和结语

Electrification

200+ by 2022

electric / hybrid models +Emerging Start-ups

Source: McKinsey

Autonomous

$21m by 2035

annual sales of autonomous vehicles

Source: IHS

Connected

Shared Services

$6b by 2030

forecasted ride share passenger miles

Source: ReThinkX

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Industry disruption is not benign – There will be winners and losers

E/E Architecture sets the foundation for your products

MBSE principles, widely applied, are a must

Siemens' Capital is your choice – be a winner

Electrification	Autonomous	Connected	Shared Services
200+ by 2022 electric / hybrid models +Emerging Start-ups	$21m by 2035 annual sales of autonomous vehicles		$6b by 2030 forecasted ride share passenger miles
			
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Realize
LIVE
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