MATLAB EXPO

中国

2024年5月28日

面向数字化工程的基于模型的设计：影响和方向

Richard Rovner

MathWorks

应用趋势

自主化

互联性

电气化

应用趋势

自主化

互联性

电气化

工作流趋势

系统工程
与设计

现代
软件实践

AI 在
系统开发中的应用

应用趋势

自主化

互联性

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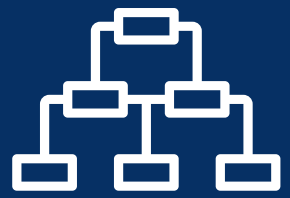
工作流趋势

系统工程
与设计

现代
软件实践

AI 在
系统开发中的应用

工作流趋势

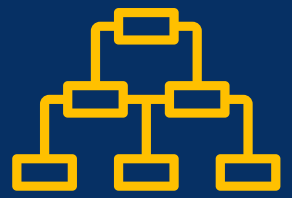


1. 全面实现自动化
2. 扩展到复杂系统
3. 利用自动代码生成
4. 尽早预防缺陷

5. 应用标准软件工作流
6. 在云端设计和仿真

7. 利用 AI 设计系统

工作流趋势



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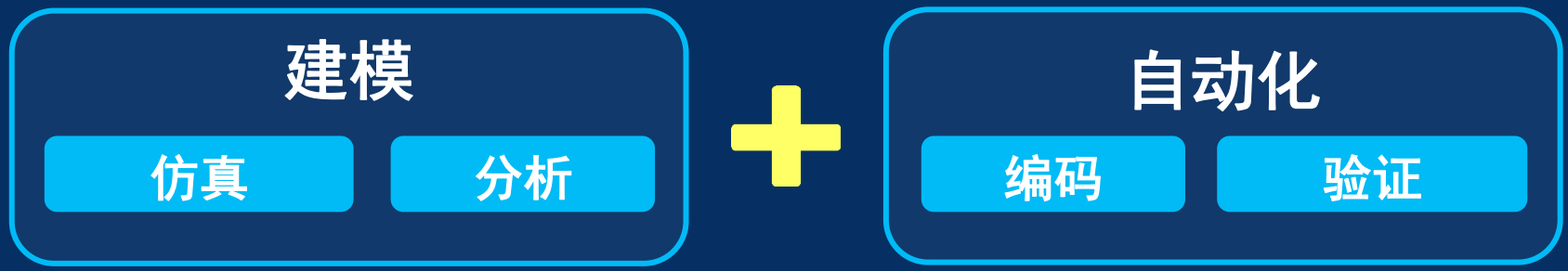
① 全面实现自动化



