

MathWorks
**AUTOMOTIVE
CONFERENCE 2023**
North America

Developing and Delivering the New Generation of Software-Defined Vehicles

Jim Tung, MathWorks



The rush for ~~Gold~~ Software

From the news...

“Software strategy is one of the key building blocks of Stellantis' overall strategy to build the most sustainable mobility for our customers.”

Carlos Tavares – Stellantis CEO

*“The vehicle is no longer the central point of the automotive value chain, as **software, electronics and on-board intelligence increasingly determine both the value and use of the vehicle for new mobility needs and services.**”*

Luca de Meo – Renault Group CEO

*“The **purpose** of the Group’s own software and technology company CARIAD is to create the technical basis for **data-based business models, new mobility services and automated driving (Level 4)**, and to leverage cross-brand synergies. Our aim is to **increase the proportion of software in the vehicle that is developed in house.**”*

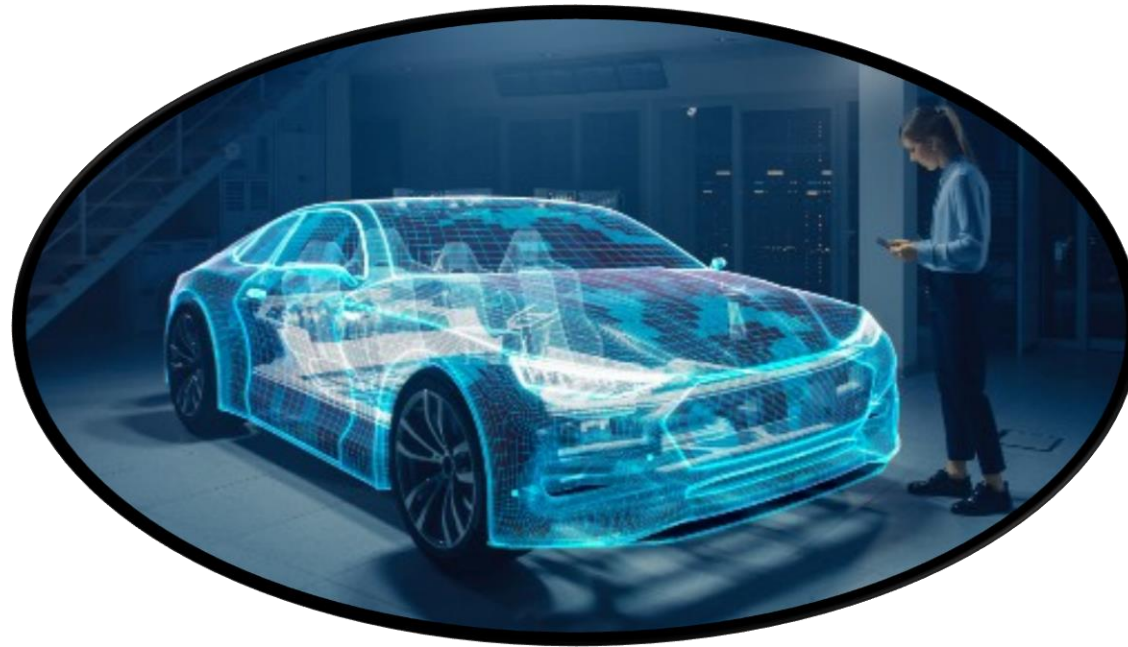
Excerpt from Volkswagen Software Strategy

<https://www.stellantis.com/en/investors/events/sw-day-2021>

<https://www.renaultgroup.com/en/news-on-air/news/the-software-republique-a-new-ecosystem-for-innovation-in-intelligent-and-sustainable-mobility/>

<https://www.volkswagenag.com/en/strategy/software.html>

Software-Defined Vehicle: Brand-distinctive features and main value for the customer will come from Software



