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Ingenuity for life

Realize
LIVE
GREATER CHINA

设计自动化和数据连续性助力功能安全和数据交换

- 汽车行业所面临的挑战
- 功能安全对电气设计过程的影响
- 数字连续性与设计自动化
- 功能安全案例演示
- 总结

汽车工业的大趋势 – 80% 创新在电气，电子及软件



- Multiple domains collaboration
- Configuration complexity handling
- Platform shared data track and transfer
- Function safety
- Early state verification
- Automation to enhance efficiency
- Design change management,
- Manufacturing efficiency ...

EV/AV company need 智能网联新能源车企业的需求

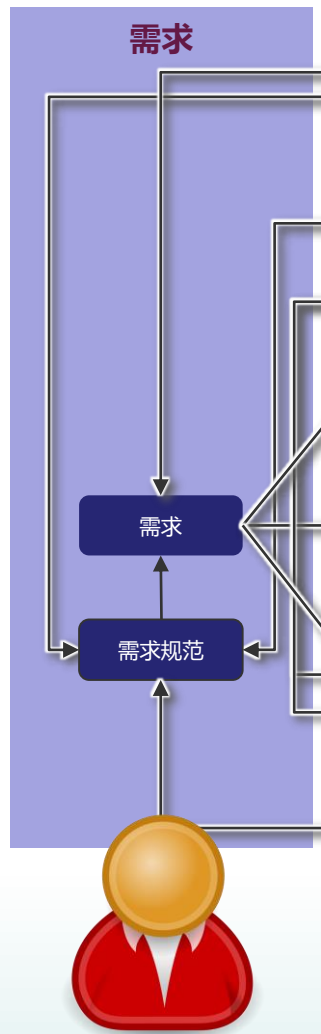
- 上市时间需求紧迫，整车研发周期仅为传统车的一半
- 缺少经验流程，需要快速构建覆盖主机厂到供应商的EV/AV研发流程
- EE相关工程师大部分来源于传统车企，如何快速提升EV/AV设计经验
- 多领域协同设计（硬件&软件&电气&总线&机械&流体）
- 在空间，重量，可靠性，性能及成本之间如何实现平衡
- 功能安全，数字化的管理数据，企业级工具集成



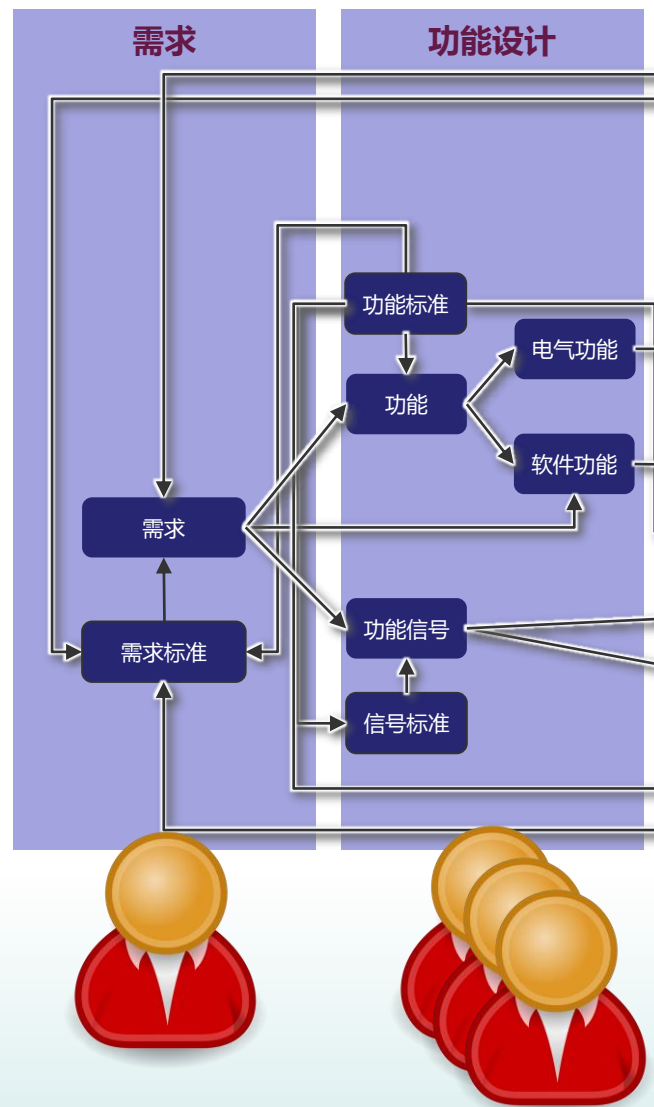
智能网联新能源车需要统一高效，多领域协同的数字化系统工程解决方案，覆盖从系统设计到生产到服务的全流程。