① 全面实现自动化

建模

仿真　分析

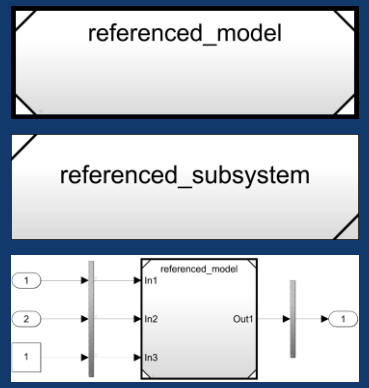
自动化

编码　验证

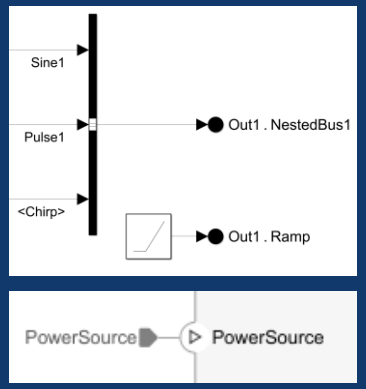
基于机理建模的医疗手术机器人设计与开发

杨量景，浙江大学

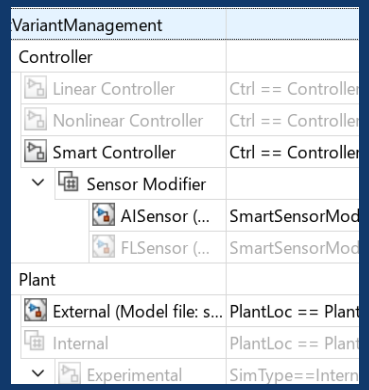
② 扩展到复杂系统



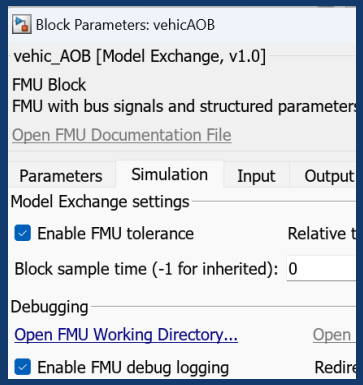
组件



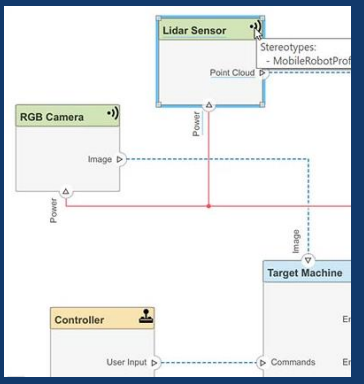
总线、端口和连接器



变体管理器

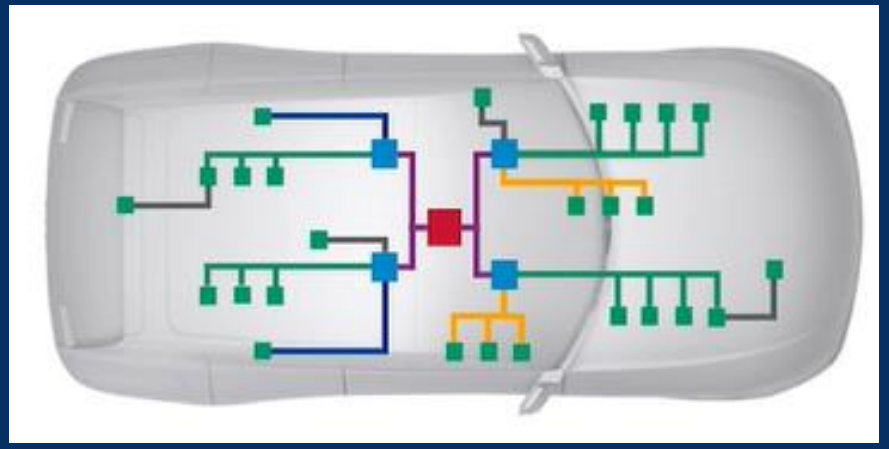


第三方工具集成

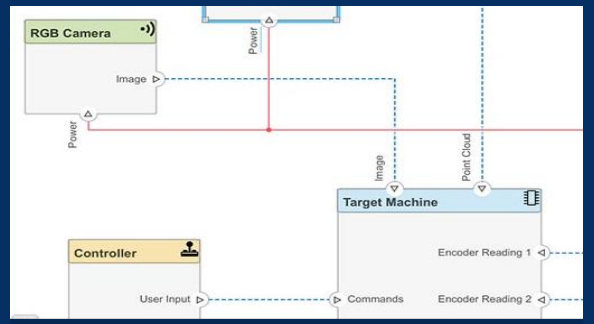


架构

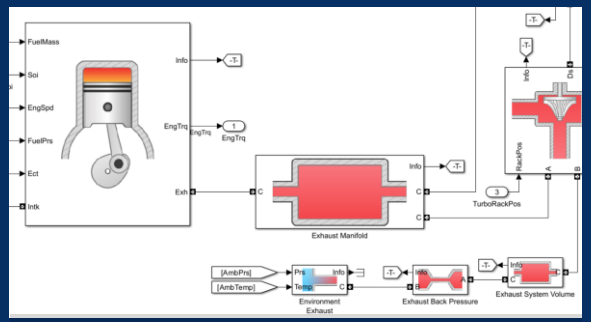
② 扩展到复杂系统



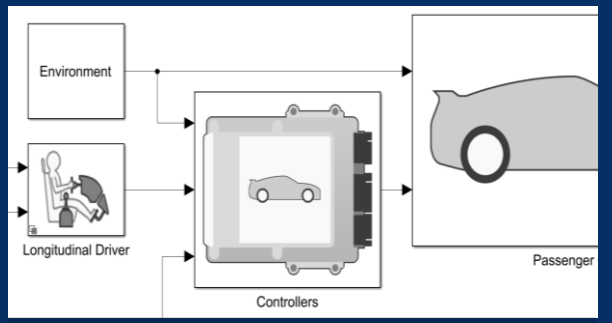
面向服务的架构



System Composer



组件

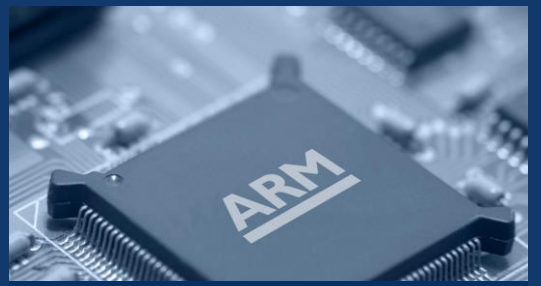


完整系统

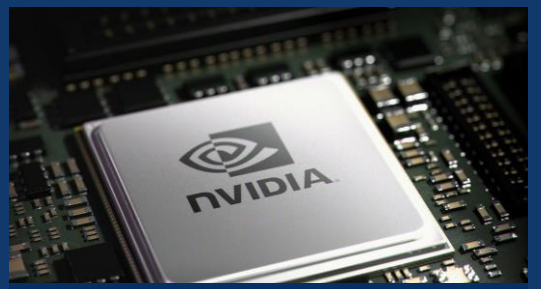
③ 利用自动代码生成

3700

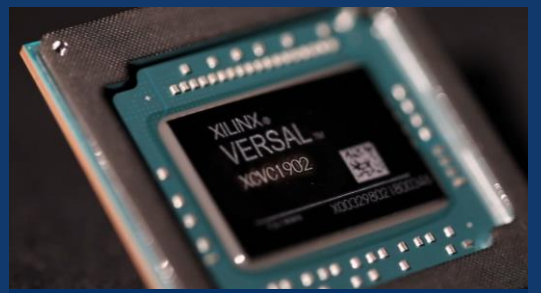
家公司利用
自动代码生成



CPU

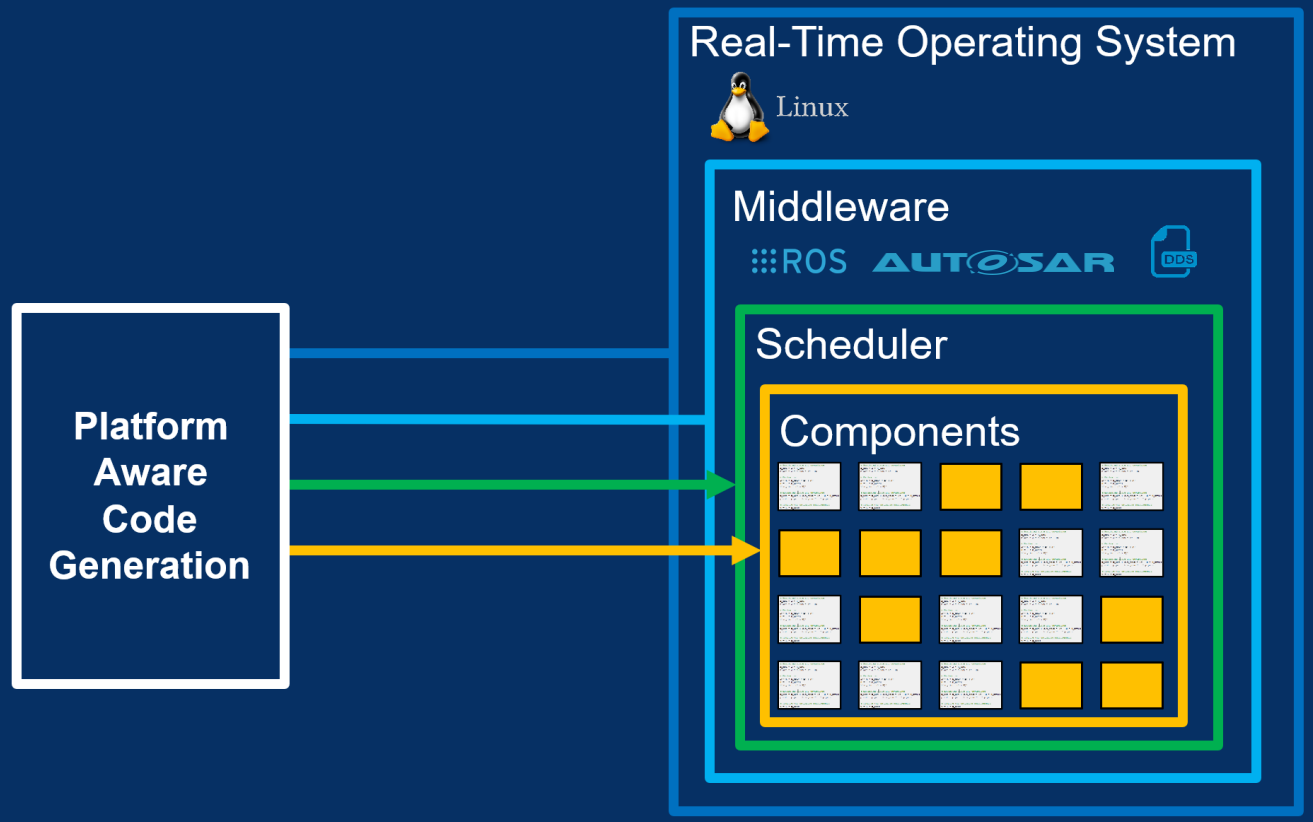


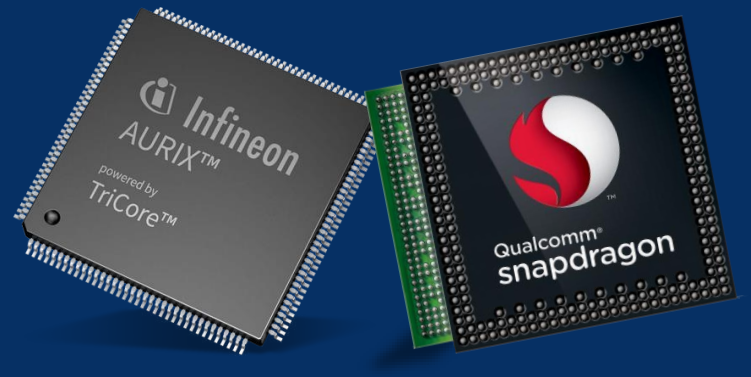
GPU



FPGA、ASIC、PLC

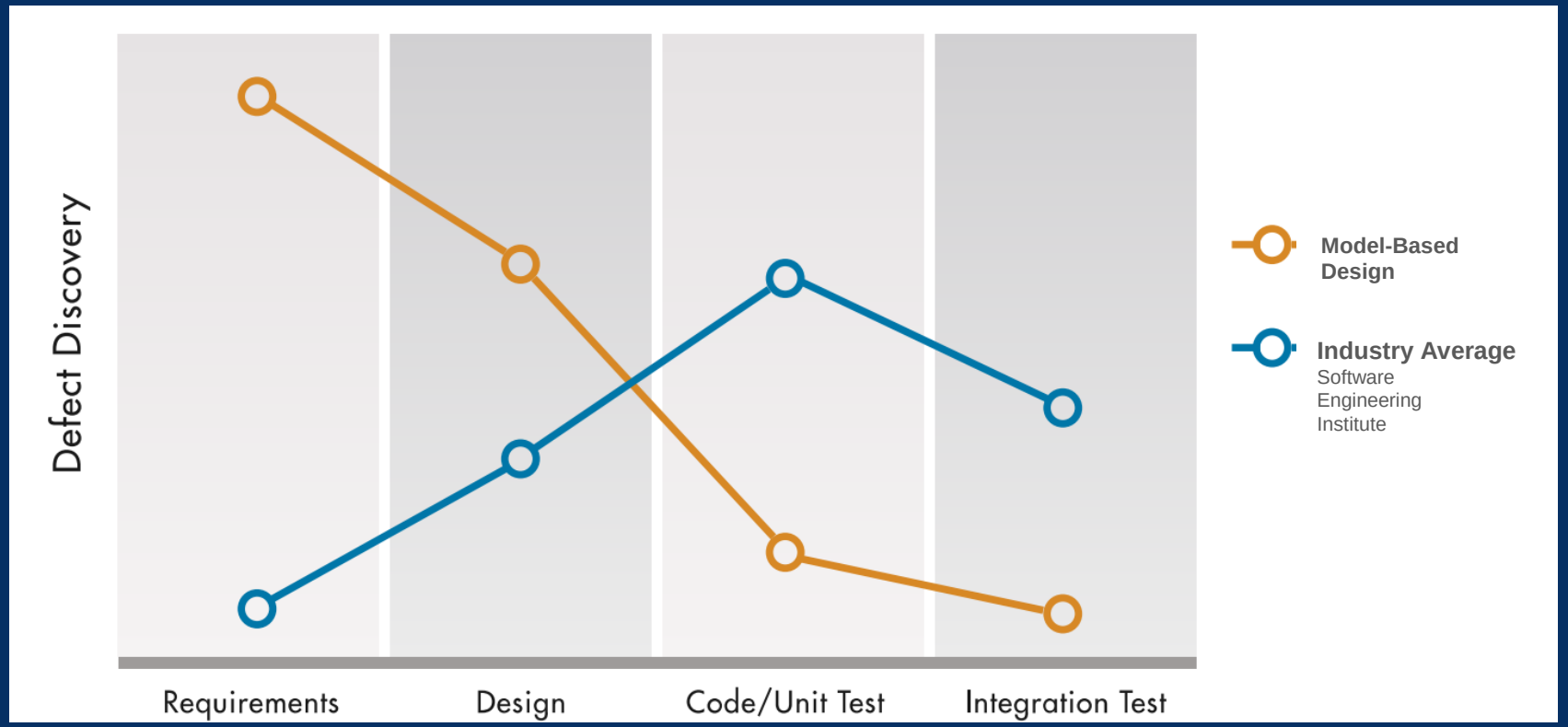
③ 利用自动代码生成


Real-Time Operating System
Linux
Middleware
ROS
AUTOSAR
DDS
Scheduler
Components
Platform Aware Code Generation


Infineon
AURIX™
powered by
TriCore™
Qualcomm
snapdragon


Infineon
All
Search
Newsletter
Products
Applications
Design Support
Community
About Infineon
Careers
Press
General Information
Press Releases
Market News
Press Kits
Media Pool
Events
Contacts
› Home
› About Infineon
› Press
› Market News
MathWorks Simulink products now support Infineon's latest AURIX™ TC4x family of automotive microcontrollers

④ 尽早预防缺陷


Defect Discovery
Requirements
Design
Code/Unit Test
Integration Test
Model-Based Design
Industry Average
Software Engineering Institute

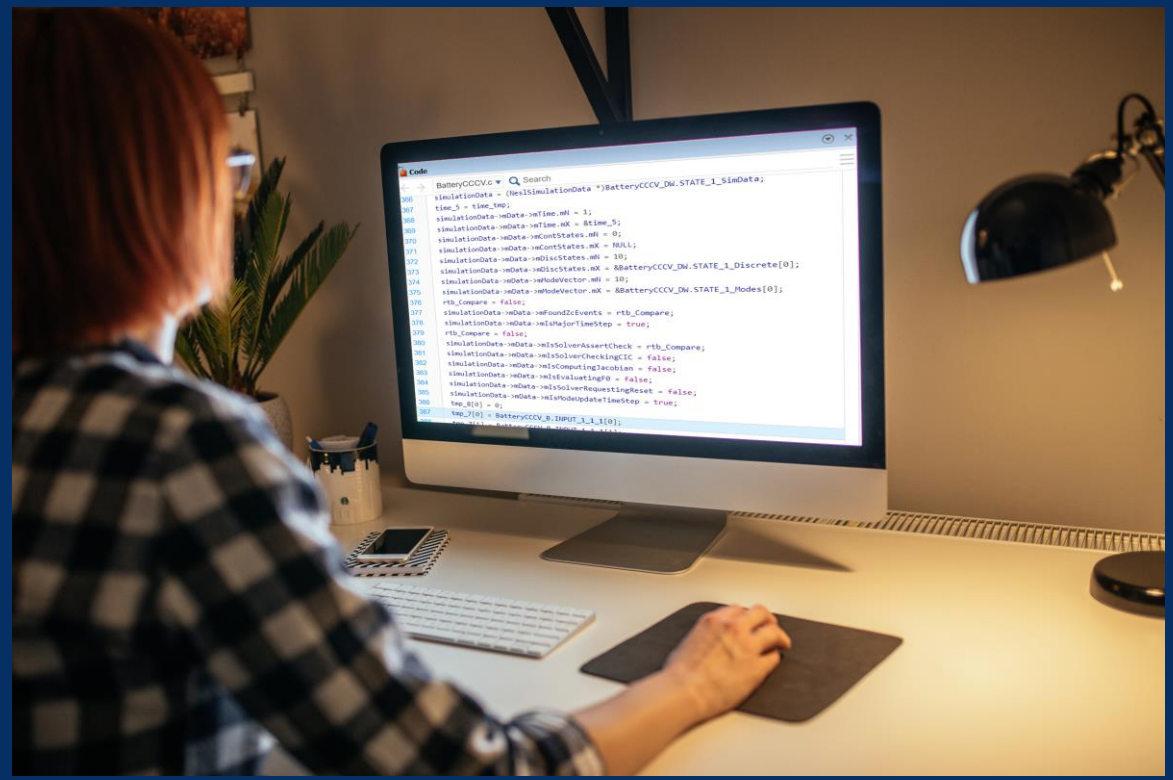
④ 尽早预防缺陷

尽早发现缺陷

设计	测试	编码	认证
Simulink Design Verifier	Simulink Test	Polyspace Bug Finder	DO Qualification Kit
Simulink Check	Simulink Coverage	Polyspace Code Prover	IEC Certification Kit
HDL Verifier	MATLAB Test	Polyspace Access	Simulink Code Inspector
Simulink Fault Analyzer	Polyspace Test		

利用基于模型的设计对电池管理系统软件进行UL认证

Saft Flex’ion Gen2



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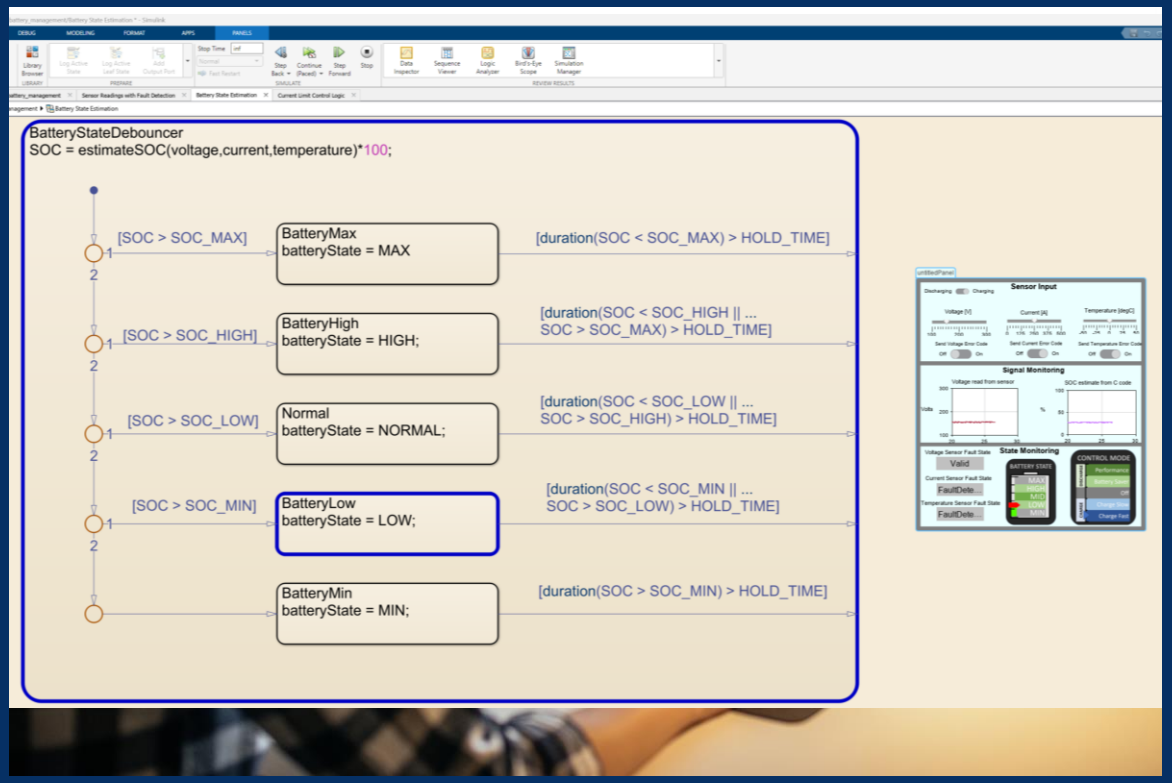

利用基于模型的设计对电池管理系统软件进行UL认证

Saft Flex’ ion Gen2

应用趋势

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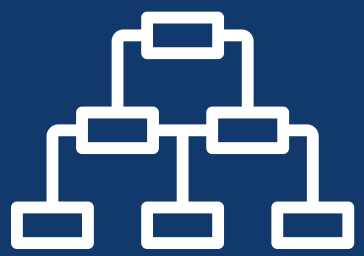
互联性