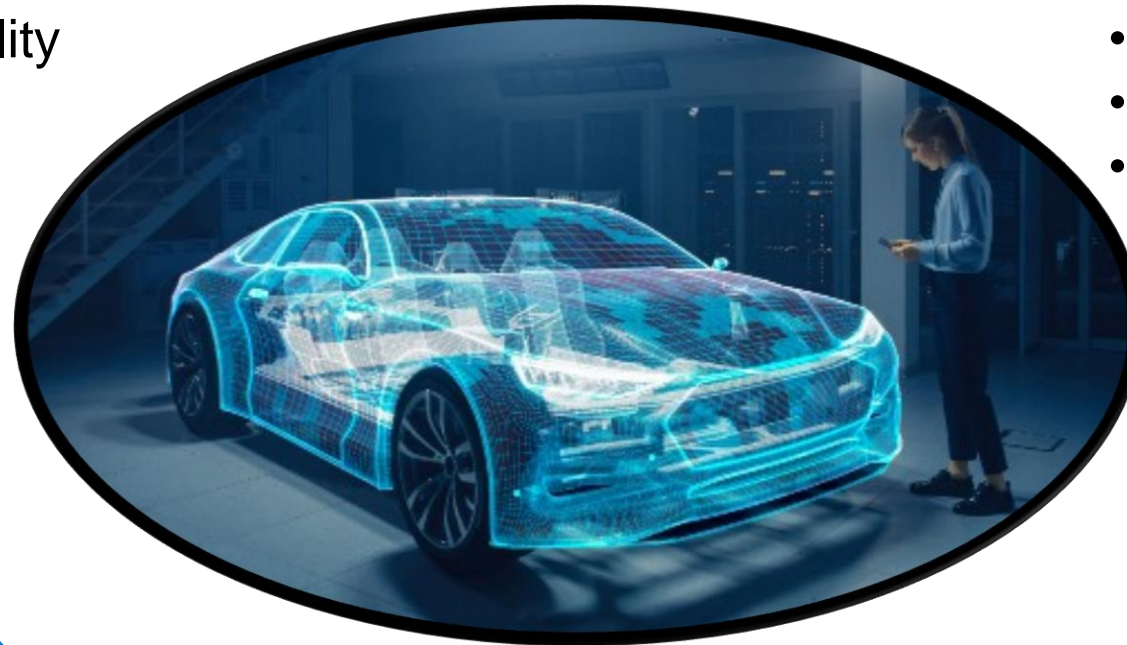
Software-Defined Vehicle

Customer Expectations

- Clean and Safe mobility
- Digital Life continuity

Technology & Innovation

- Electrification
- Autonomy
- Connectivity



monetize

Business Opportunity

- App stores, SW features on demand
- SW services subscription plans

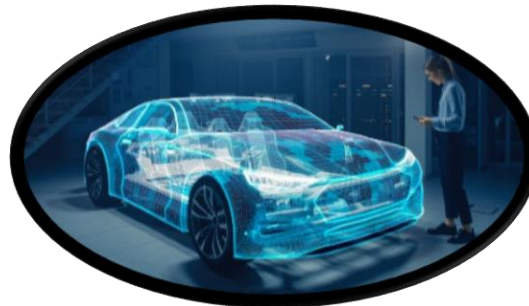
invest

demand

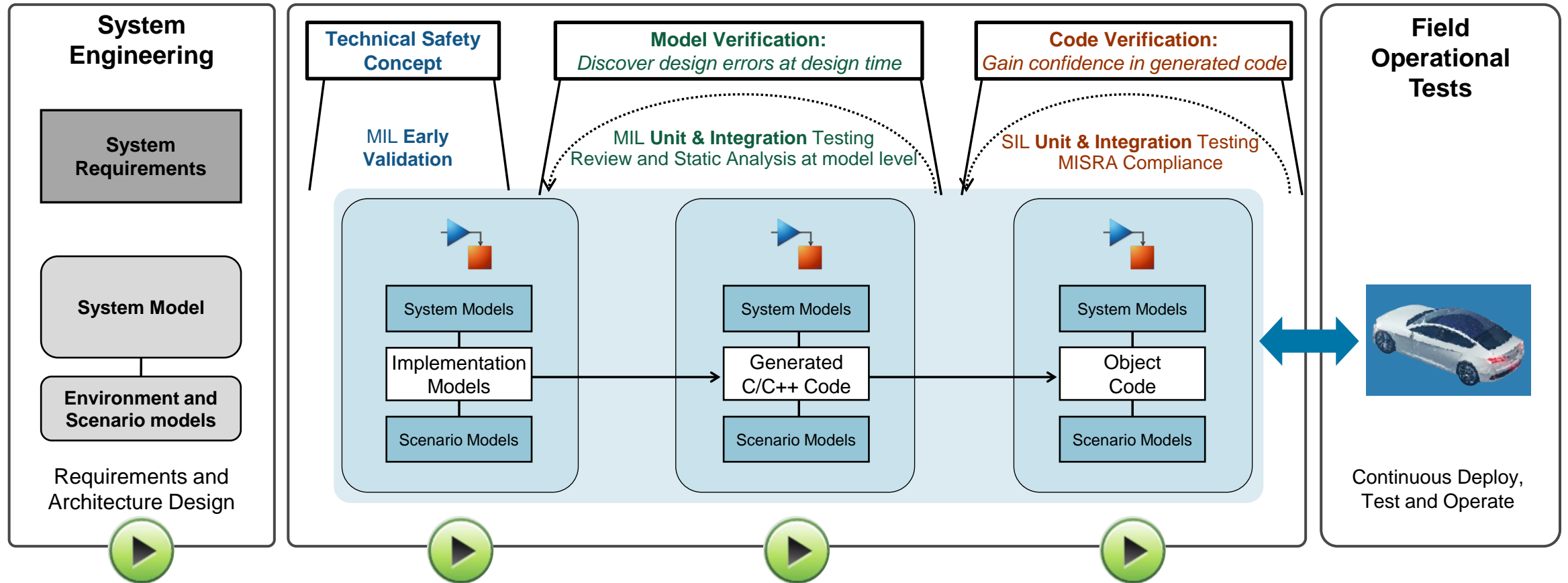
Model-Based Design



Software: that interacts with the vehicle's physical systems
that needs real-time (deterministic) execution
that requires high assurance
that meets maturity-model principles (Automotive SPICE)
that supports standard architectures (AUTOSAR Classic and Adaptive)



Model-Based Design Today



Shift-Left: Find System/Software Defects Sooner