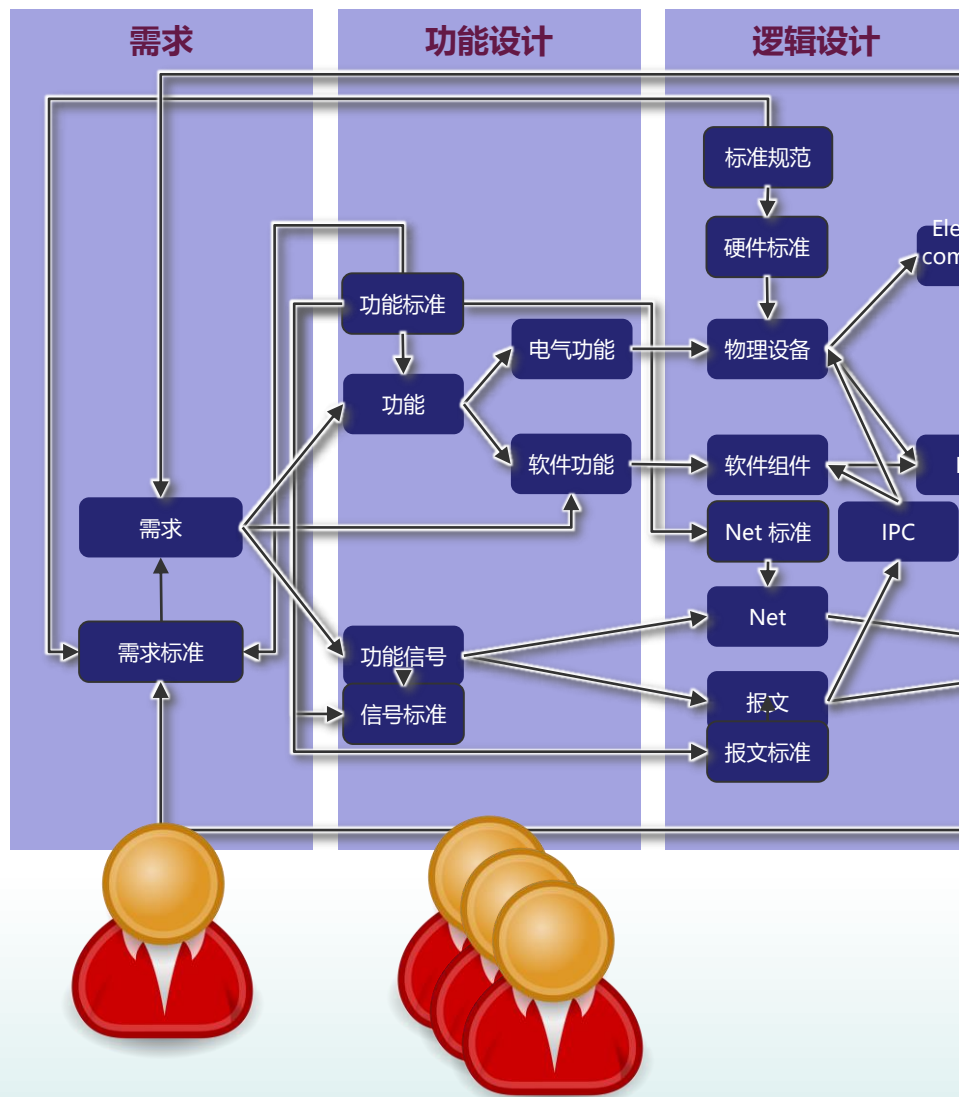
汽车电子电气开发流程及数据交互愈发复杂



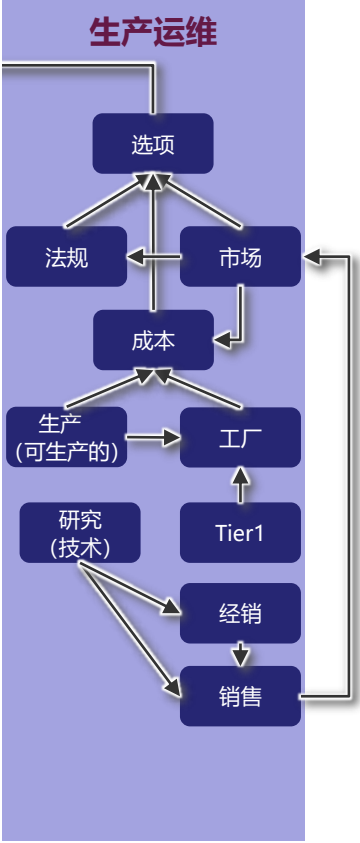
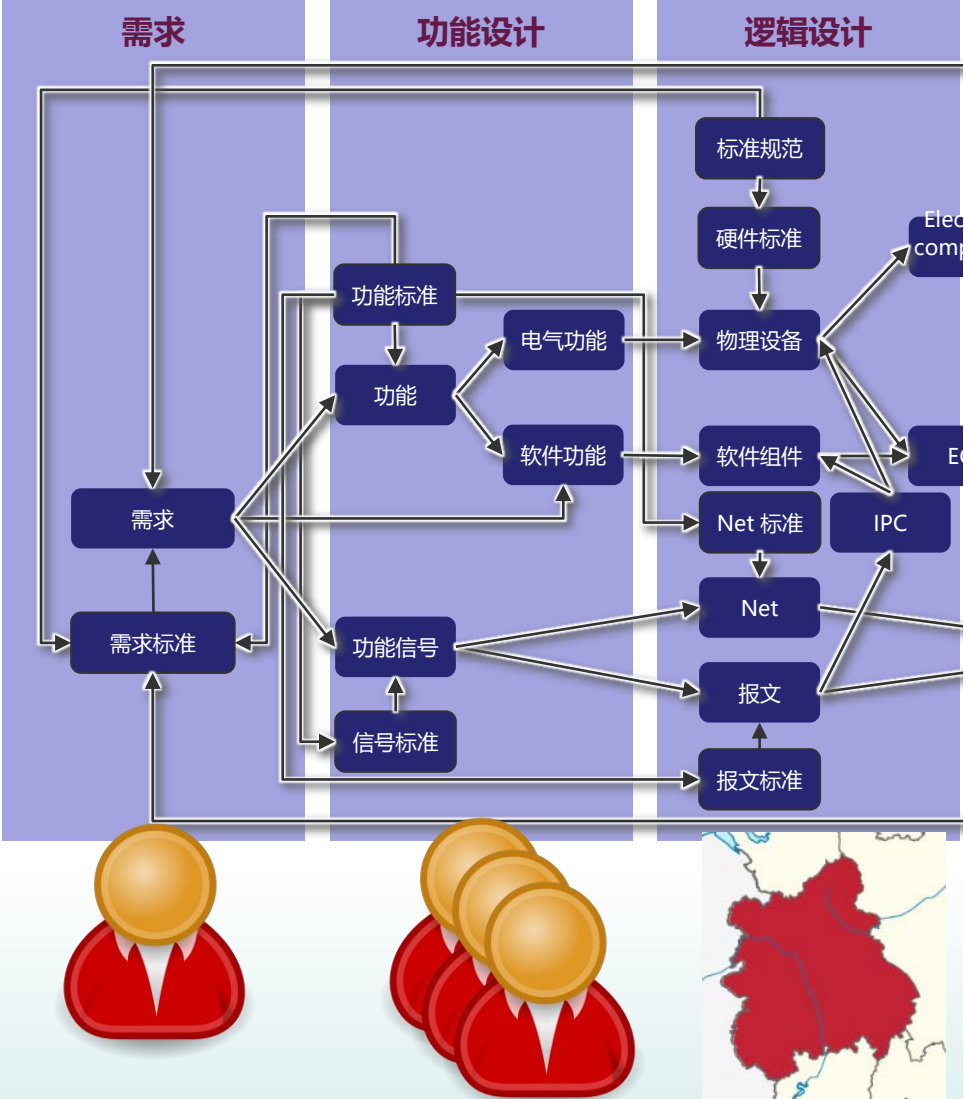
汽车电子电气开发流程及数据交互愈发复杂