电气化

工作流趋势



系统工程
与设计

现代
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AI 在
系统开发中的应用

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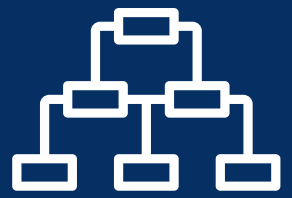

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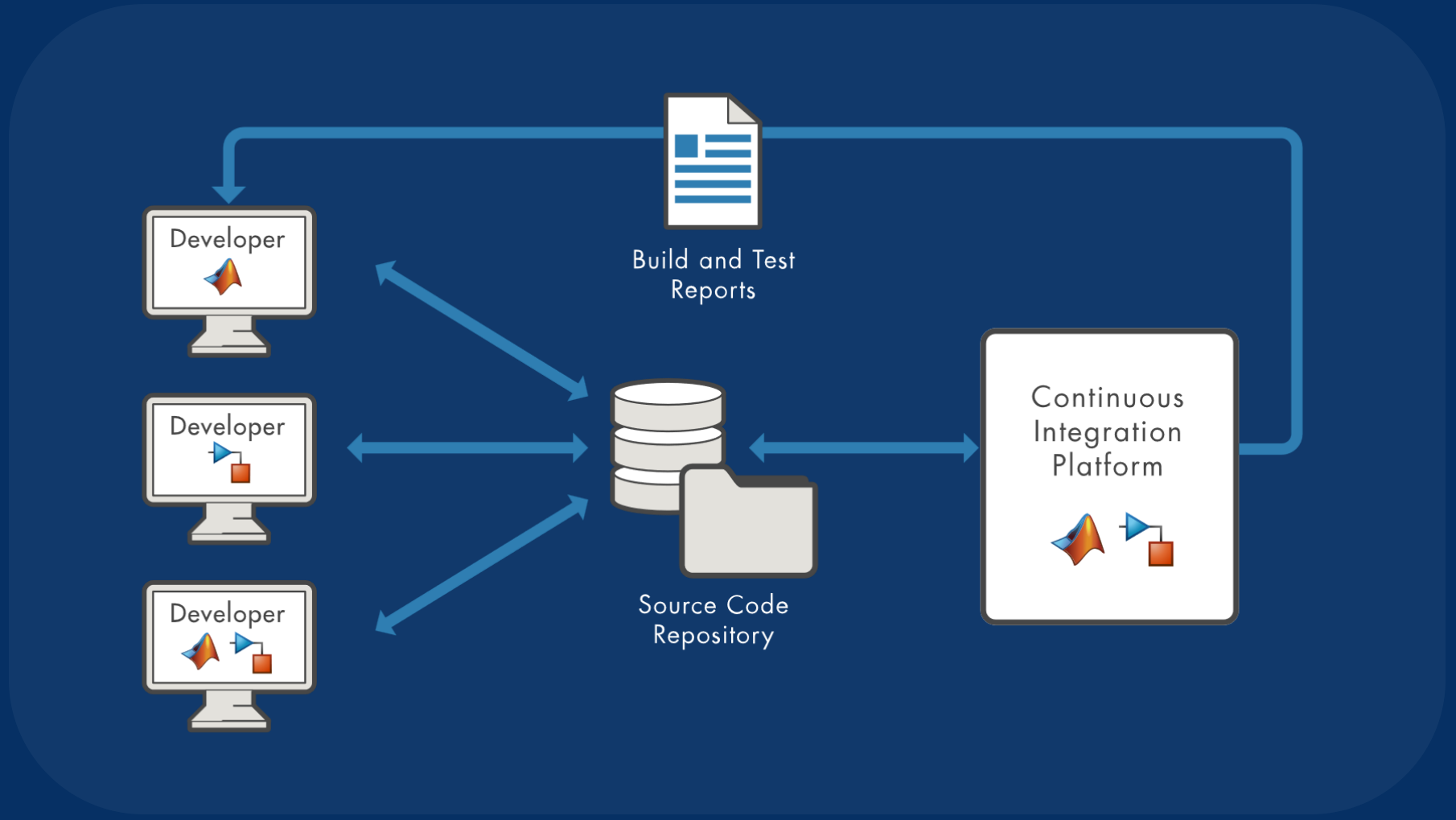
5 应用标准软件工作流

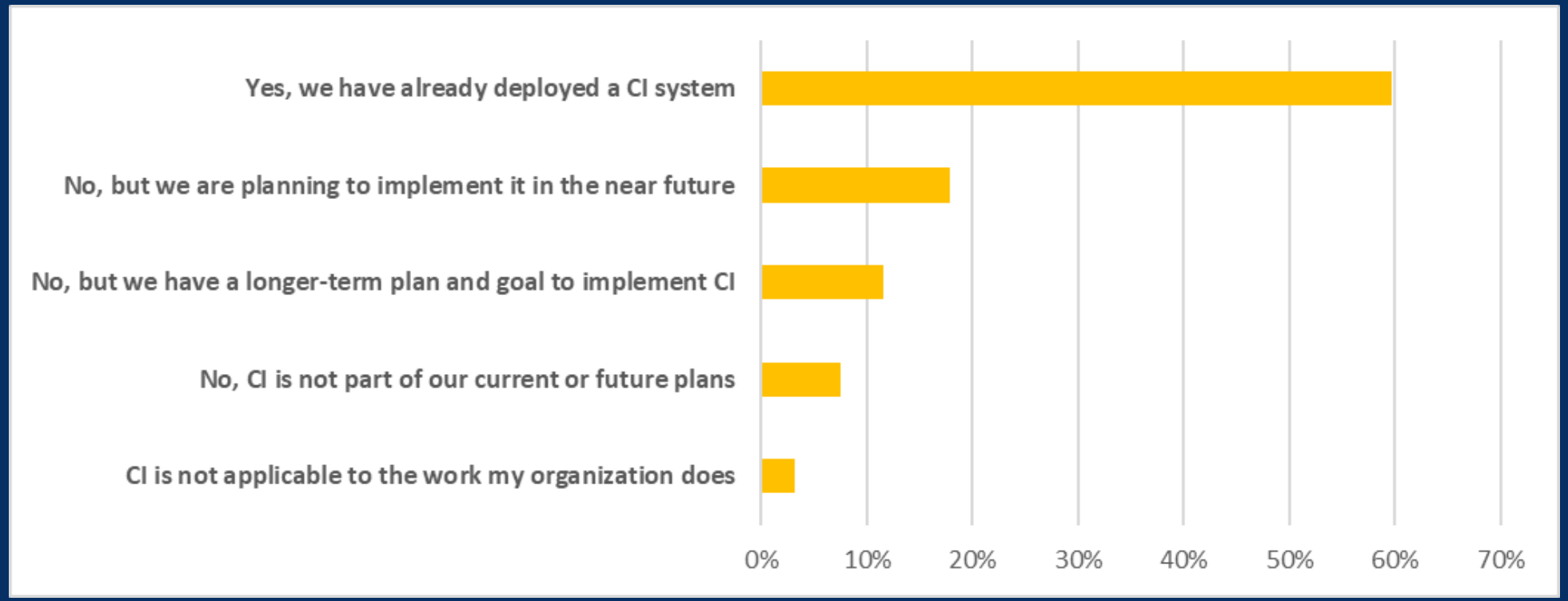
“软件是自动化的语言。”

–黄仁勋， NVIDIA 公司联合创始人兼首席执行官

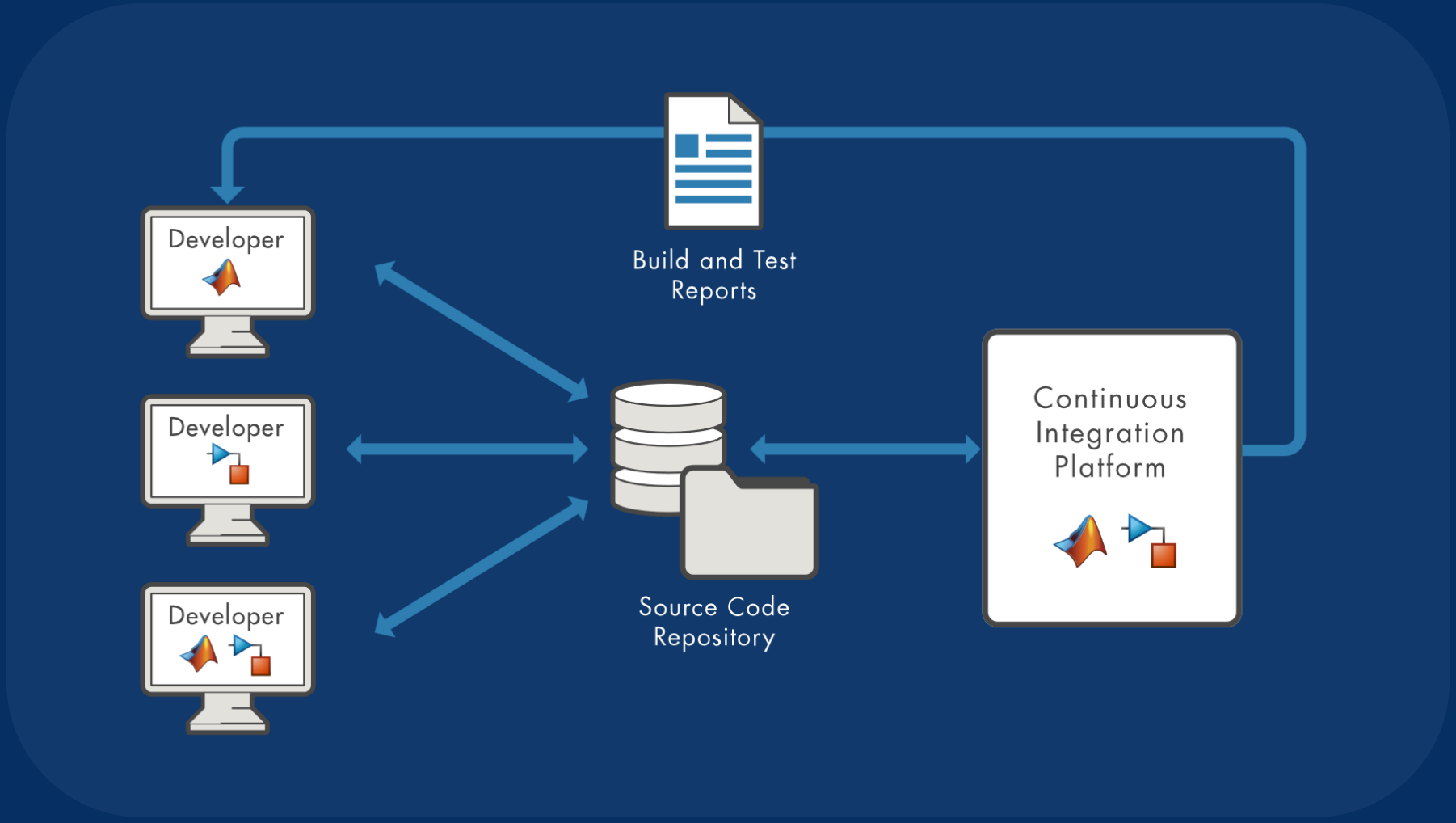
⑤ 应用标准软件工作流


Developer
Developer
Developer
Build and Test Reports
Source Code Repository
Continuous Integration Platform