Approaches, Processes, and Tools**Model-Based Design for the Software-Defined Vehicle****Established MBD Approaches**

Hard real-time, resource-limited ECUs

Signal flow, invoked by RTOS/scheduler

Tools packaged for desktop

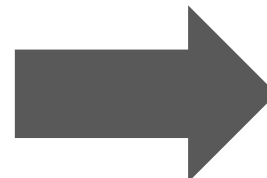
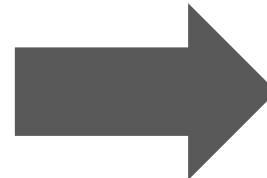
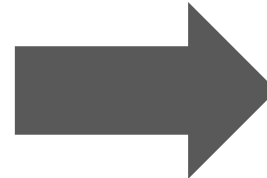
Interactive, human-driven

Focus on Design, Implementation, V&V

Tool criteria primarily around Design

Managed by PLM systems

Installed from Windows

**Updated and Additional MBD Approaches**

Could target ECUs, central/zonal computers, or cloud

Service-oriented, invoked by API calls

Cloud execution, including as containers

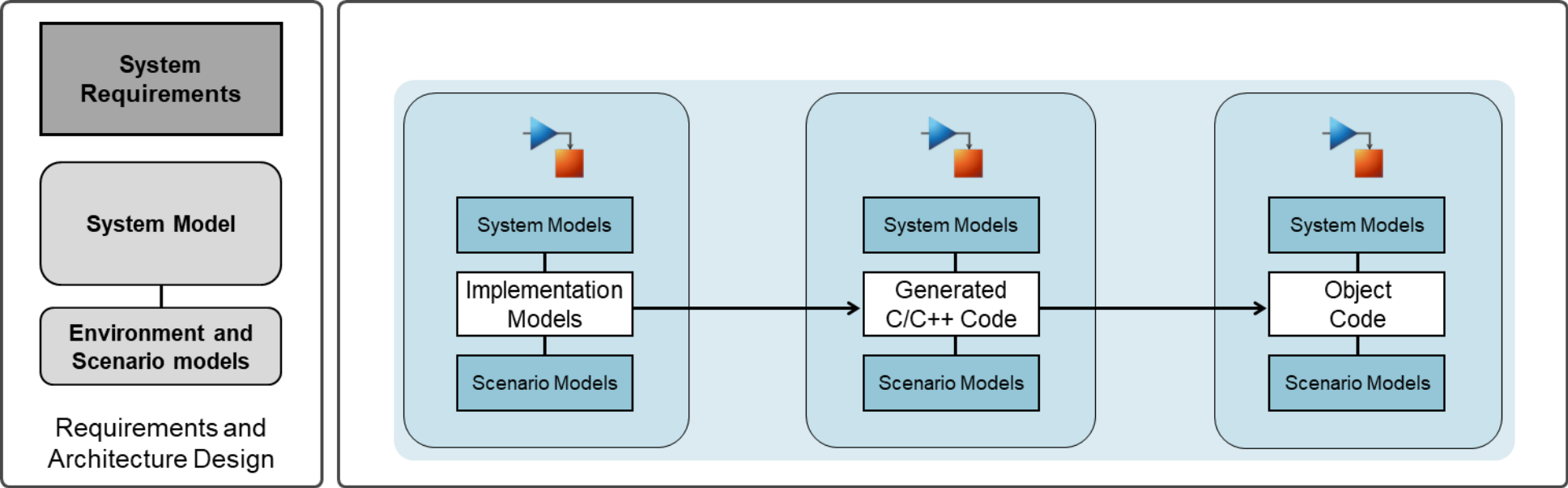
Automate when possible, CI or Kubernetes driven