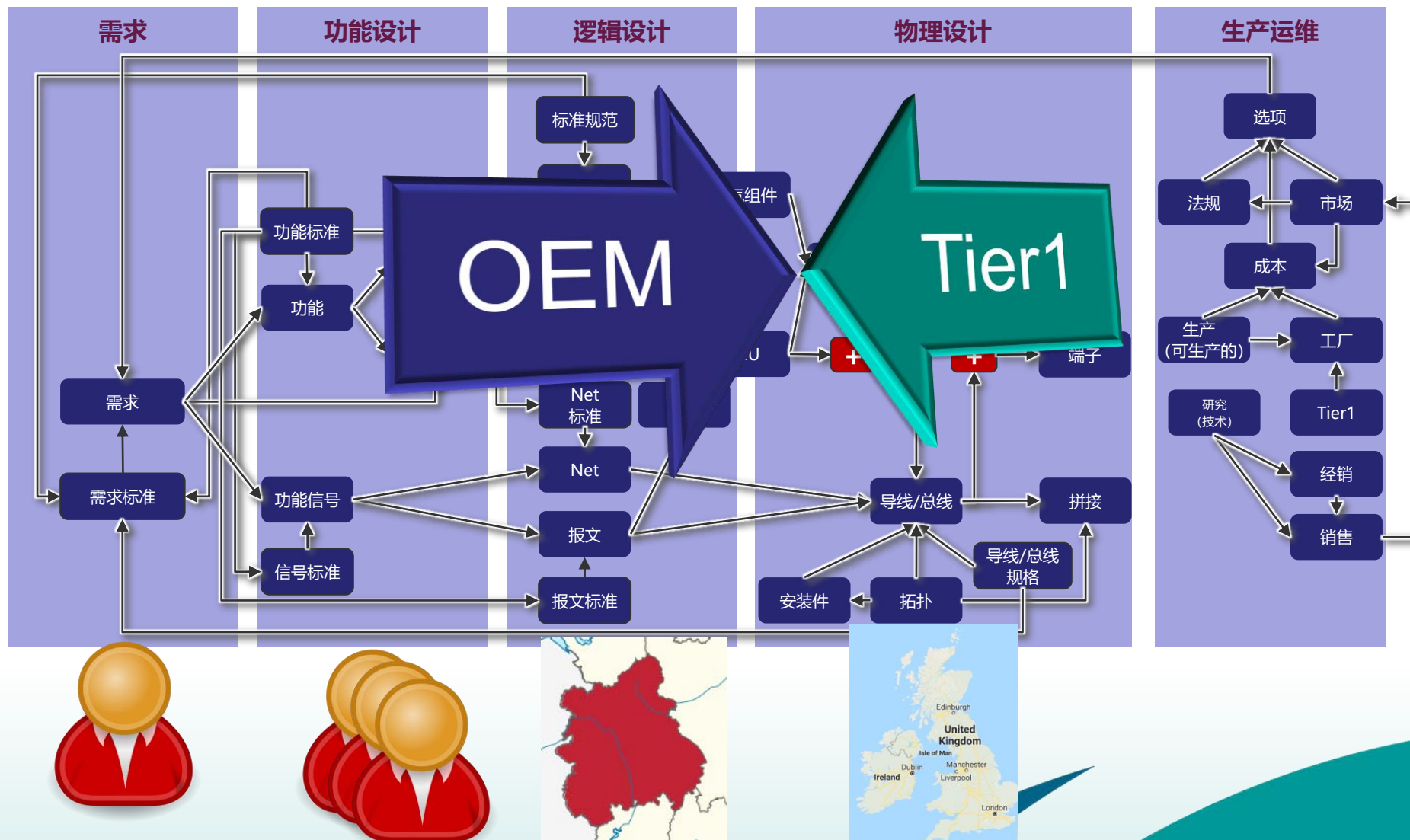
汽车电子电气开发流程及数据交互愈发复杂



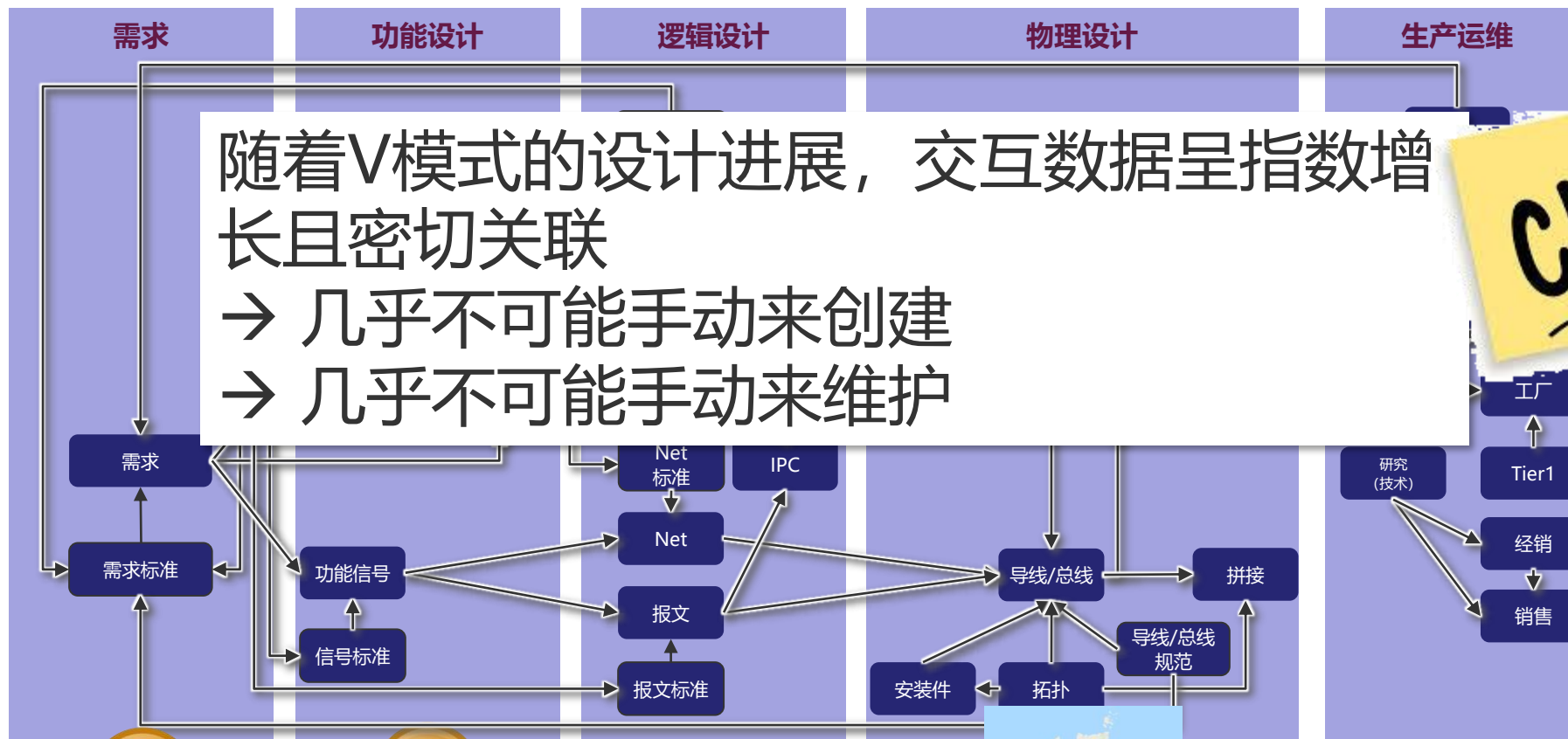
汽车电子电气开发流程及数据交互愈发复杂



汽车电子电气开发流程及数据交互愈发复杂



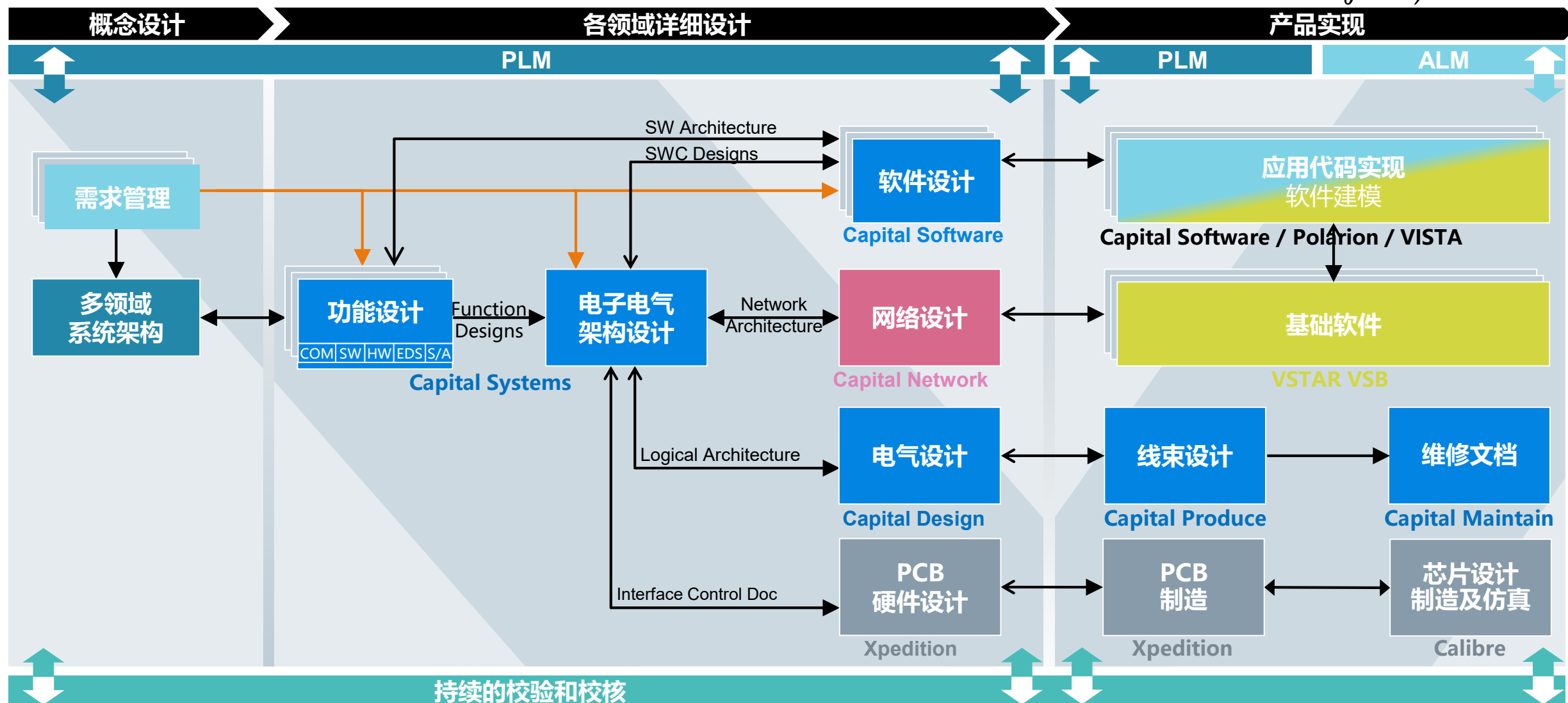
汽车电子电气开发流程及数据交互愈发复杂



基于模型的系统工程 - MBSE 电子电气解决方案

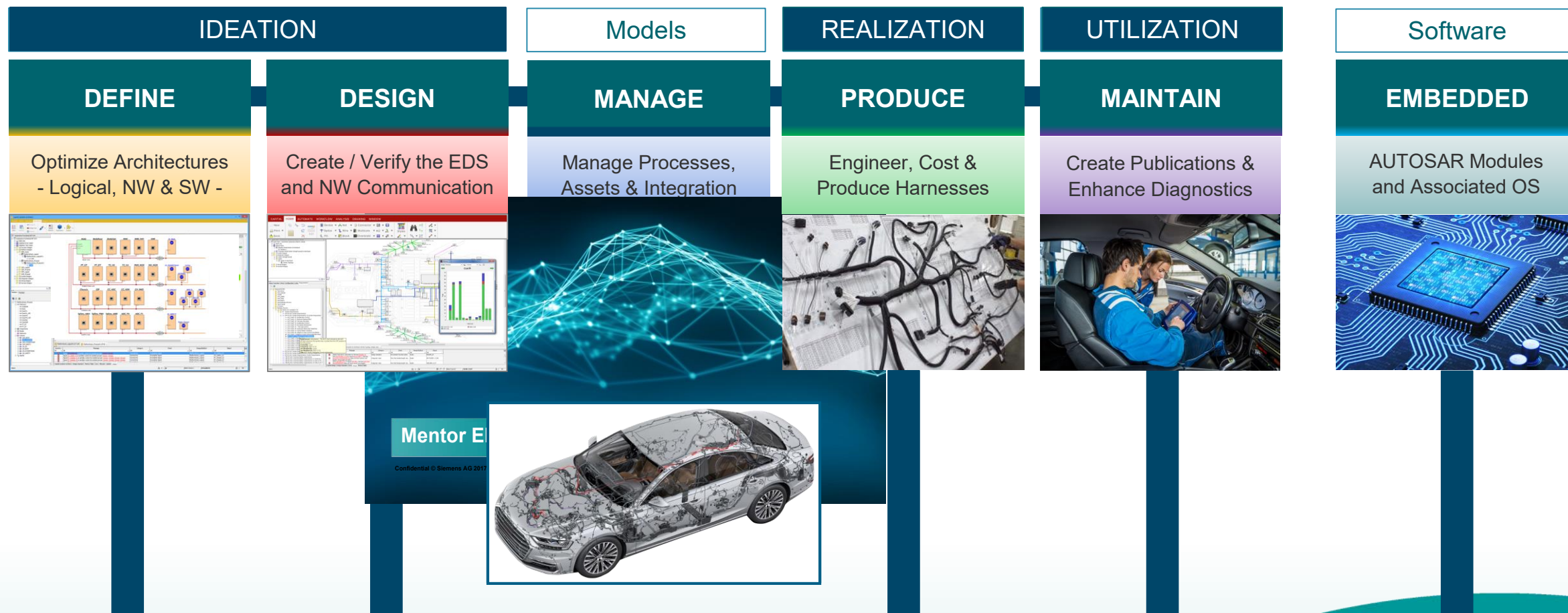
覆盖电子电气, 总线, 软件, 硬件

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基于模型的企业 / 设计自动化

—Capital工具支持整个电子电气设计生命周期



Product Life Cycle Management – Orchestrating Enterprise Wide Collaboration and Innovation Environment