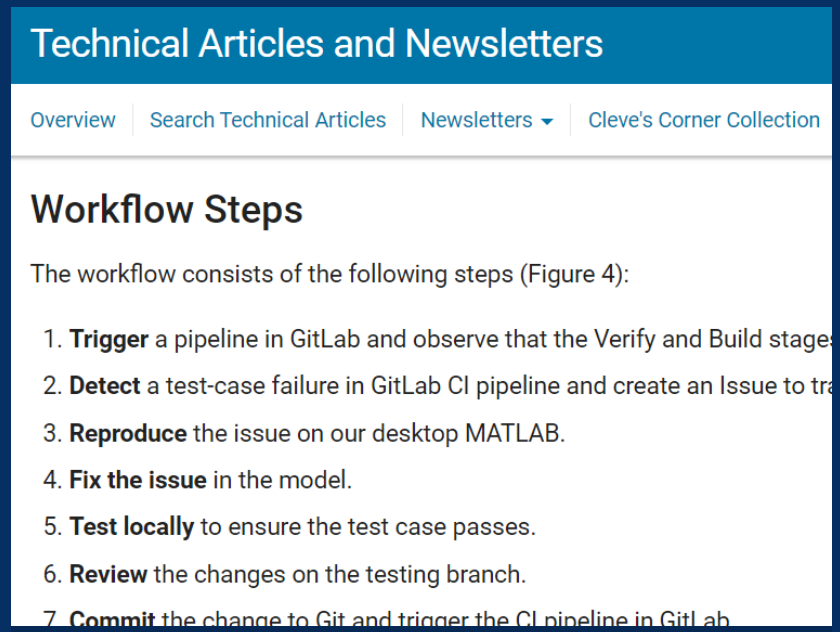
贵组织目前是否在使用持续集成(CI)系统？（请选择一个选项）



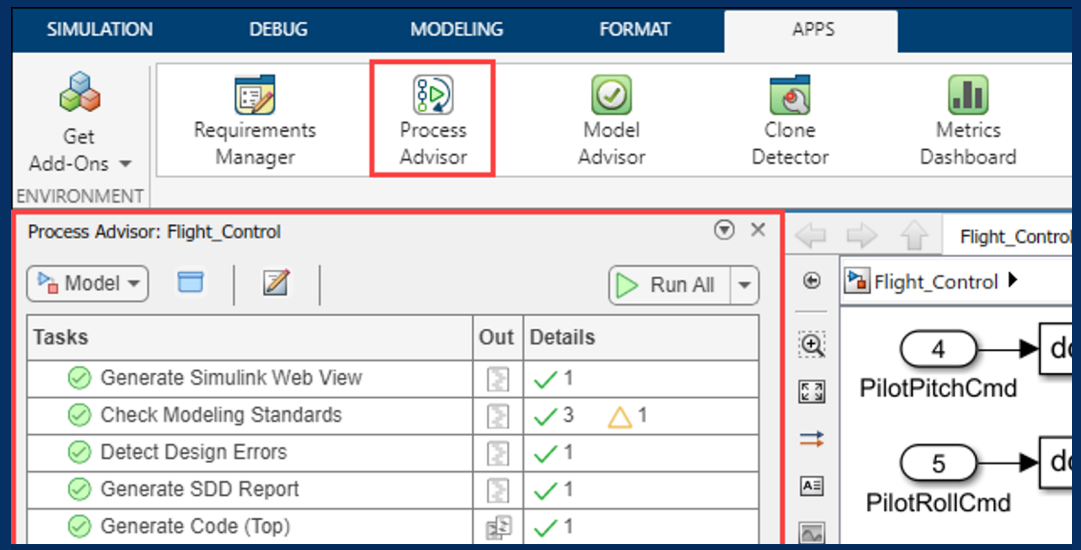
⑤ 应用标准软件工作流


Developer
Developer
Developer
Build and Test Reports
Source Code Repository
Continuous Integration Platform

⑤ 应用标准软件工作流



分步教程



流程顾问

从脚本化管道转向流程顾问

Continental

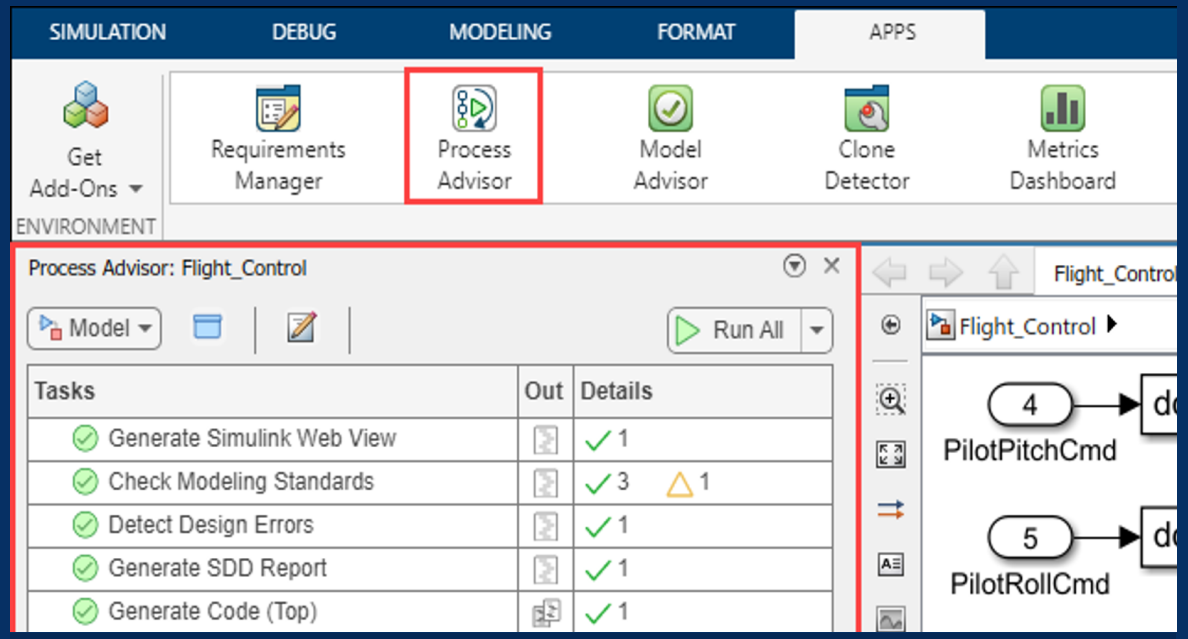
从脚本化管道转向流程顾问

从脚本化管道转向流程顾问

“将所有操作都集成到 MATLAB 中”

– *Martin Römpert，大陆汽车技术有限公司*

从脚本化管道转向流程顾问

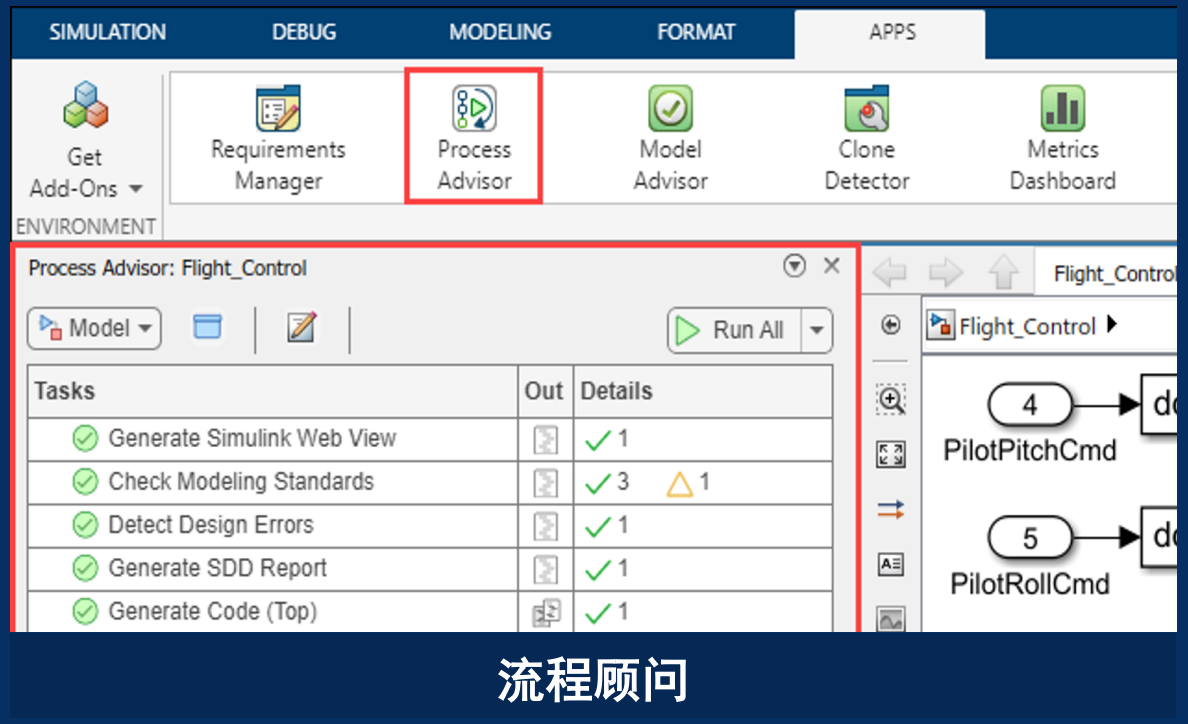


流程顾问

- 利用数字线索
- 识别过时测试
- 与模型交互

2X

从脚本化管道转向流程顾问



流程顾问

500 个接口

1,000 个组件

100 个组合

⑥ 在云端设计和仿真


matlab.mathworks.com
MathWorks
MATLAB Online
MATLAB® Online
MathWorks
Email
mcarone@mathworks.com
No account? Create one!
By signing in you agree to our privacy policy.
Next
Learn about MATLAB Online
Use MATLAB Drive™ to synchronize your MATLAB files

⑥ 在云端设计和仿真

```
for i = 1:10000
    in(i) = Simulink.SimulationInput(my_model)
    in(i) = setVariable(my_var, i);
end
out = parsim(in);
```

Parallel Computing Toolbox

MATLAB Parallel Server

海量仿真

⑥ 在云端设计和仿真

例如：集成四个广泛使用的工具链

MathWorks®

aws FOR AUTOMOTIVE

Elektrobit

SYNOPSYS®

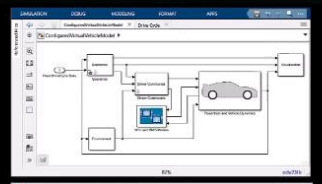
⑥ 在云端设计和仿真

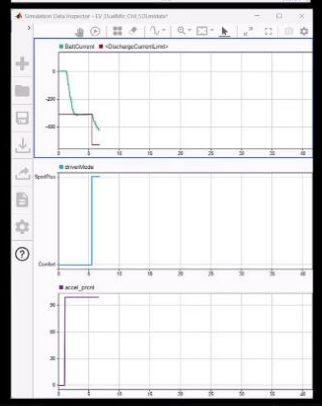
Automotive Software Development in the Cloud

powered by aws FOR AUTOMOTIVE

MathWorks

Virtual Vehicle Simulation in MATLAB & Simulink





Application Code from Model

Elektrobit

Road-ready Automotive Software

Infotainment (Android Automotive OS)

Vehicle Control Unit (Adaptive AUTOSAR)

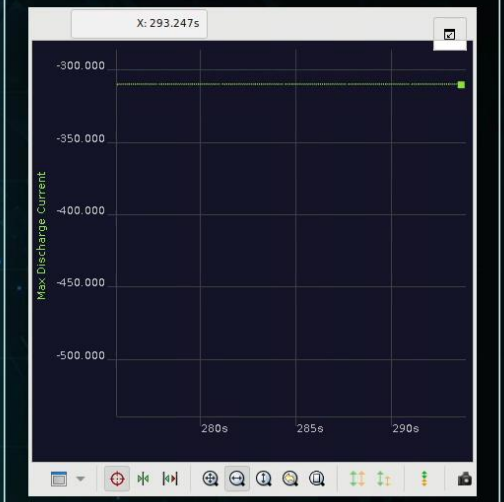
```
[205.18] Adaptive AUTOSAR HPC - received discharge current limit: -310.00     charge current limit: 102.30     charge: 0.75
[206.18] Adaptive AUTOSAR HPC - received discharge current limit: -310.00     charge current limit: 102.30     charge: 0.75
[207.19] Adaptive AUTOSAR HPC - received discharge current limit: -310.00     charge current limit: 102.30     charge: 0.75
[208.20] Adaptive AUTOSAR HPC - received discharge current limit: -310.00     charge current limit: 102.30     charge: 0.75
[209.20] Adaptive AUTOSAR HPC - received discharge current limit: -310.00     charge current limit: 102.30     charge: 0.75
[210.21] Adaptive AUTOSAR HPC - received discharge current limit: -310.00     charge current limit: 102.30     charge: 0.75
[211.21] Adaptive AUTOSAR HPC - received discharge current limit: -310.00     charge current limit: 102.30     charge: 0.75
[212.22] Adaptive AUTOSAR HPC - received discharge current limit: -310.00     charge current limit: 102.30     charge: 0.75
[213.23] Adaptive AUTOSAR HPC - received discharge current limit: -310.00     charge current limit: 102.30     charge: 0.75
[214.23] Adaptive AUTOSAR HPC - received discharge current limit: -310.00     charge current limit: 102.30     charge: 0.75
[215.24] Adaptive AUTOSAR HPC - received discharge current limit: -310.00     charge current limit: 102.30     charge: 0.75
[216.24] Adaptive AUTOSAR HPC - received discharge current limit: -310.00     charge current limit: 102.30     charge: 0.75
[217.25] Adaptive AUTOSAR HPC - received discharge current limit: -310.00     charge current limit: 102.30     charge: 0.75
[vivi-adg]0:bash  1:adg  2:app  3:ita-  4:log*                                                    "ip-10-230-62-5" 19:31 18-Dec-23
```