Focus on Production, Release, Throughput, Flow

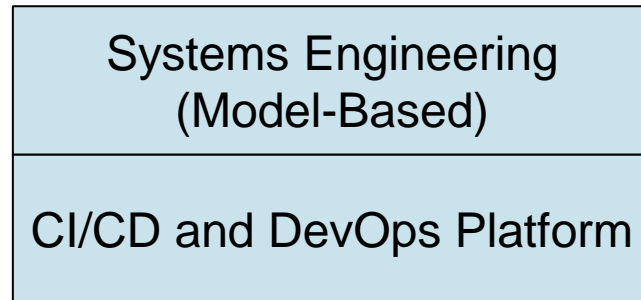
Tool criteria also include Automation, Cloud use

Trunk and Branch: Uses source & production repos

Stand up tooling using IaC (Infrastructure as Code)



Shifts in Mindset



- 1** Shift Systems Team
Mindset toward
Automation and DevOps



- 2** Shift Software Team
Mindset to Leverage
Systems via Simulation

Shifts in Mindset

Software-Centric Applications
(Agile, DevOps)

CI/CD and DevOps Platform

Systems Engineering
(Model-Based)

CI/CD and DevOps Platform

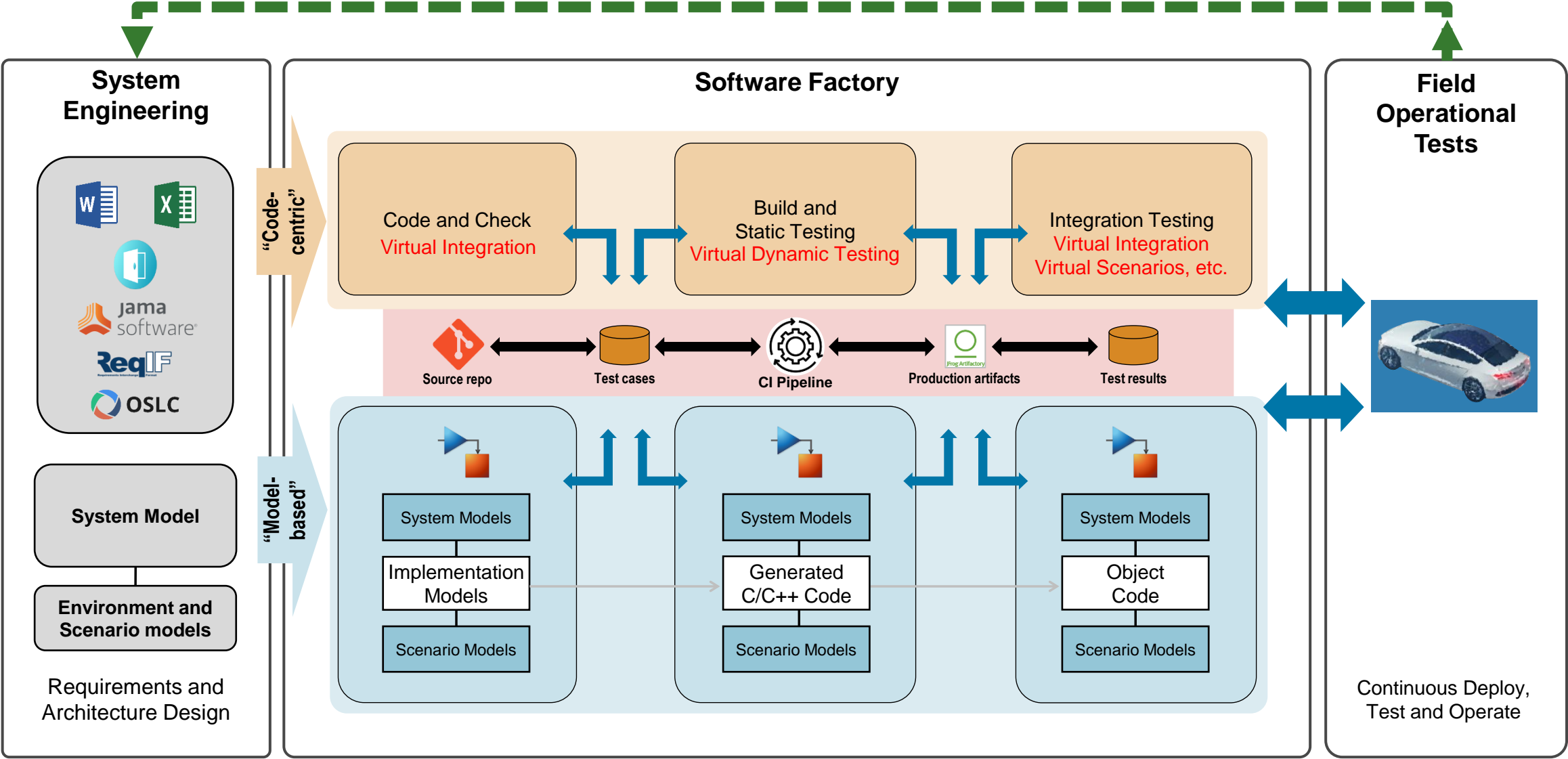
- 4** Define Shared KPIs:
- Velocity/Flow
 - Software Robustness
 - System Rigor