Capital 产品平台三要素

实现基于电气模型的企业



数据一致性

通过规则确保数据正确性，可同步和易管理



跨领域集成

通过使用相邻学科规则创建无缝并易于管理的完整数据流

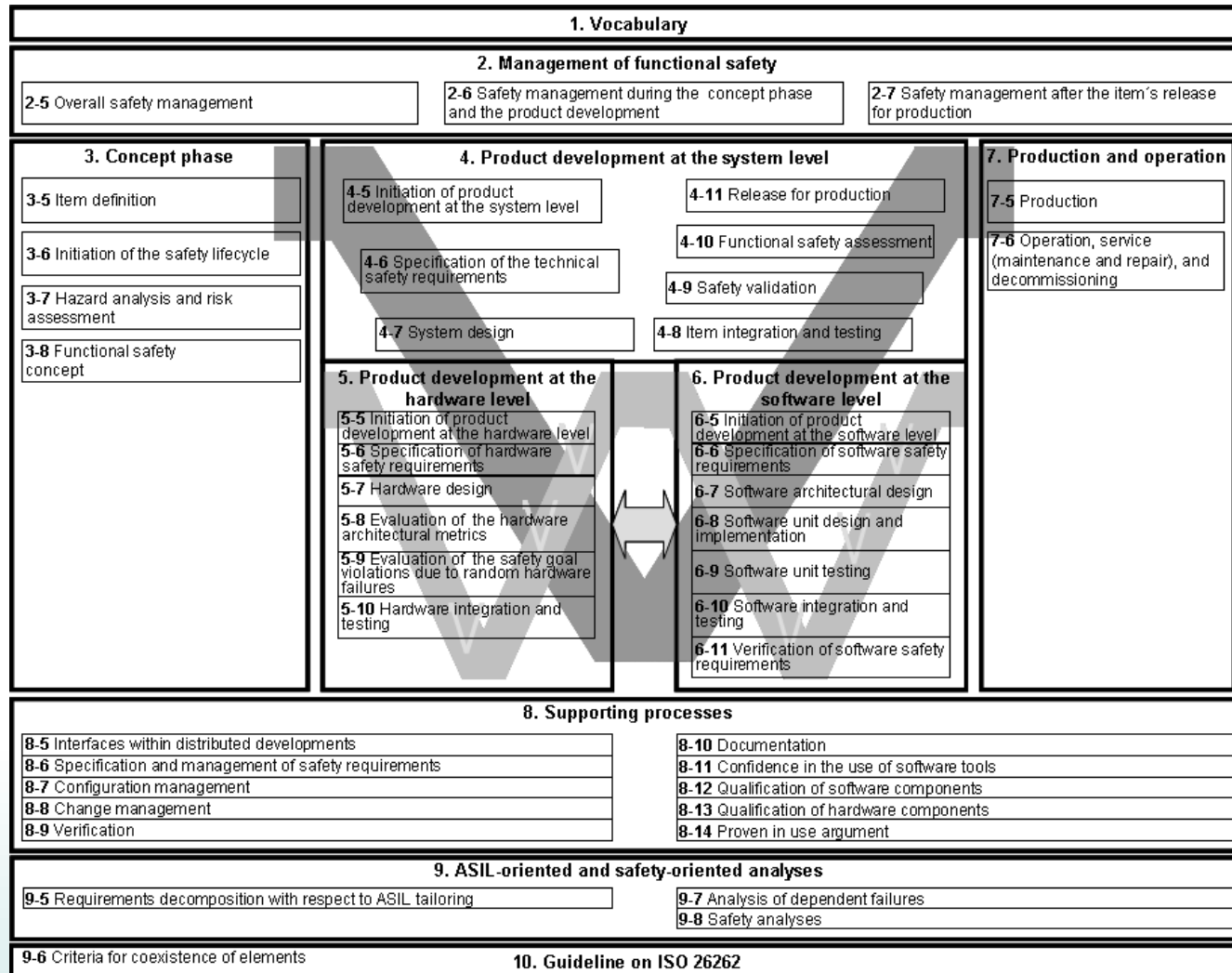


高度自动化

使用基于模型的规则来自动执行复杂任务并验证结果

高度自动化，数据一致性和跨领域集成

ISO 26262 简介

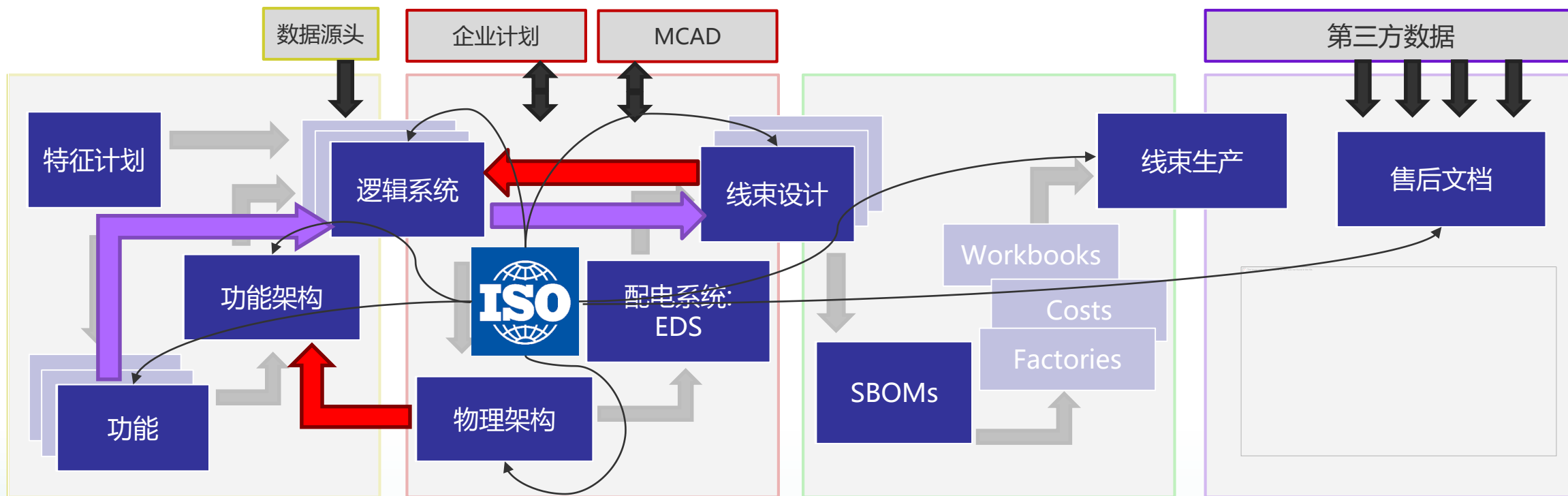


Core processes

1. Vocabulary
2. Management of functional safety
3. Concept phase
4. Product development at the system level
5. Product development at the hardware level
6. Product development at the software level
7. Production and operation
8. Supporting processes
9. Automotive Safety Integrity Level (ASIL)-oriented and safety-oriented analysis
10. Guideline on ISO 26262