Battery Management System (Classic AUTOSAR)

```
[281.02] Classic AUTOSAR ECU - sending discharge current limit: -310.00     charge current limit: 102.30     charge: 0.75
[281.62] Classic AUTOSAR ECU - sending discharge current limit: -310.00     charge current limit: 102.30     charge: 0.75
[282.62] Classic AUTOSAR ECU - sending discharge current limit: -310.00     charge current limit: 102.30     charge: 0.75
[283.62] Classic AUTOSAR ECU - sending discharge current limit: -310.00     charge current limit: 102.30     charge: 0.75
[284.62] Classic AUTOSAR ECU - sending discharge current limit: -310.00     charge current limit: 102.30     charge: 0.75
[285.62] Classic AUTOSAR ECU - sending discharge current limit: -310.00     charge current limit: 102.30     charge: 0.75
[286.62] Classic AUTOSAR ECU - sending discharge current limit: -310.00     charge current limit: 102.30     charge: 0.75
[287.62] Classic AUTOSAR ECU - sending discharge current limit: -310.00     charge current limit: 102.30     charge: 0.75
[288.62] Classic AUTOSAR ECU - sending discharge current limit: -310.00     charge current limit: 102.30     charge: 0.75
[289.62] Classic AUTOSAR ECU - sending discharge current limit: -310.00     charge current limit: 102.30     charge: 0.75
[290.62] Classic AUTOSAR ECU - sending discharge current limit: -310.00     charge current limit: 102.30     charge: 0.75
[291.62] Classic AUTOSAR ECU - sending discharge current limit: -310.00     charge current limit: 102.30     charge: 0.75
[292.62] Classic AUTOSAR ECU - sending discharge current limit: -310.00     charge current limit: 102.30     charge: 0.75
[vivi-clas0:bash  1:log*                                                                             "ip-10-230-62-5" 19:30 18-Dec-23
```

SYNOPSYS

Virtual ECUs in Synopsys Silver



ECU Simulation

MATLAB EXPO

应用趋势

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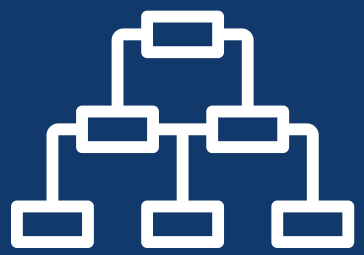

系统工程
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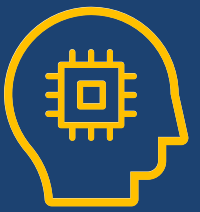
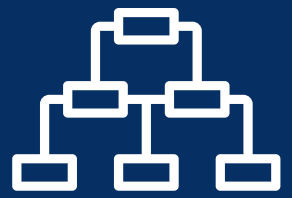


AI 在
系统开发中的应用

工作流趋势



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⑦ 利用 AI 设计系统

将 AI 融入基于模型的设计

需求 | 功能和架构 | 设计 | 实现 | 系统集成和测试

系统

子系统模型
基于物理
AI 和数据驱动

算法
模型、代码、AI

CPU ▪ GPU
DSP ▪ FPGA
IEC 61131 for PLCs
Microcontroller
Software Component
App ▪ Container
Microservice

物理硬件

组件及系统验收测试

实际环境

ReqIF Requirements Interchange Format

OSLC

环境模型

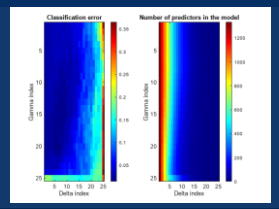
环境模型

持续测试、验证和确认
需求验证▪早期设计验证▪虚拟集成测试(SIL/PIL/HIL)▪物理系统测试

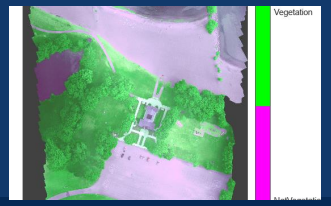
数字线索

⑦ 利用 AI 设计系统

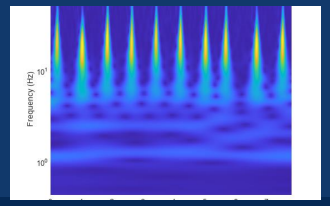
AI 参考示例



预测性维护



高光谱成像



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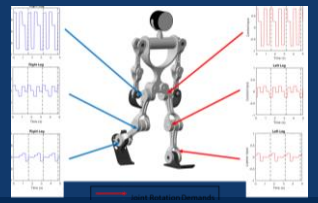
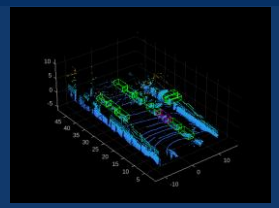
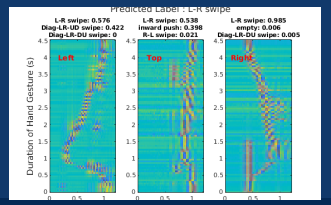


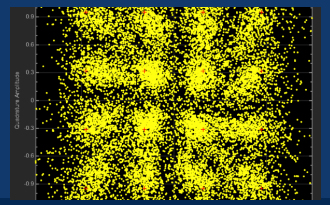
机器人控制



激光雷达处理

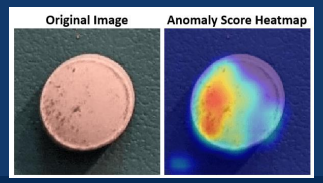


雷达处理

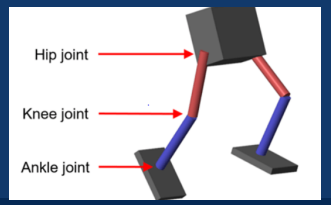


无线通信

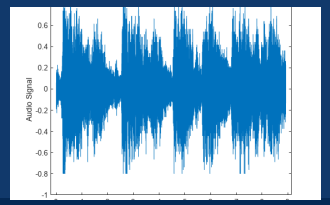
自动驾驶



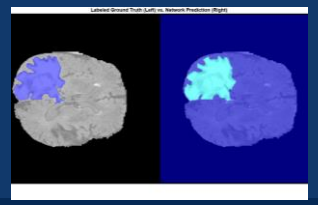
视觉检查



强化学习



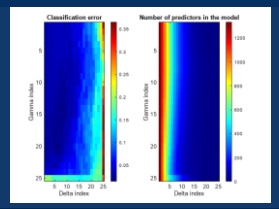
音频



医学成像

⑦ 利用 AI 设计系统

AI 参考示例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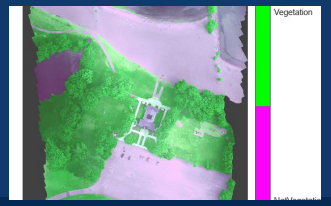

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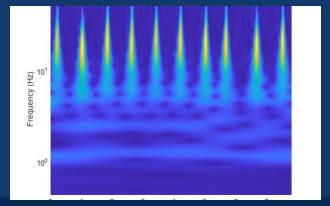
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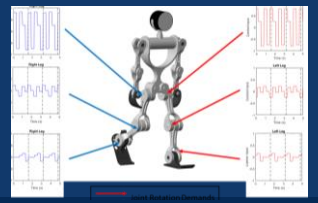
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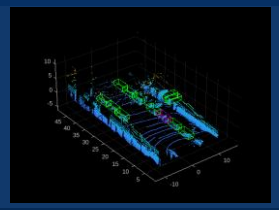
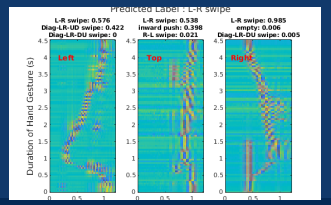
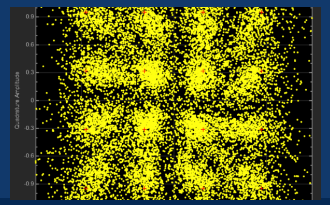
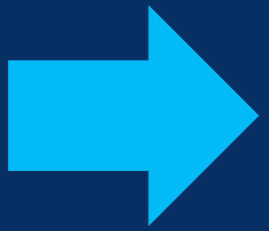

激光雷达处理


雷达处理

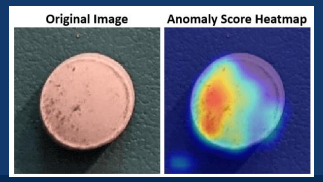

无线通信


自动驾驶

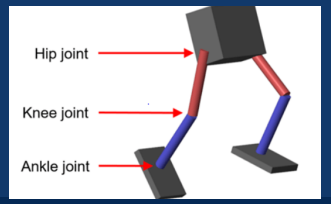


CPU

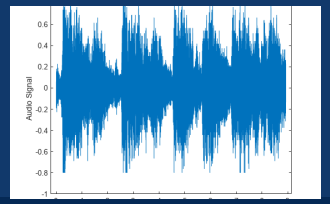
GPU

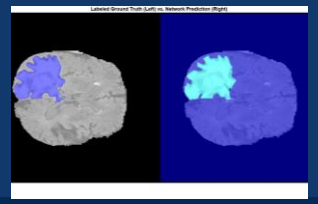


视觉检查



强化学习


音频


医学成像

FPGA、ASIC、PLC

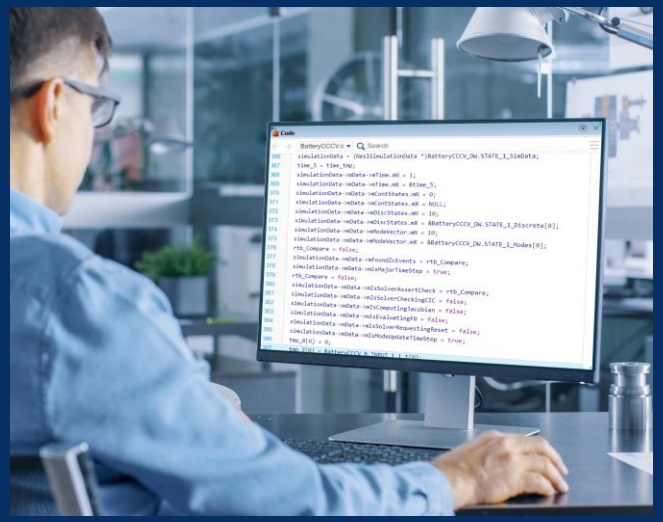
Mercedes-Benz

利用深度神经网络仿真硬件传感器

Mercedes-Benz

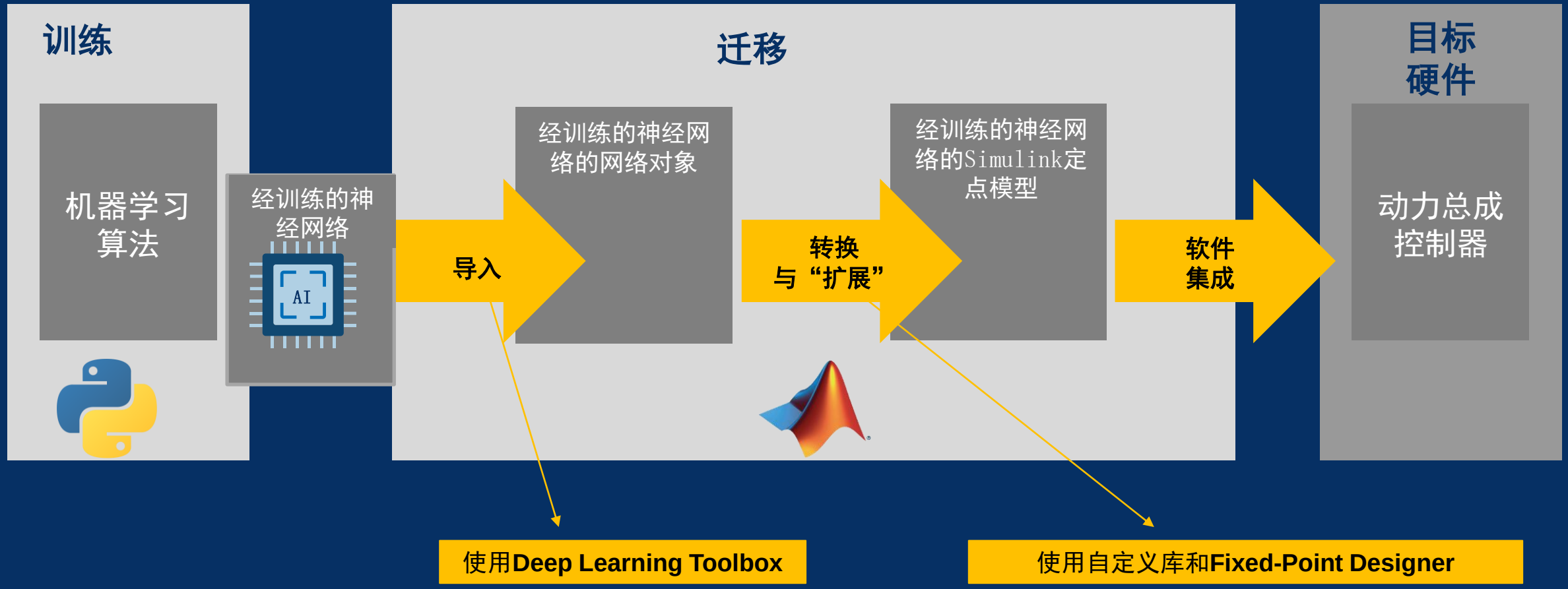
利用深度神经网络仿真硬件传感器

QKeras



利用深度神经网络仿真硬件传感器

Mercedes-Benz

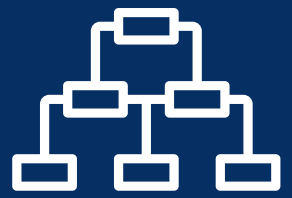


利用深度神经网络仿真硬件传感器

*“我们已将基于 MATLAB 和 Simulink 创建的**自动化工作流**成功应用于其他使用场景……我们只做了细微的调整，即支持在两种不同的动力总成控制器上部署。此外，该工作流还适用于**其他类型的深度学习模型**，如门控循环单元和全连接神经网络……得益于手动开发工作量的显著减少，我们在创建模型和代码工程中所犯的错误也相应减少了。”*