2 Shift Software Team Mindset to Leverage Systems via Simulation

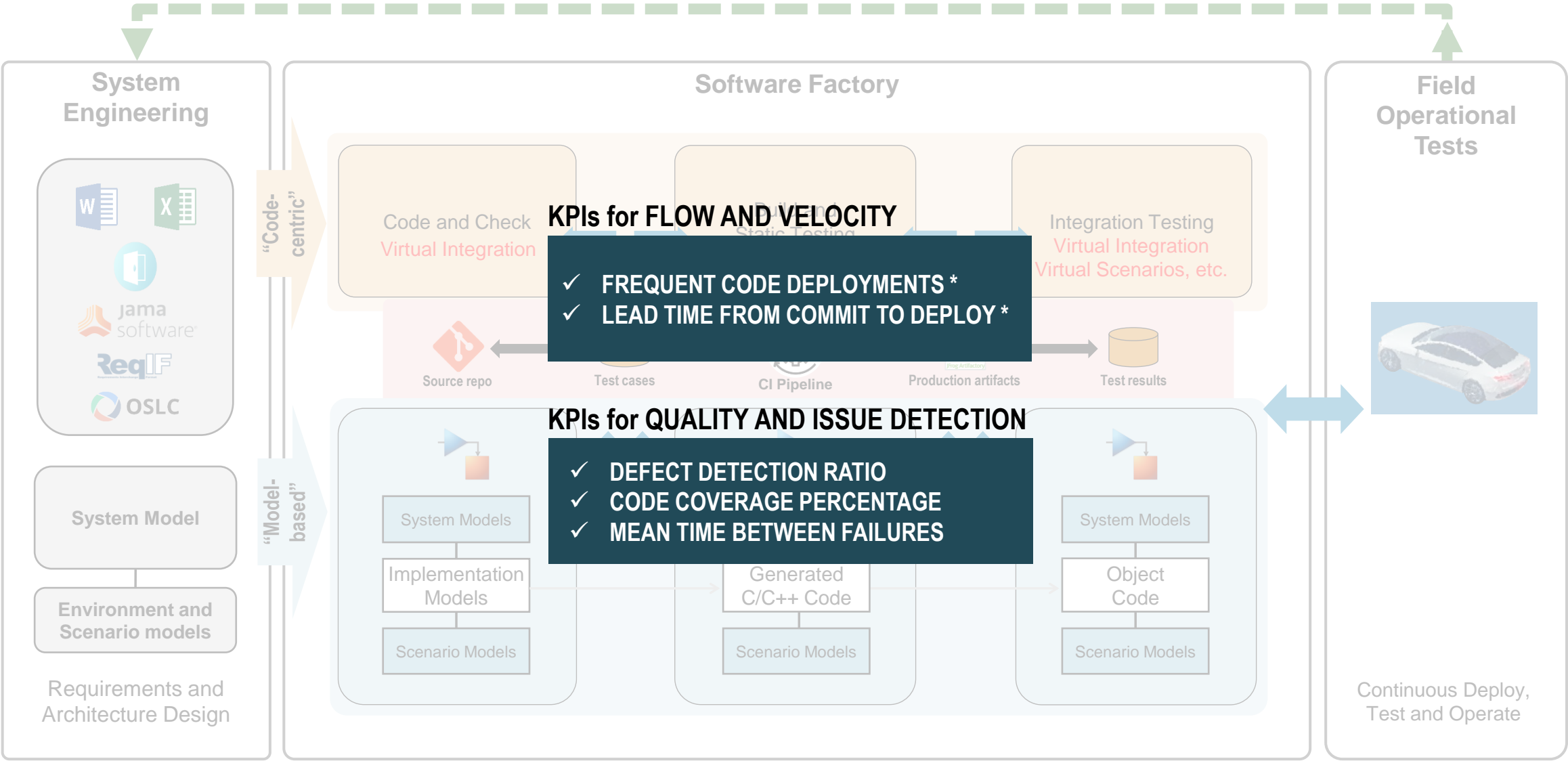
3 Shift Mindsets to Commonize CI/DevOps Platforms for Systems and Software