功能安全要求对电气设计过程的影响

定义安全要求，设计并验证实施



支持合规性和认证的可追溯性

所有领域和学科都以自然的方式连接并集成到ALM&PLM中



双向可追溯性

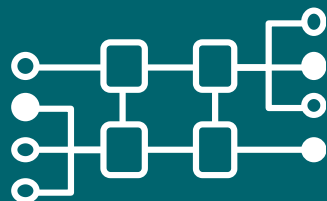
跨领域系统建模

- 系统定义
- 系统建模
- 系统分析
- 资产管理
- 变更管理
- 配置
- workflow
- 工程Viewpoints



E/E架构-功能, 电气, 电子, 软件, 硬件、网络

- 自动化生成
- 输出综合
- 隔离
- 冗余
- DRC
- 指标
- 需求可追溯



软件

- AUTOSAR
- 应用设计
- 行为建模



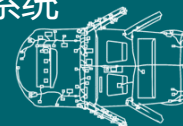
通信

- 防火墙/网关
- 网络设计
- 协议和时间安排
- 保证交付



电气

- 自动化生成
- 原理, 接线和线束系统
- 电气分析
- 制造和服务



ECU 软件实现

- Service 架构
- 网络安全和库,
- 安全的Bootloader, 端到端的保护,
- 端到端加密,
- 看门狗, 诊断



认证

- Fn安全
- 安全性
- 证据



长期

短期

确保自动驾驶系统的数字连续性, 跨领域可追溯性, 安全性和保密性

听起来不错，在电气设计领域如何运作呢？

功能设计

IBM



Rational Quality Manager



Rational Team Concert



Rational DOORS Next Generation



Rational DOORS Web Access



OSLC

Inspired by the web

PREEvision

SysML



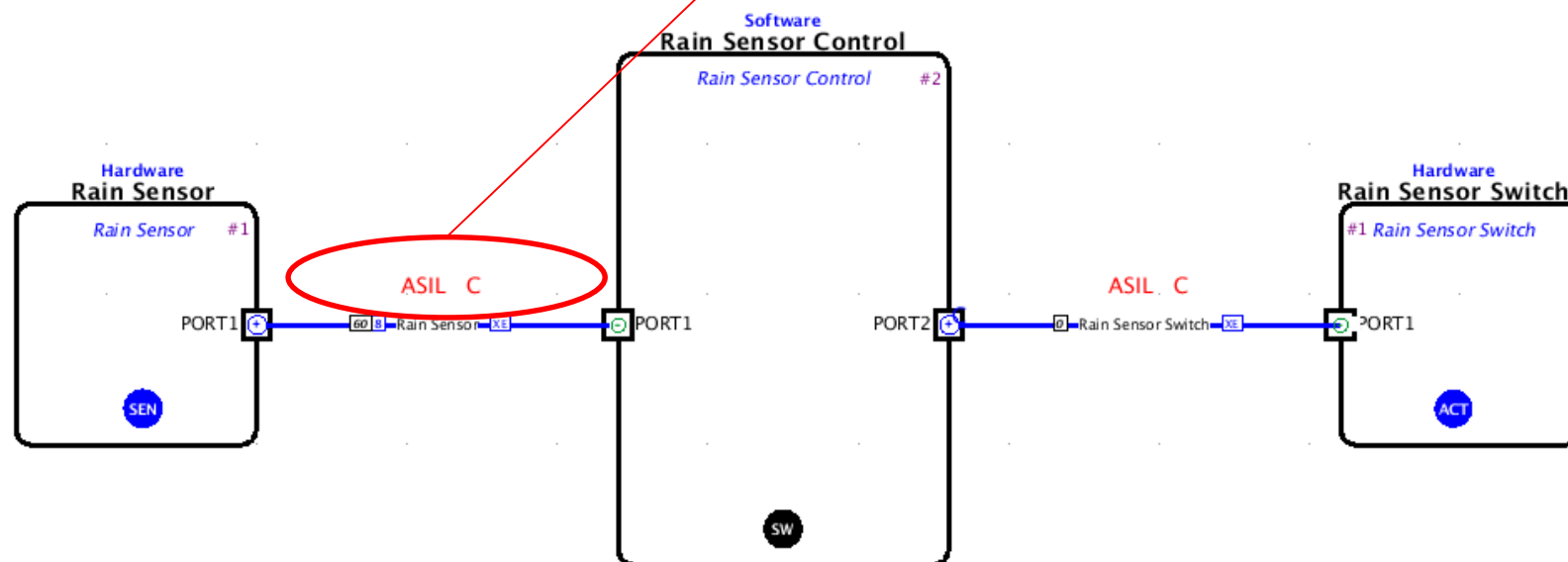
TEAMCENTER

magiedraw

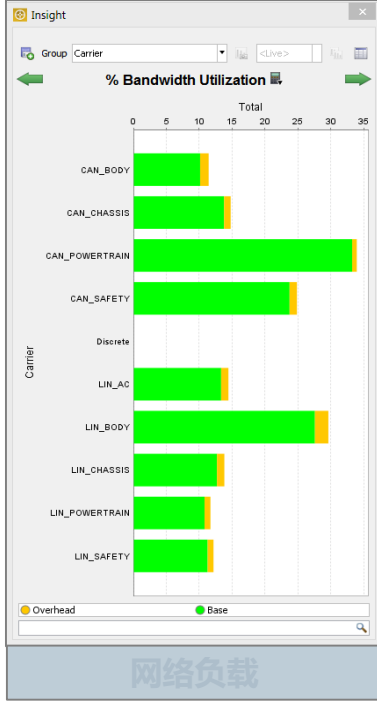
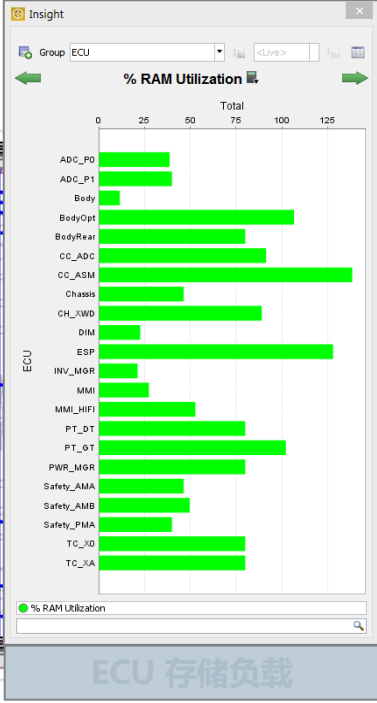
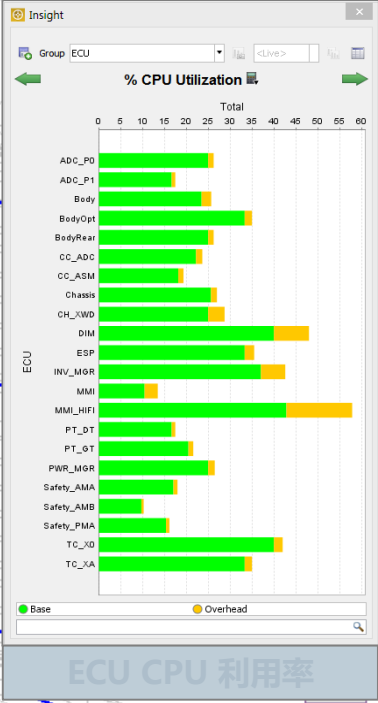
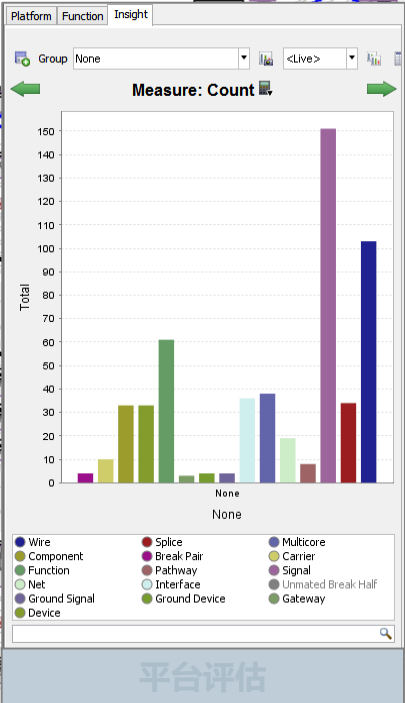
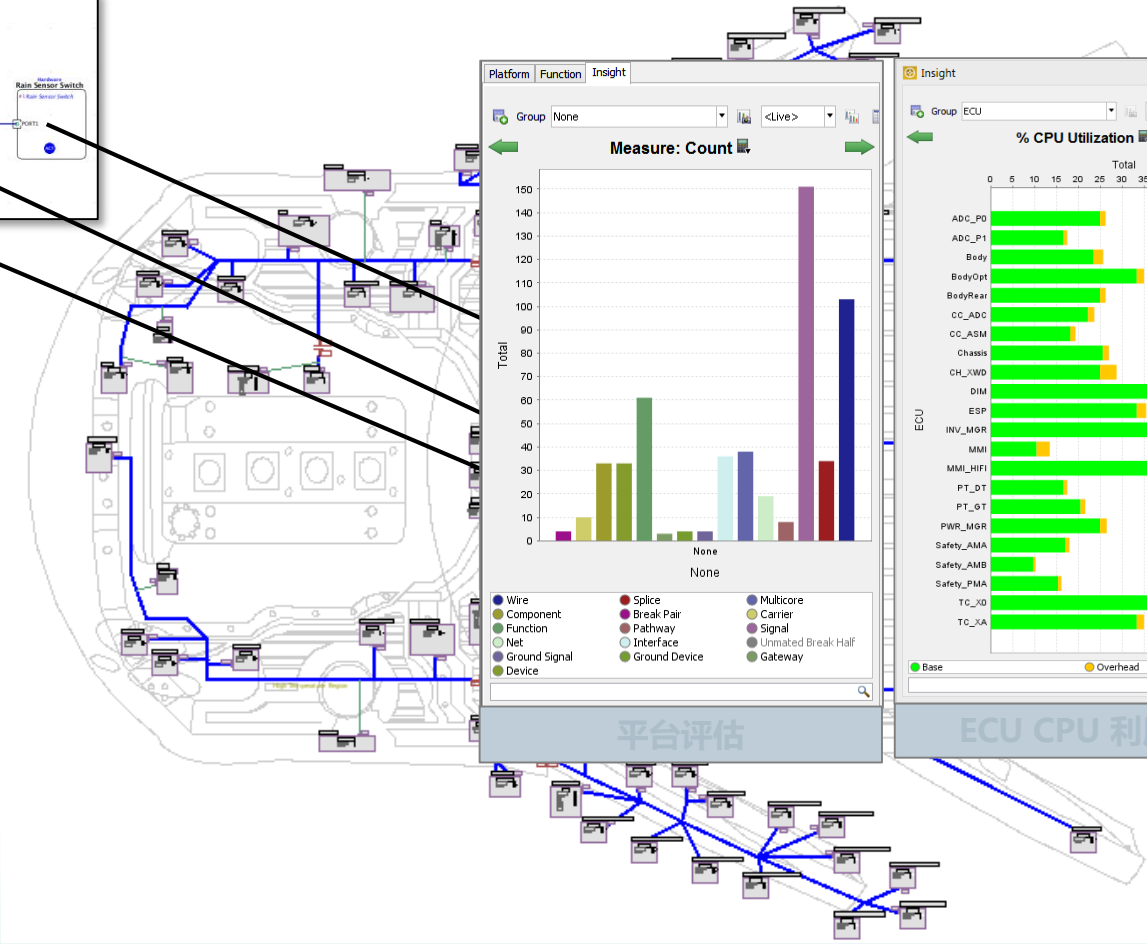
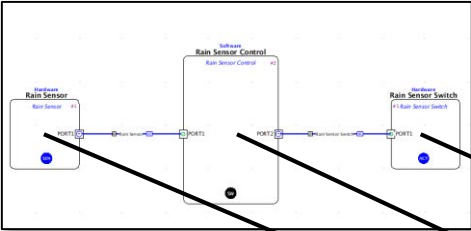
Signal: Rain Sensor

General Graphical Properties

Name	Value	Type	Visible	Attributes
ASIL	C	String	☐	



功能架构 – 功能分配



功能架构 – 为网络分配规范

Edit Design Properties

Properties Rules

✗ Conductor Spec: ASIL is C where Signal matches ASIL = C 继承属性

✗ Conductor Spec: Wire CSA is 0.5 where Signal matches Name = .*

✗ Conductor Spec: Wire CSA is 2.5 where Signal matches ASIL = C

✗ Conductor Spec: Wire Material is TWC where Signal matches ASIL = C 分配规格

✗ Conductor Spec: Wire Specification is 19/41 where Signal matches ASIL = C

规则:

- 传递ASIL属性
- 指定规格

将功能网络转换成逻辑原理图

Conductor: BODY_Rain Sensor 继承属性

Name	Value	Type	Visible	Attributes
ASIL	C	String	☐	

Conductor: BODY_Rain Sensor 指定规格

Name: BODY_Rain Sensor ☐ Fixed ☒

Short Description:

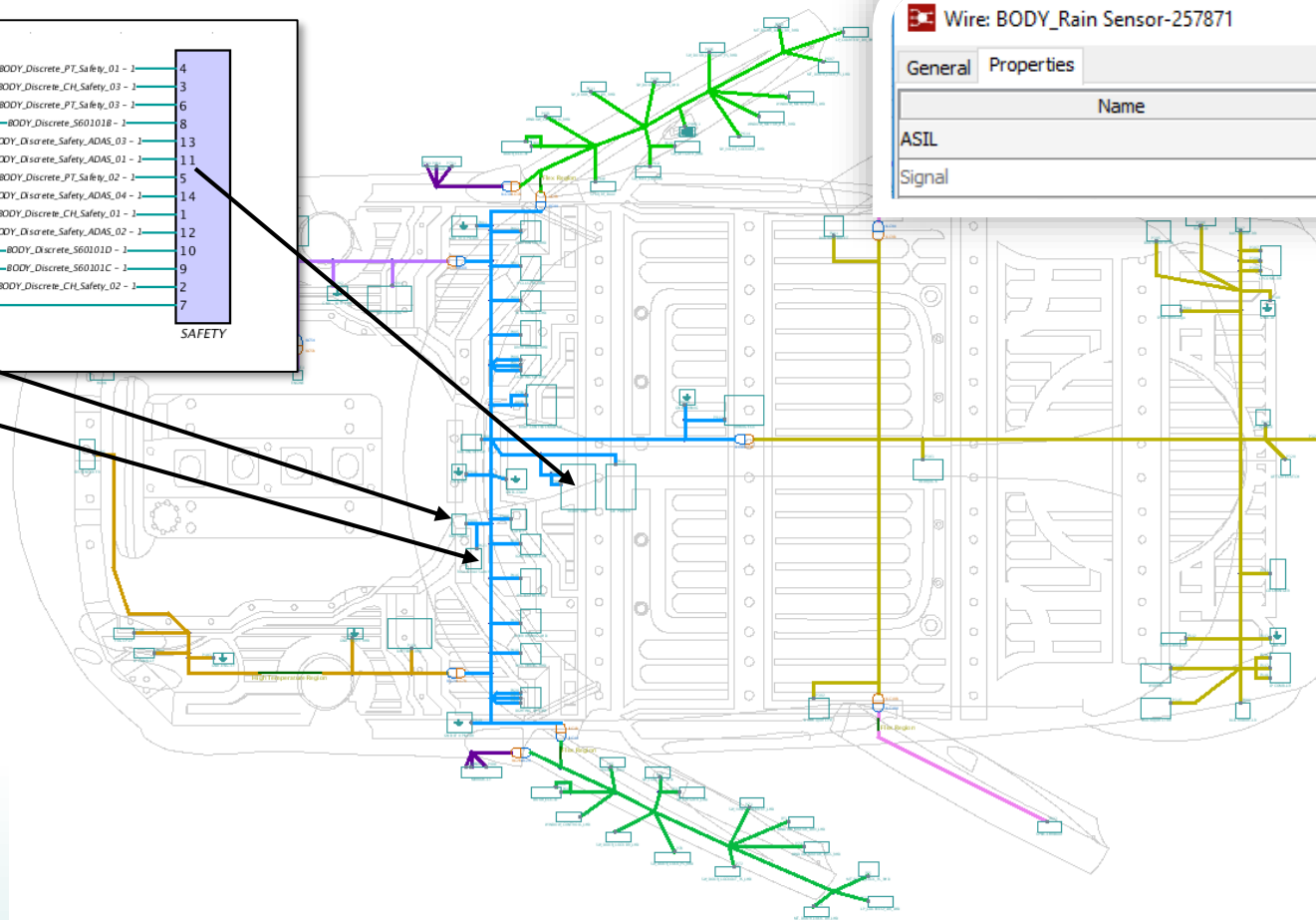
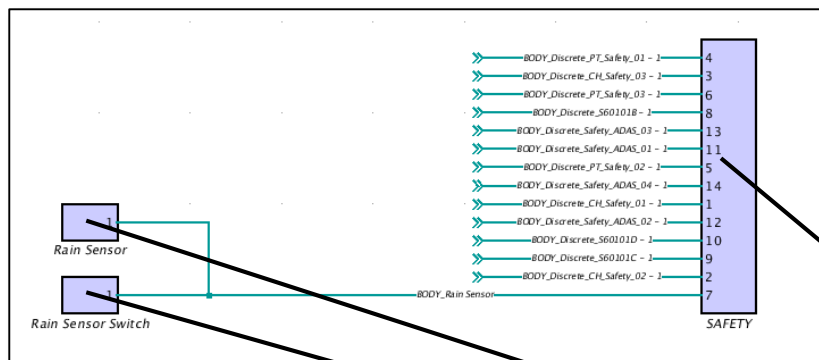
Specification

Color: ☐ Material: TWC ☐

Spec: 19/.41 ☐ CSA: 2.5 ☐



在物理平台上集成逻辑子系统



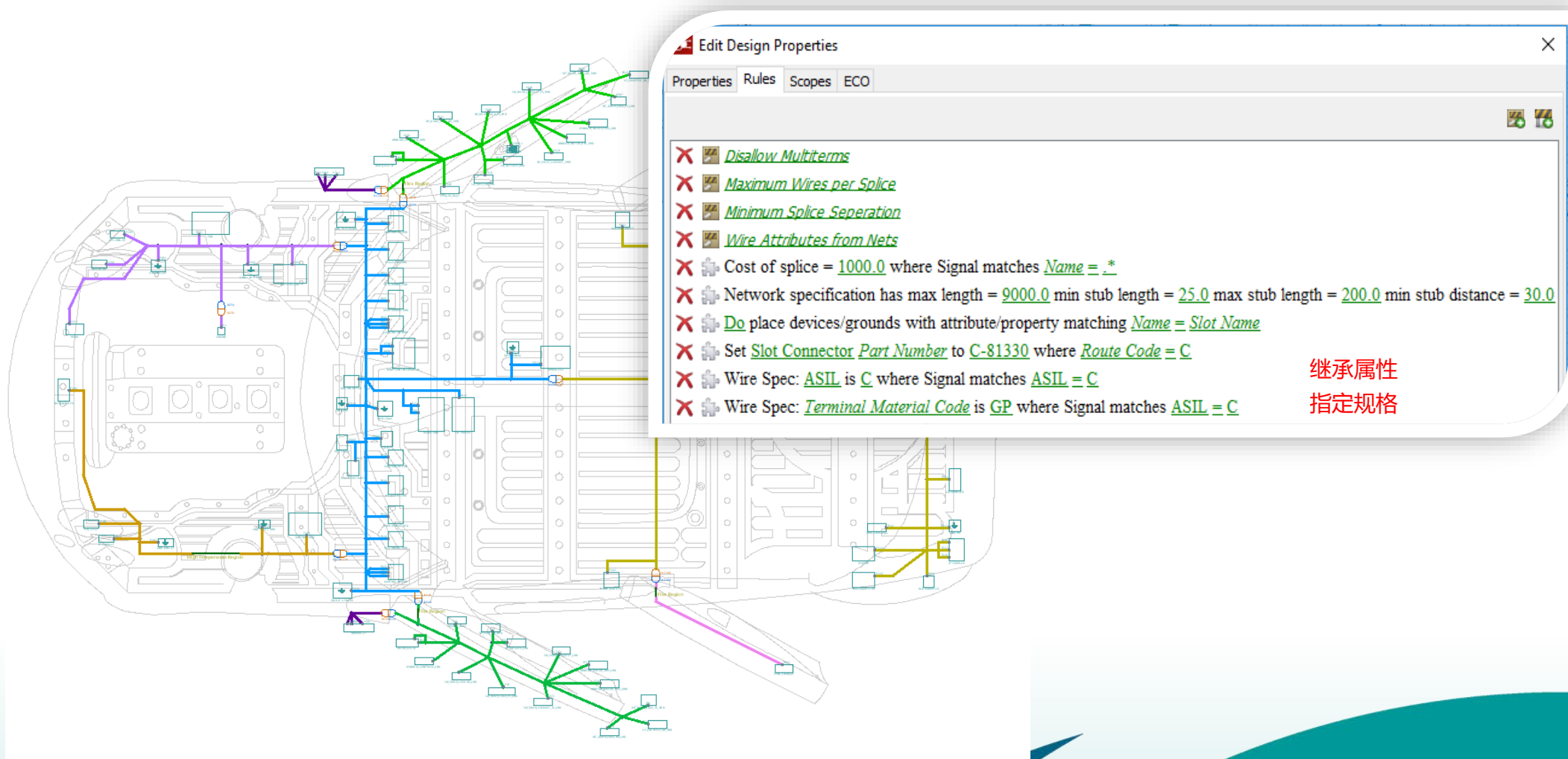
Wire: BODY_Rain Sensor-257871

继承属性

General Properties

Name	Value	Type
ASIL	C	String
Signal	BODY_Rain Sensor	String

在物理平台上集成逻辑子系统



自动导线选择

Wire: BODY_Rain Sensor-257871

General Properties

Name: BODY_Rain Sensor-257871

Short Description:

Specification

Color: Material: TWC

Spec: 19/.41 CSA: 2.5

Library Part

Configuration

Module: Core

Option:

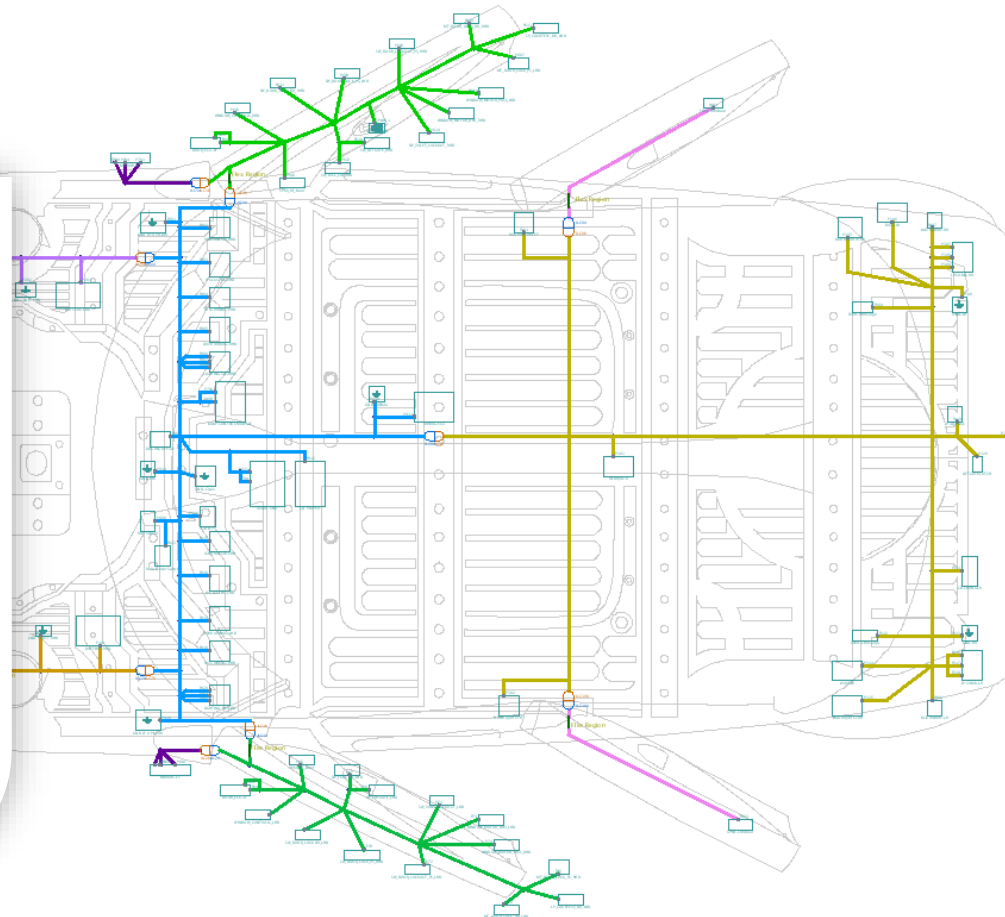
Level: _3Door_LHD1, _3Door_LHD2, _3Door_RHD1, _3Door_RHD2, _3Door_RHD3, _3Door_RHD4, _3Door_RHD5, ...