– Katja Deuschl，梅赛德斯–奔驰的 AI 研发人员

工作流趋势

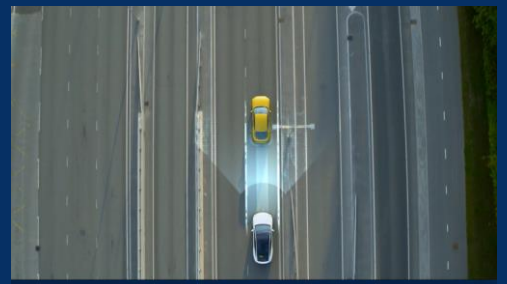


1. 全面实现自动化
2. 扩展到复杂系统
3. 利用自动代码生成
4. 尽早预防缺陷

5. 应用标准软件工作流
6. 在云端设计和仿真

7. 利用 AI 设计系统

应用趋势



自主化

互联性

电气化

工作流趋势

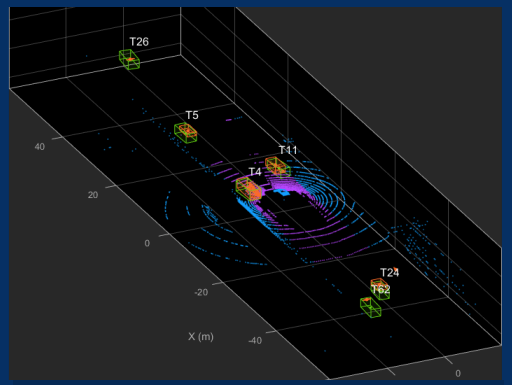
系统工程
与设计

现代
软件实践

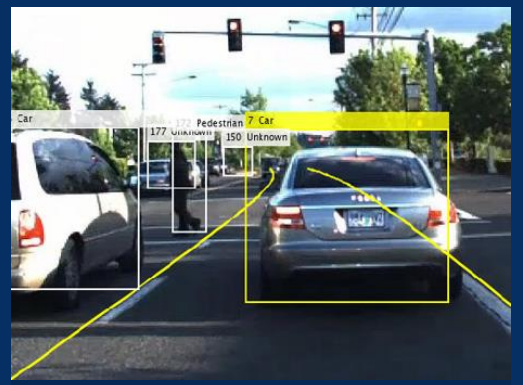
AI 在
系统开发中的应用

自主系统

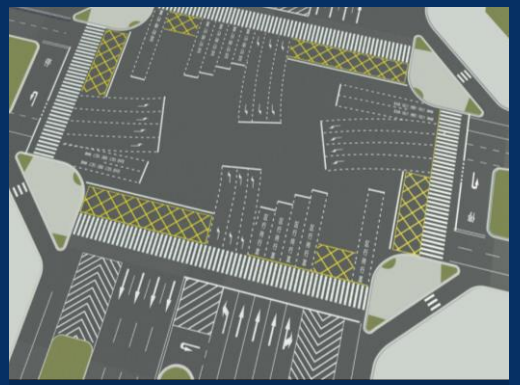
制动和转向



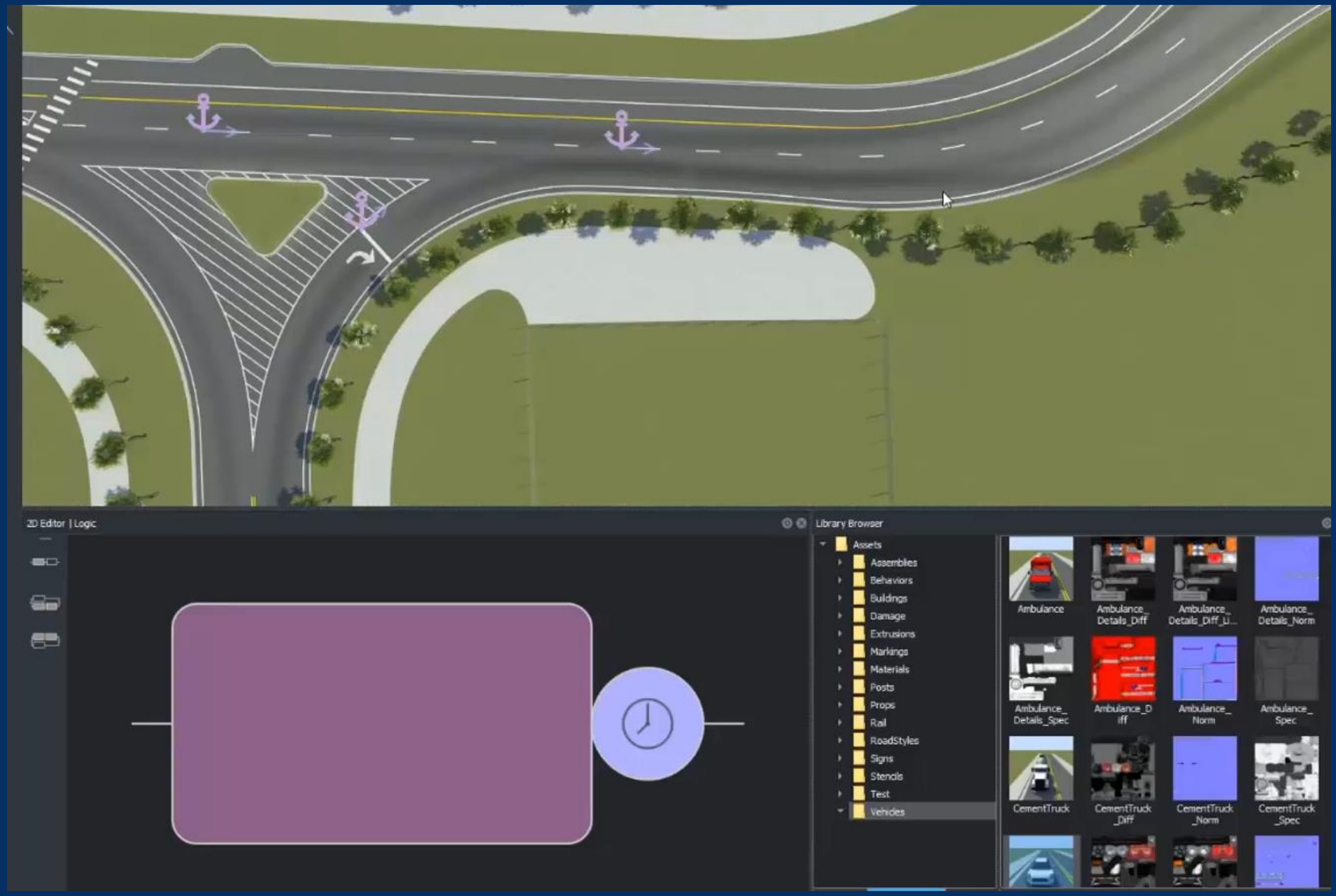
传感器融合与跟踪

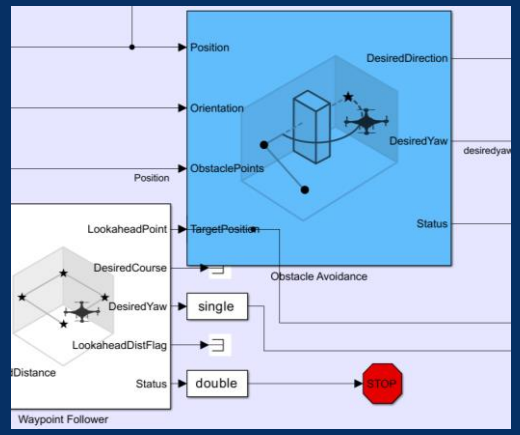


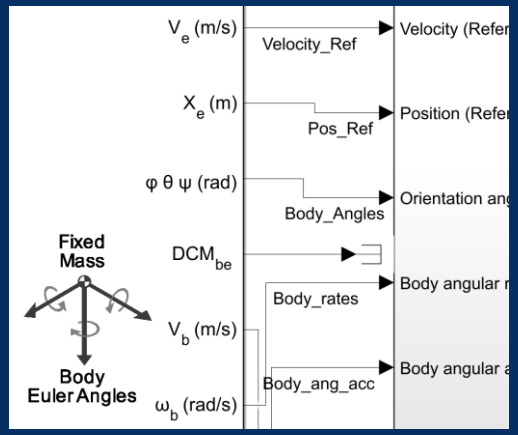
计算机视觉
雷达、激光雷达

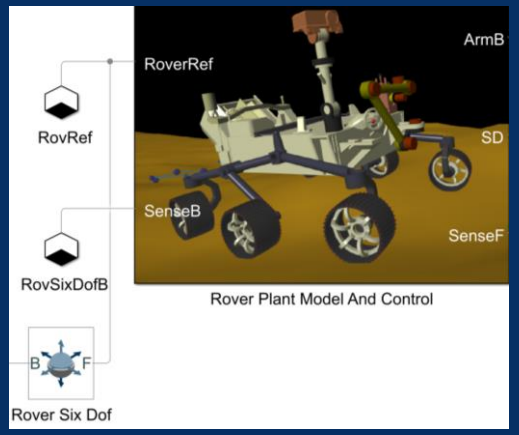


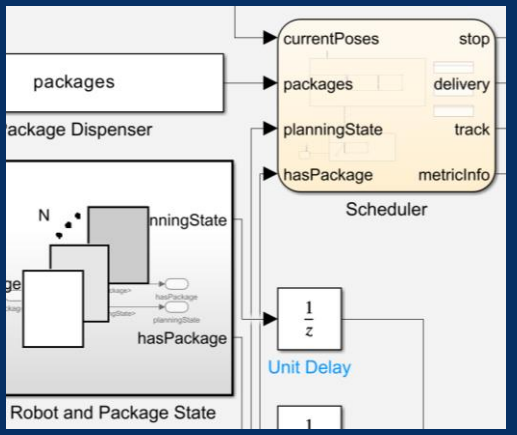
道路网络设计


2D Editor | Logic
Library Browser
Assets
Assemblies
Behaviors
Buildings
Damage
Extrusions
Markings
Materials
Posts
Props
Rail
RoadStyles
Signs
Stencils
Test
Vehicles
Ambulance
Ambulance_ Details_Diff
Ambulance_ Details_Diff_Li...
Ambulance_ Details_Norm
Ambulance_ Details_Spec
Ambulance_D iff
Ambulance_ Norm
Ambulance_ Spec
CementTruck
CementTruck _Diff
CementTruck _Norm
CementTruck _Spec

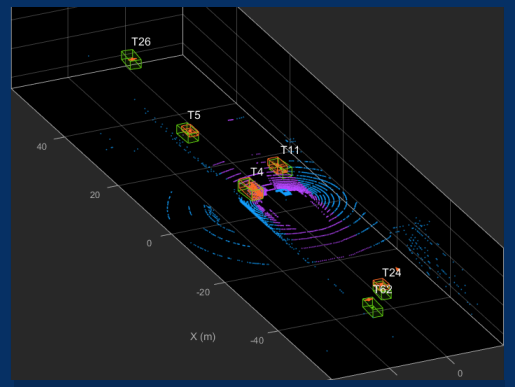








无人机



自主水下航行器

地面机器人

工业机器人

应用趋势

自主化

互联性

电气化

工作流趋势

系统工程
与设计

现代
软件实践

AI 在
系统开发中的应用

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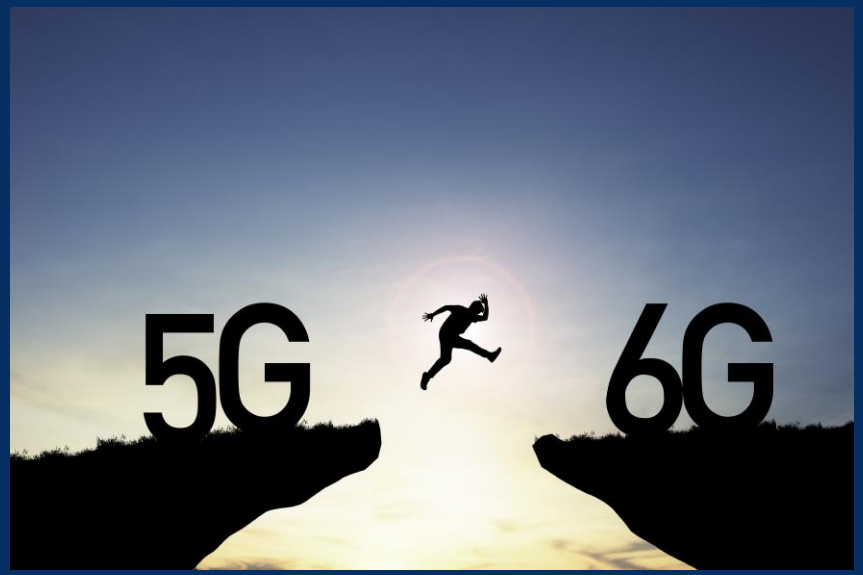
5G 标准