1 Shift Systems Team Mindset toward Automation and DevOps

Aligning and Automating MBD and Code-Centric Approaches

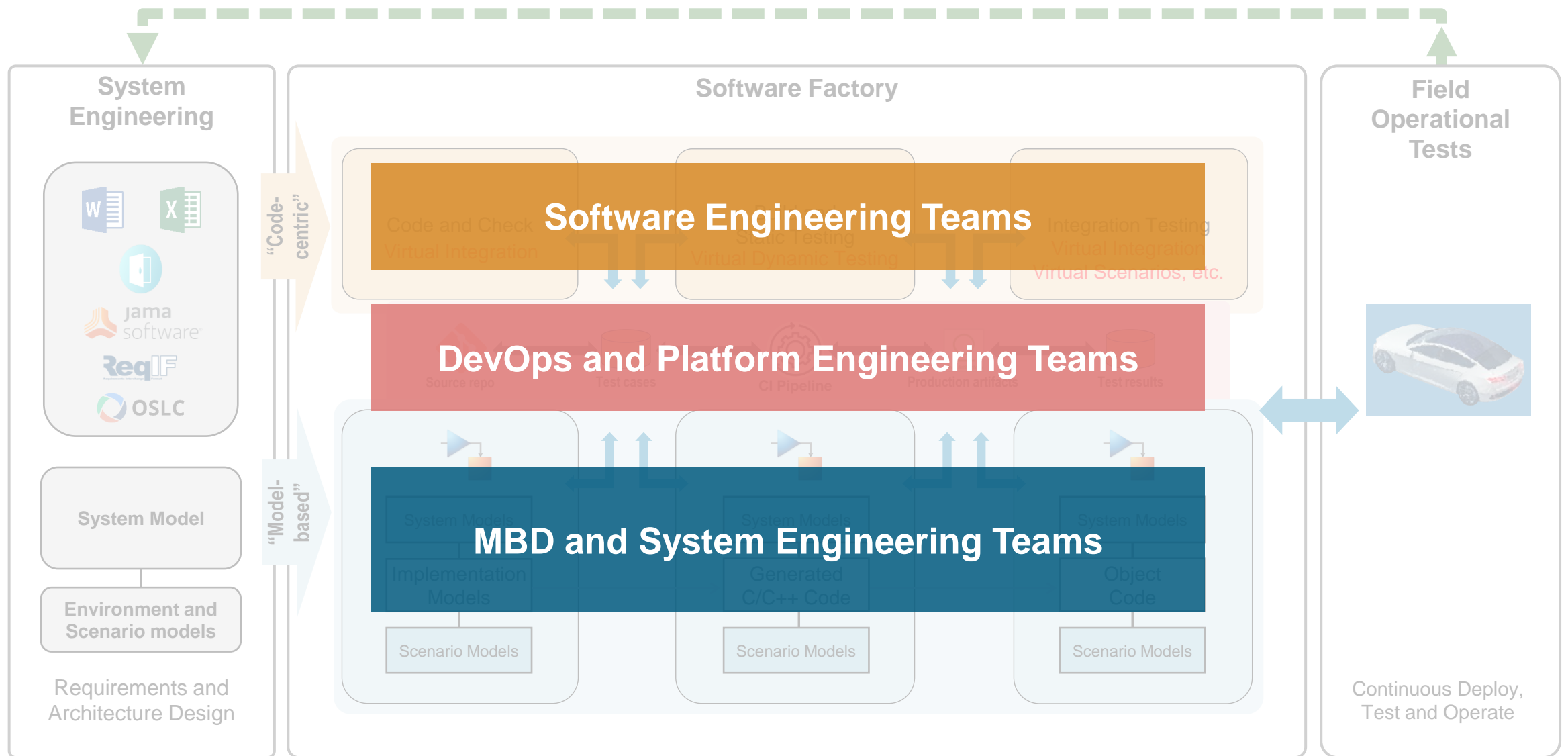


Automation of MBD Workflows



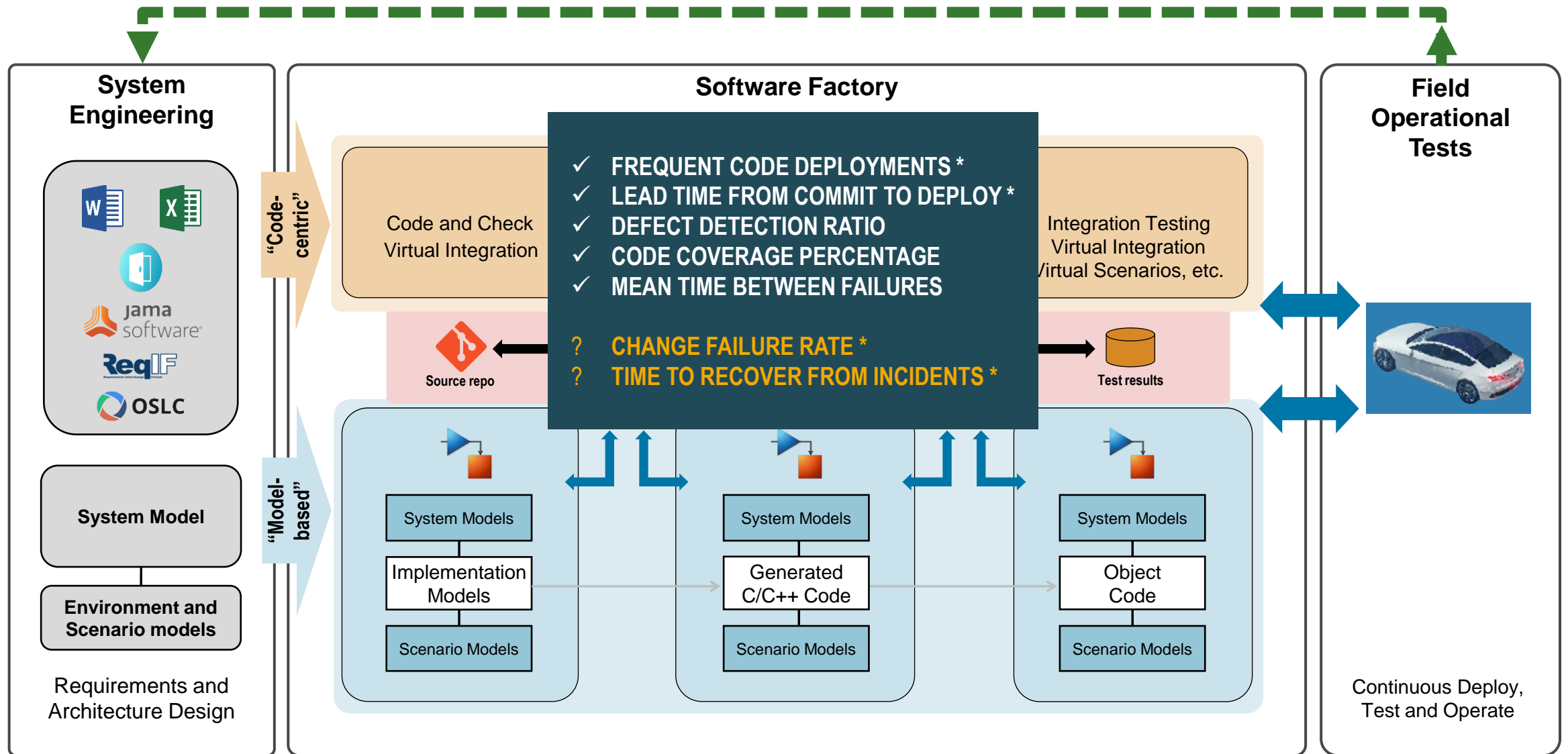
* DORA Metrics