Attributes

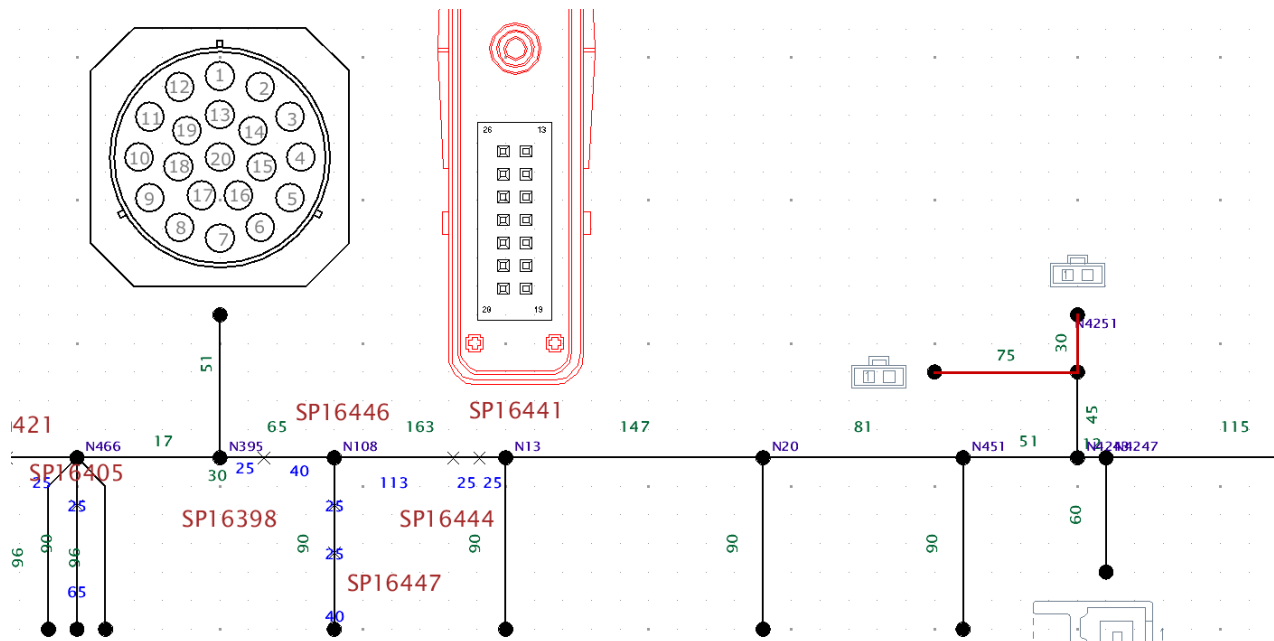
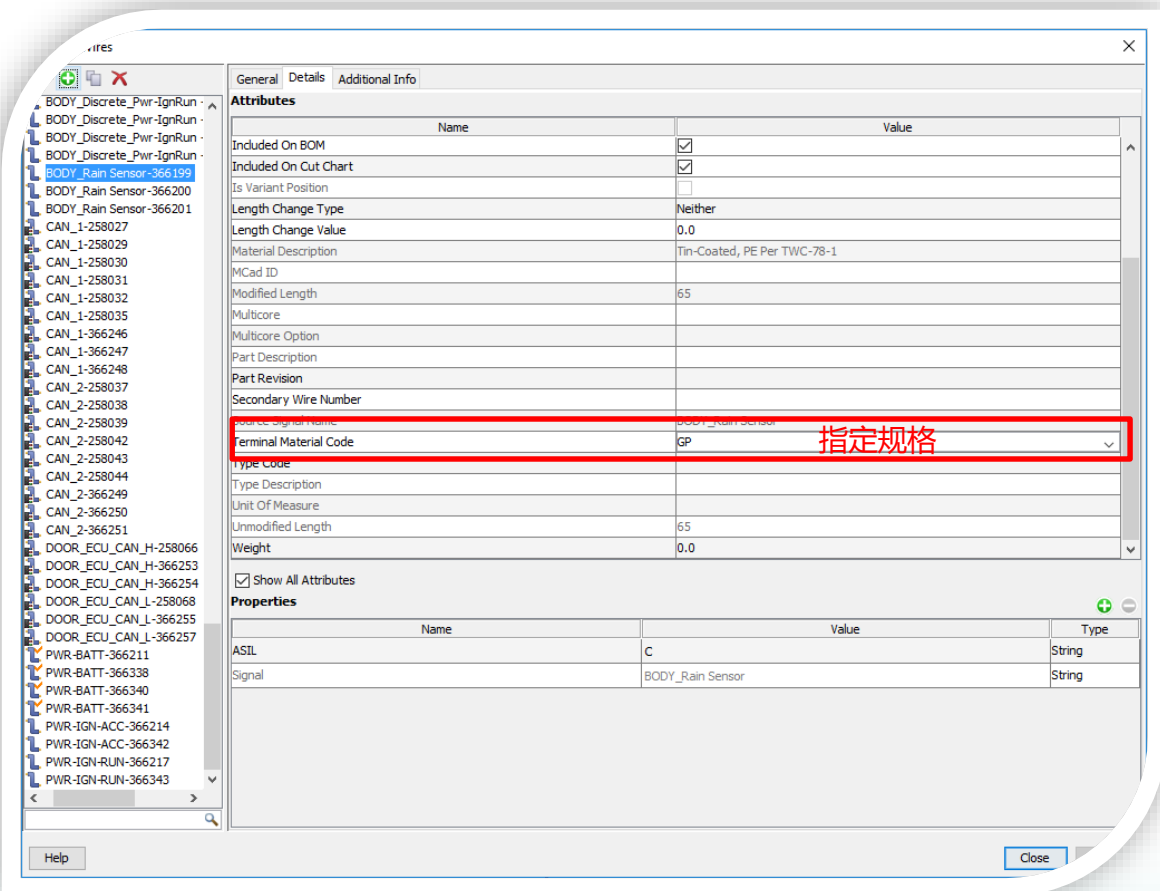
Name	Value
Analysis Model	
Terminal Material Code	GP
Assembly	
BOM ID	

☒ Show All Attributes

Help OK Cancel



在线束上关联端子



关联端子

Cavity Component Management

P899

Name	Value	Cavity	Wire Combinations	T/Mat	Terminal	Seal	...	Extra Components	Backshell Plug	Designs
Backshell Orientation		1								
Backshell Plugged	☐	2	BODY_Rain Sensor-366199	GP	☒ 173633-3					
Backshell Seal Part Number		3								
Backshell Seal Required	☐									
Datum	Default									
Greased	☐									
Keyway Orientation										
Name	P899									
Part Number	12345									
Plugs Required	☐									
Sealed	☐									
Terminal Material Driver										

自动端子选择

Help OK Cancel Appl

关联端子 – 手动覆盖

Select Part

housing Definitions

Matching Wire Specifications

Part	Revision	Cavity	Factor	Material	Description
12048074			0	TP	Tin plated sea...
173633-3			0	GP	Gold plated so...

如果端子被手动更改...

Non-Matching Wire Specifications

Part	Revision	Cavity	Factor	Material	Description
------	----------	--------	--------	----------	-------------