5G

其他

6G 标准



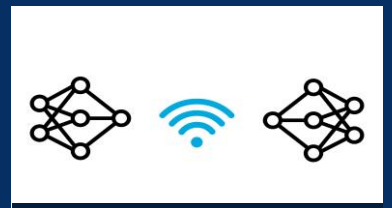
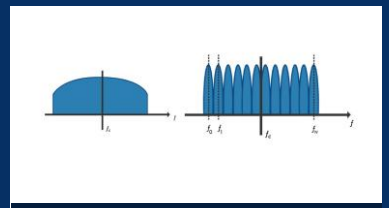
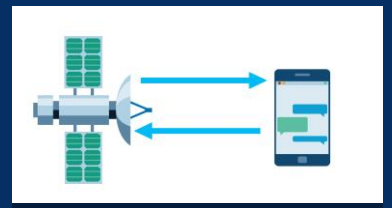
RCRWireless News
INTELLIGENCE ON ALL THINGS WIRELESS

China aims for 6G commercialization by 2030: Report

By **Juan Pedro Tomás** December 13, 2023

6G Standards

6G 现处设计阶段

	人工智能和机器学习	光谱波段	可感知网络	极端连接	新网络架构
关键技术					
MathWorks产品	Communications Toolbox、5G Toolbox、WLAN Toolbox以及Deep Learning Toolbox	RF Blockset、Antenna Toolbox	WLAN Toolbox、5G Toolbox、Radar Toolbox	Satellite Communications Toolbox	

6G Exploration Library (R2024a)

无线趋势 – 无线 AI

Wireless challenges

- Hard-to-model problems
- Computational infeasibility of optimal solution
- Efficient modem parameter optimization
- Dealing with non-linearity

AI-enhanced wireless communications

AI strengths

- Determining appropriate representations for hard-to-model problems
- Finding near-ideal and computationally realizable solutions
- Modeling non-linear functions

Applying AI to solve difficult wireless challenges

Deep wireless domain knowledge is required to optimally use AI capabilities

幻灯片由高通提供

应用趋势

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互联性

电气化

工作流趋势

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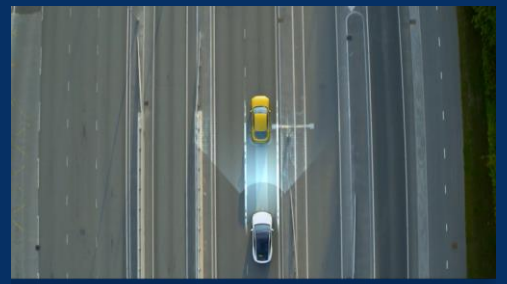
与设计

现代
软件实践

AI 在
系统开发中的应用

应用趋势



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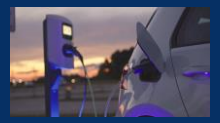
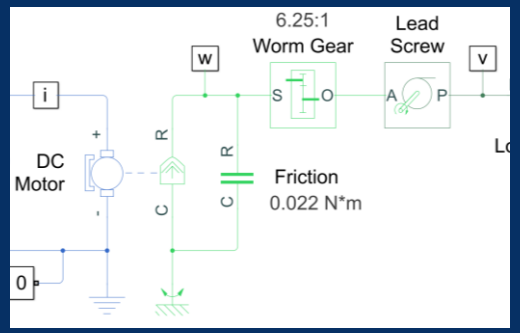
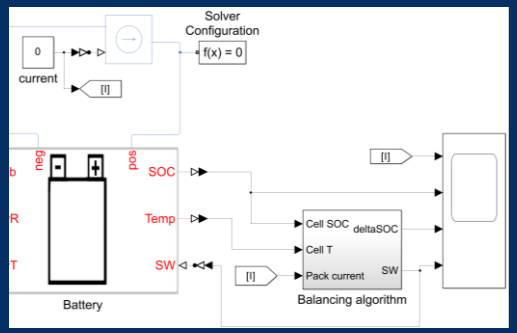
电动汽车

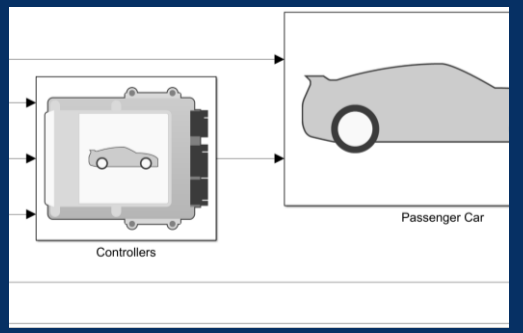
考虑电热特性的电池组建模

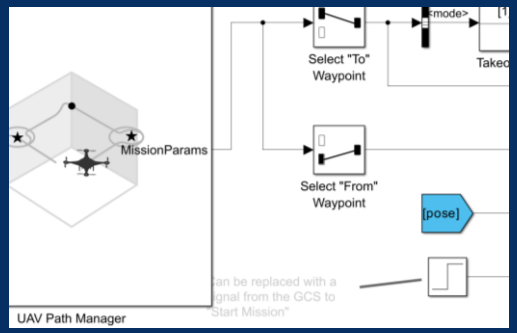
栗秀花， MathWorks中国











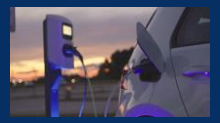
电机

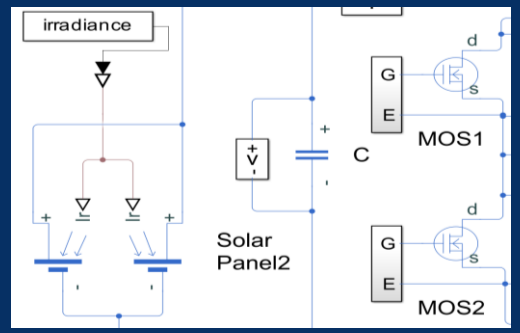
电池组

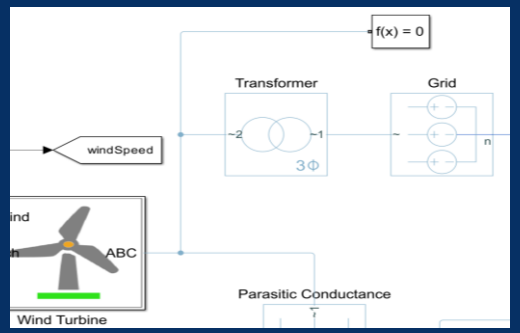
整车模型

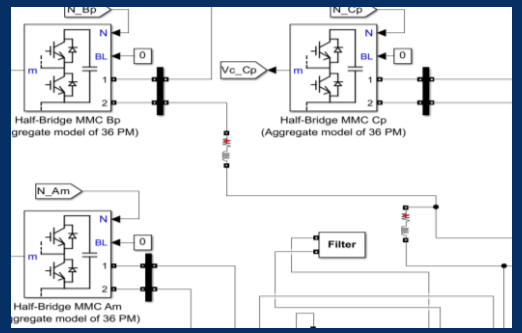
飞行器

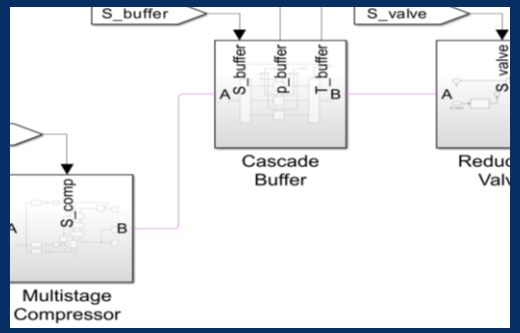
绿色能源











太阳能

风能

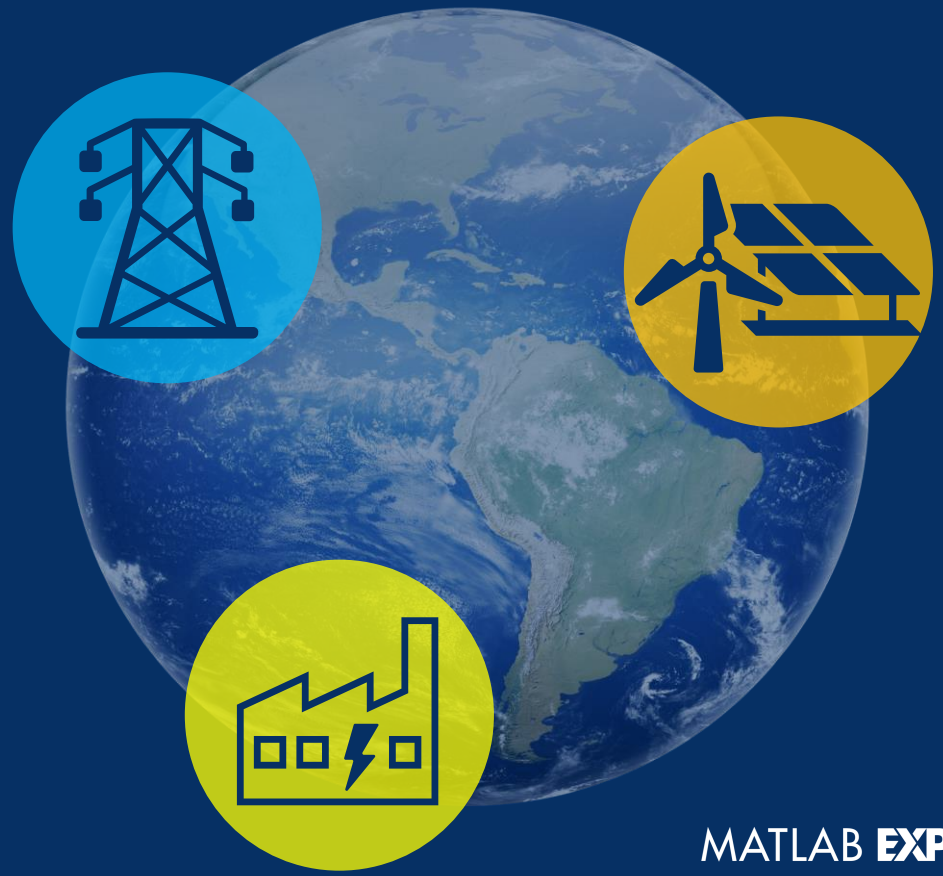
水力发电

绿氢

SIEMENS energy

推动全球能源转型

1. 设计太阳能、生物质能、氢能和风能解决方案
2. 改造或升级基础设施
3. 加强电网建设



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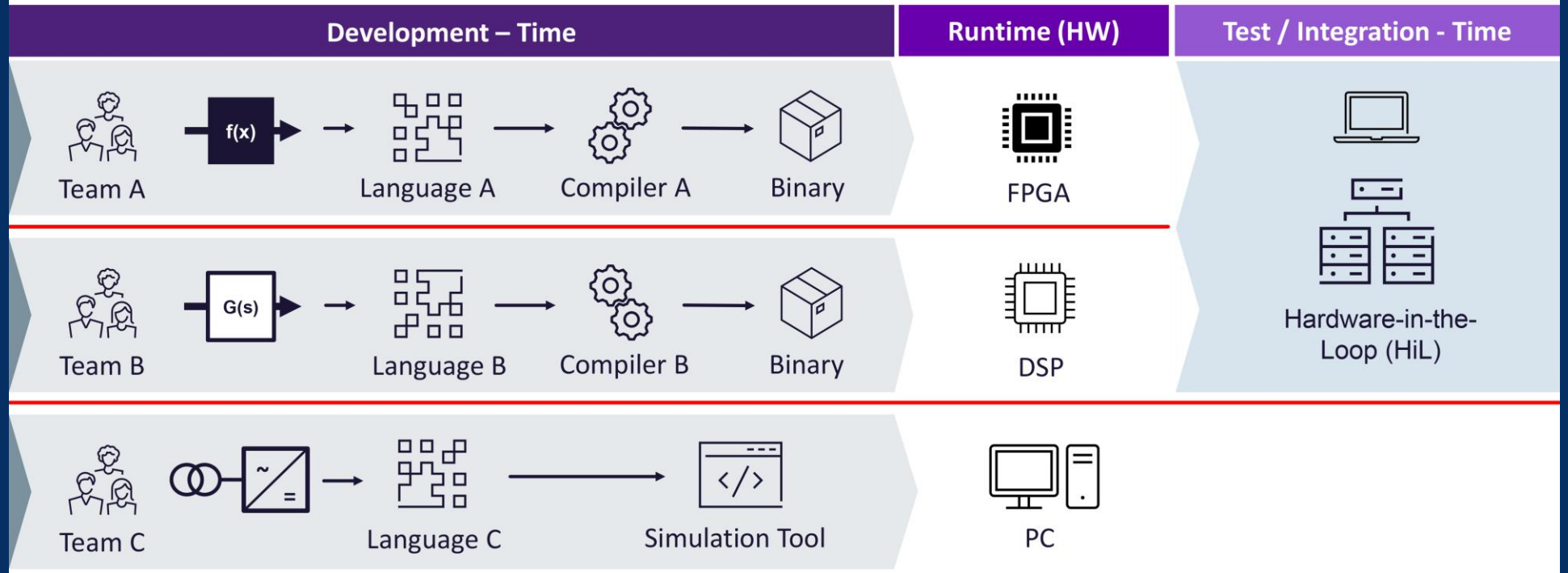
推动全球能源转型

Swimlane Engineering

When the organization shapes development



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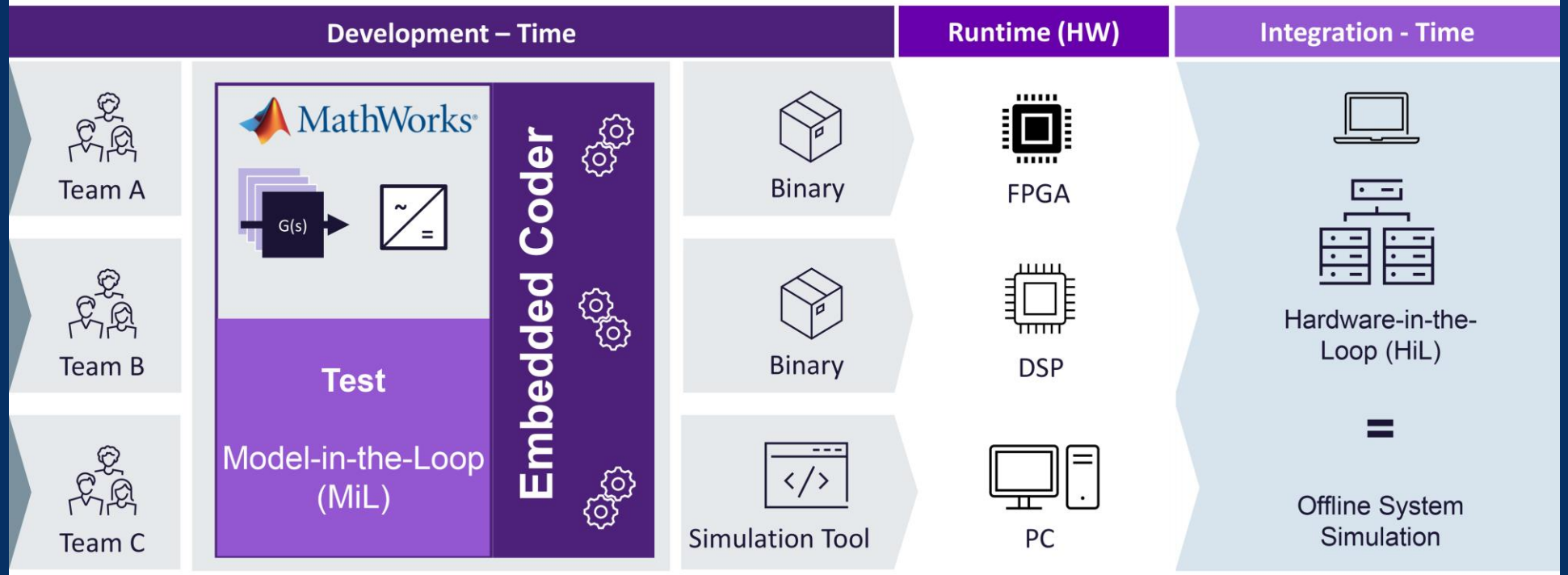
推动全球能源转型

Centralized Engineering Ecosystem

When development extends across the organization



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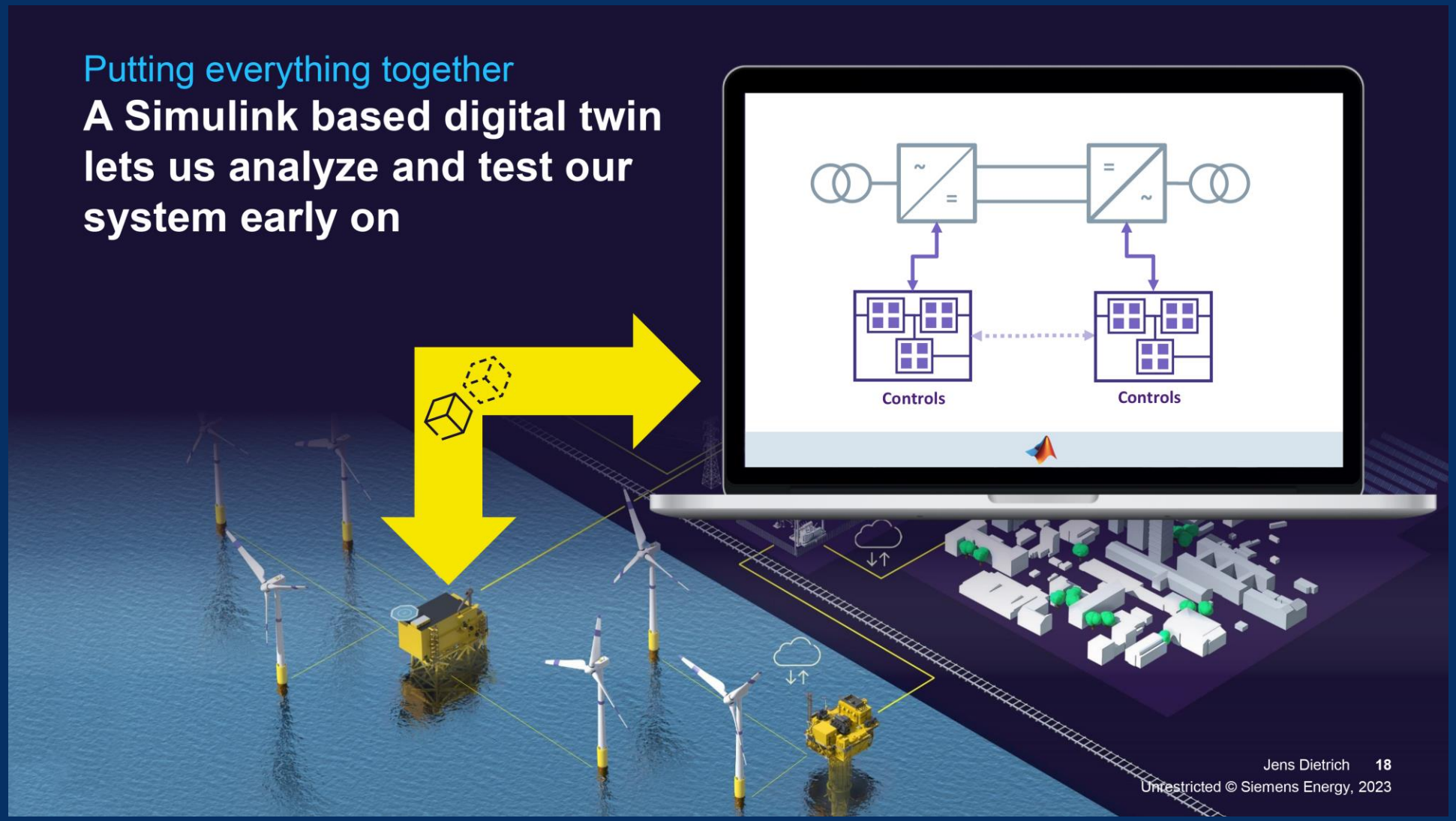
推动全球能源转型



MATLAB EXPO

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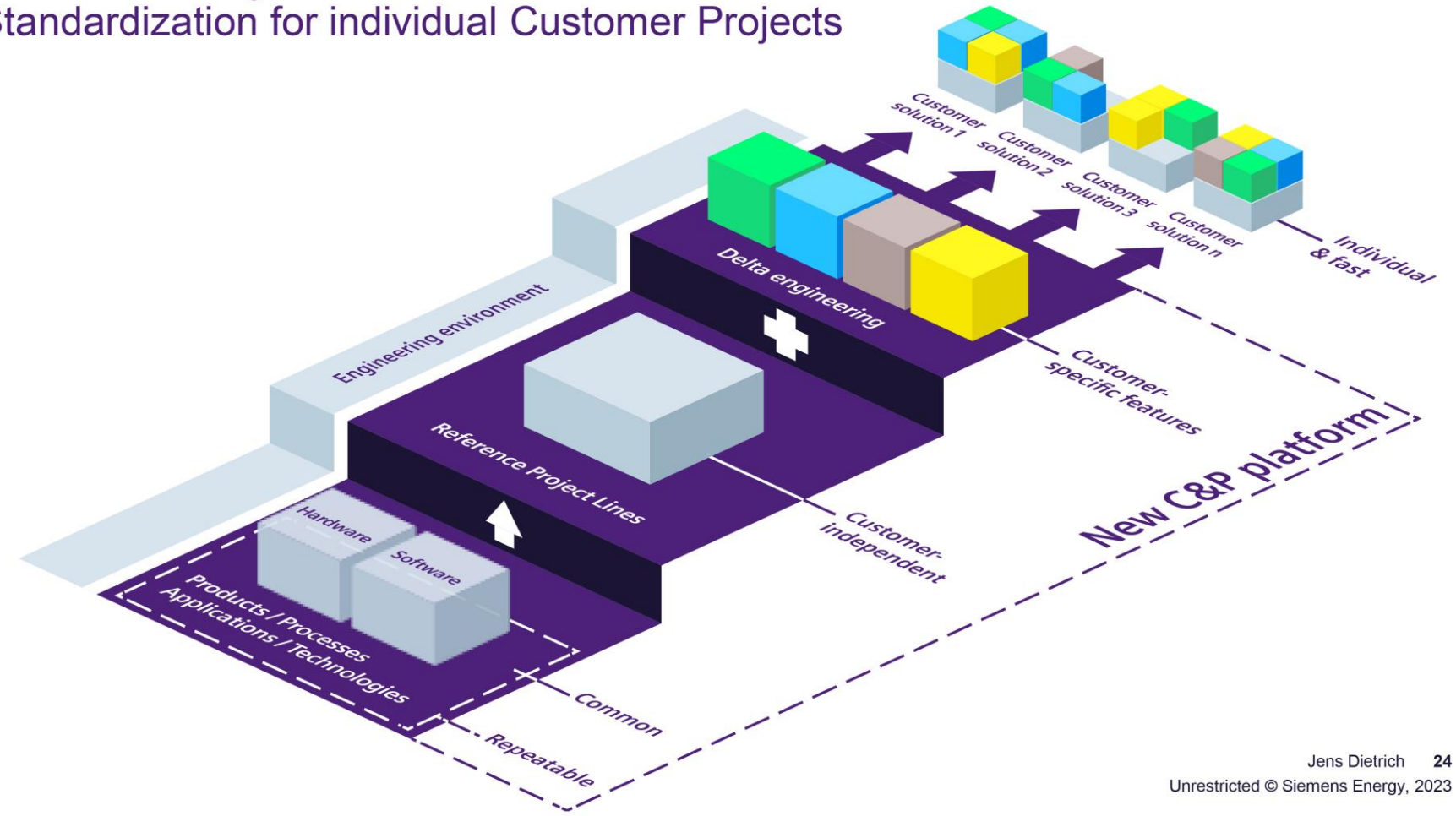
推动全球能源转型

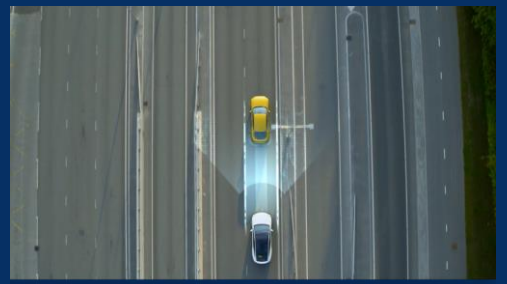
Reference Project Lines

Standardization for individual Customer Projects



Jens Dietrich 24

应用趋势

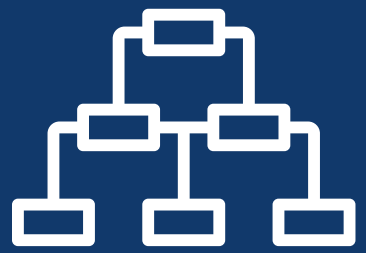


自主化

互联性

电气化

工作流趋势



系统工程
与设计

现代
软件实践

AI 在
系统开发中的应用

MATLAB EXPO

谢谢