Add

Help OK Cancel

Information

Results

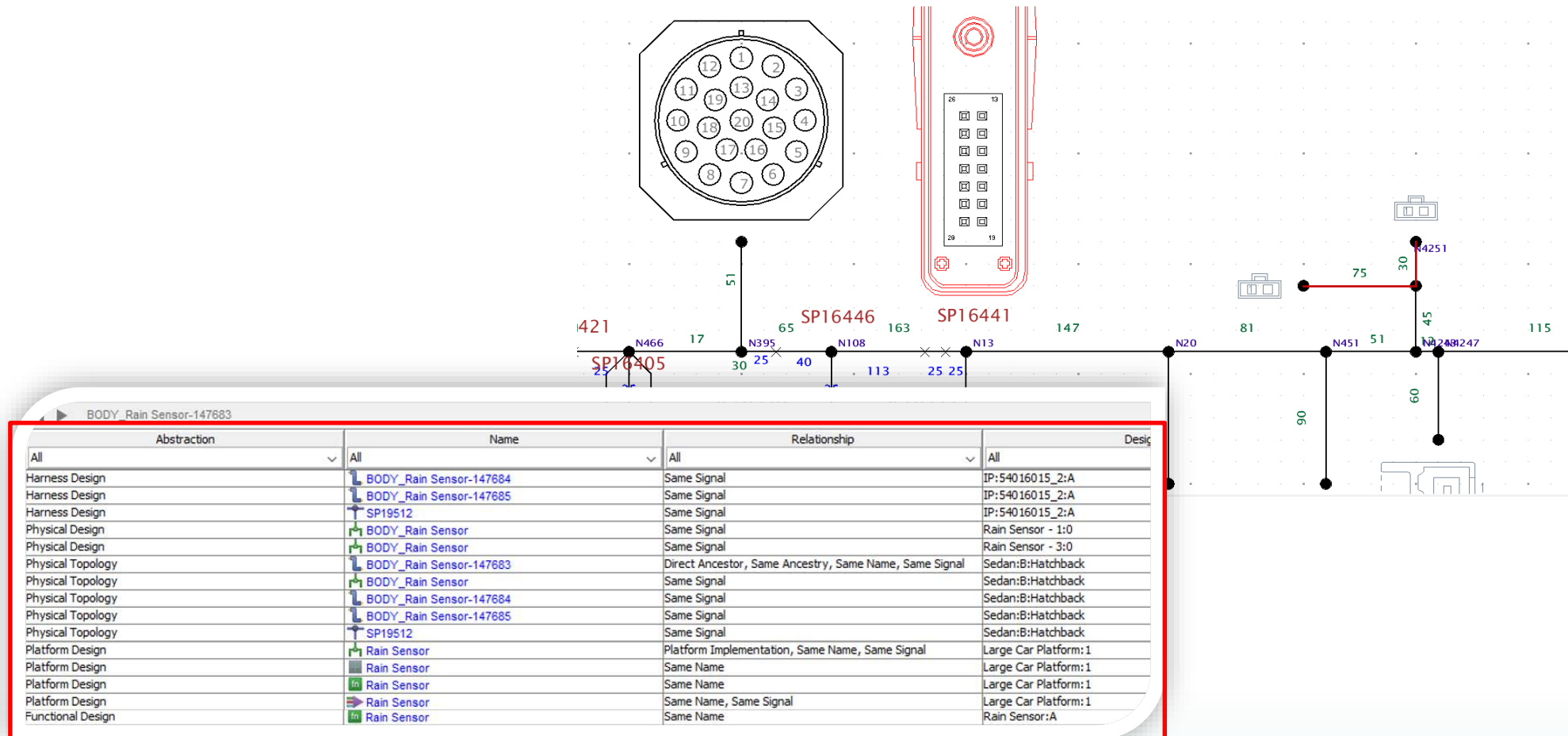
[Warning] Wire BODY_Rain Sensor-366199 Connector P899 Connector Cavity 2 Inappropriate Terminal Material for wire

... 将会发出警告

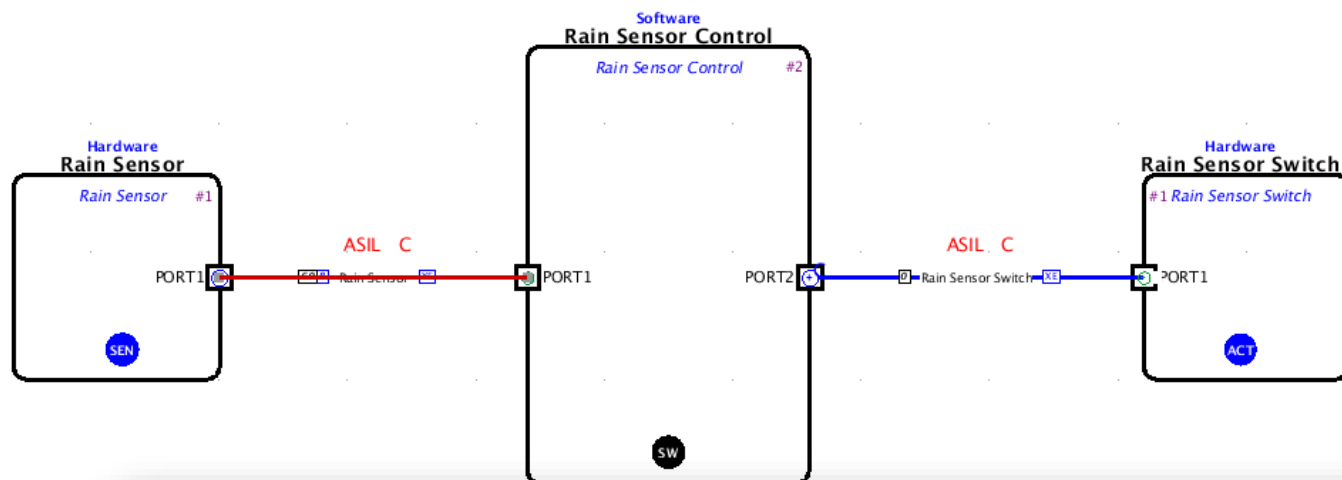
OK

OK Cancel Appl

追溯关联 - 从线束到功能



追溯关联 -- 从功能到线束

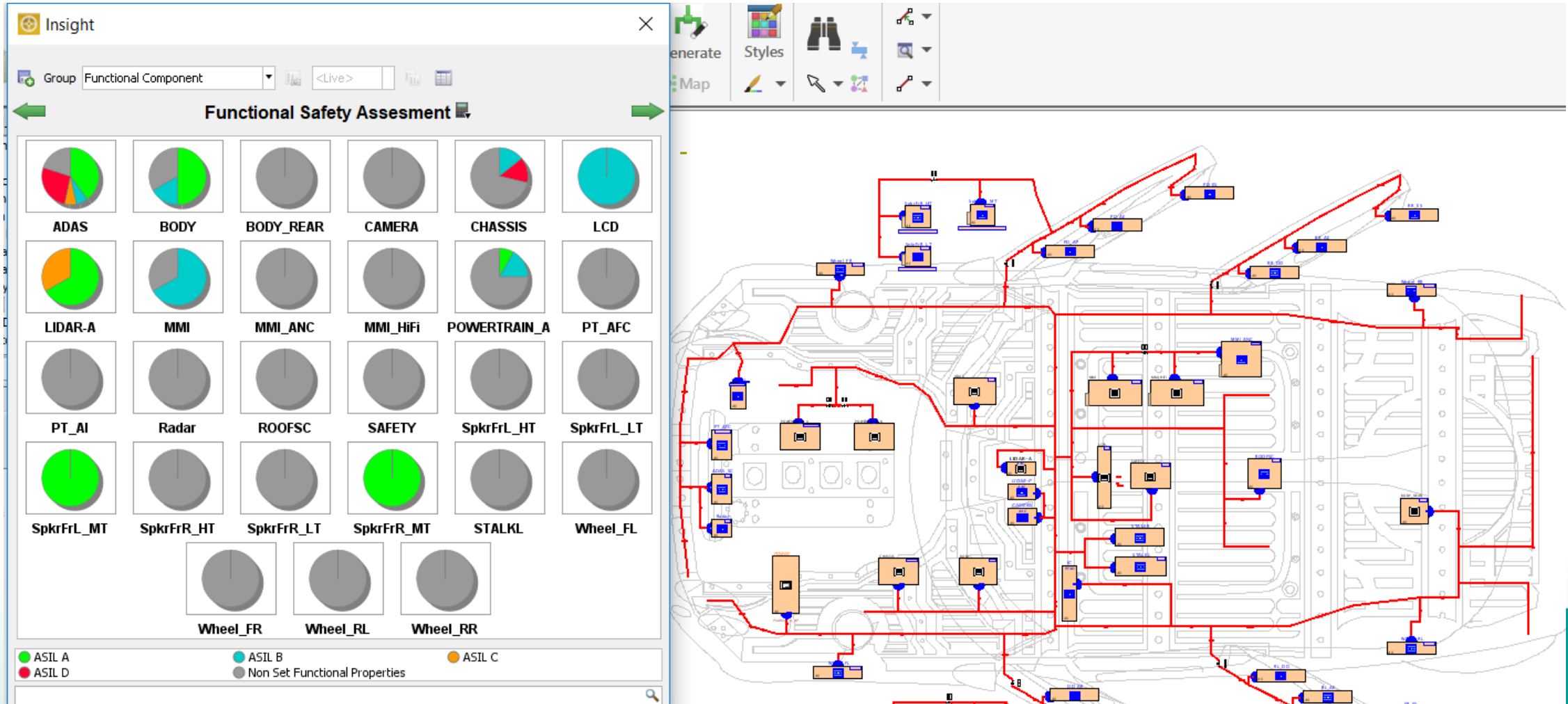


Rain Sensor:A:Rain Sensor

Rain Sensor

Abstraction	Name	Relationship	Design
All	All	All	All
Functional Design	Rain Sensor	Same Name	Rain Sensor:A
Physical Design	Rain Sensor	Same Name	Rain Sensor - 1:0
Physical Design	Rain Sensor	Same Name	Rain Sensor - 3:0
Physical Design	BODY_Rain Sensor	Same Signal	Rain Sensor - 3:0
Physical Topology	Rain Sensor	Same Name	Sedan:B:Hatchback
Physical Topology	Rain Sensor	Same Name	Sedan:B:Hatchback
Platform Design	Rain Sensor	Platform Implementation, Same Name, Same Signal	Large Car Platform:1
Platform Design	Rain Sensor	Same Name	Large Car Platform:1
Platform Design	Rain Sensor	Same Name	Large Car Platform:1
Platform Design	Rain Sensor	Same Name, Same Signal	Large Car Platform:1

ASIL 评估



结论

功能安全增加了电子电气设计的复杂度

- ❑ 处理这一复杂问题需要自动化设计及正确的实施方法
 - 基于规则进行自上而下的转换
 - 需求的自动应用
 - 设计输出的自动生成和维护

Capital支持实现

- ❑ 双向溯源
- ❑ 实施验证
- ❑ 在提交前分析变更影响
- ❑ 生成指标和报告
- ❑ 维护跨领域的数据一致性



Thanks A Lot!