Team Interactions: Complexity in technology, culture, and processes

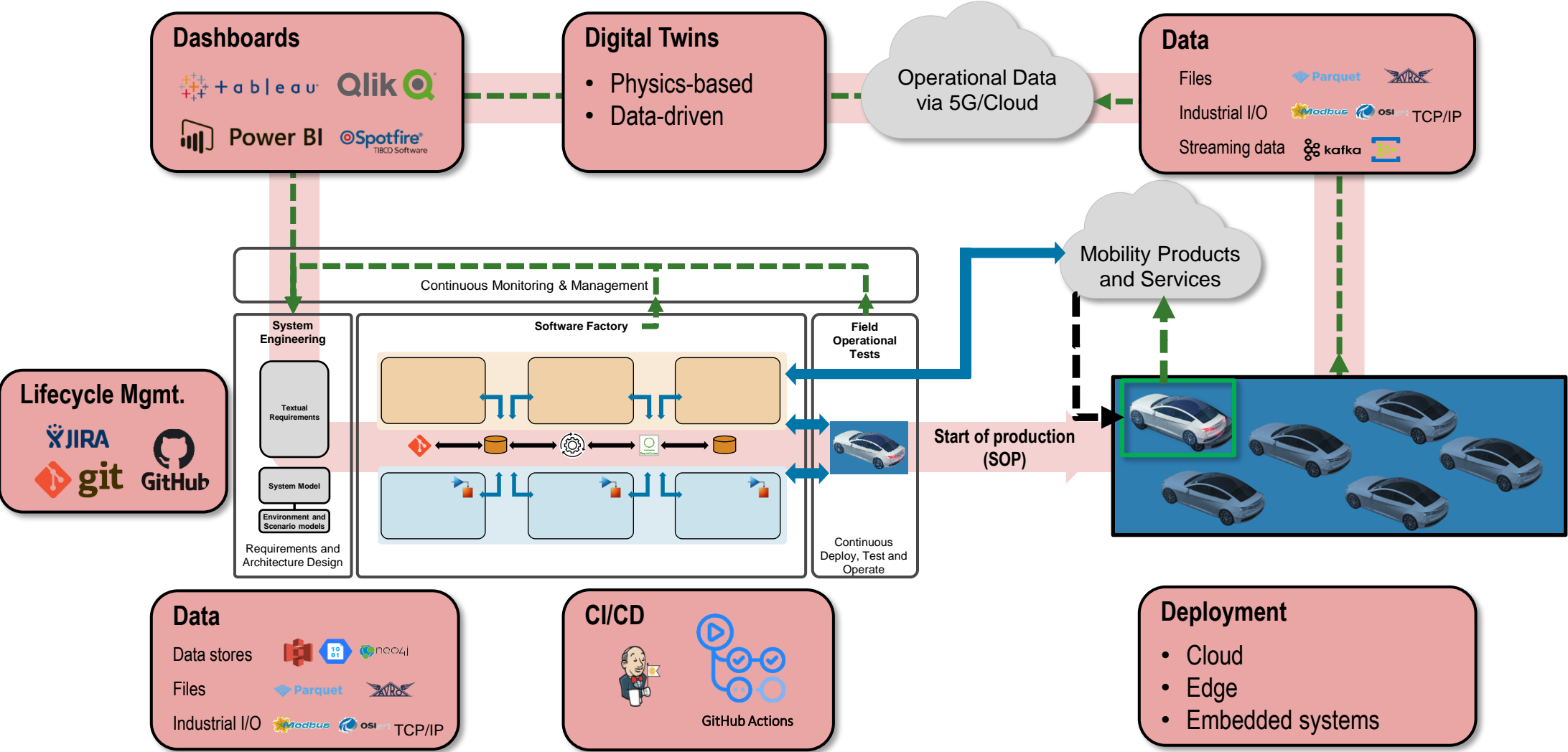


* DORA Metrics

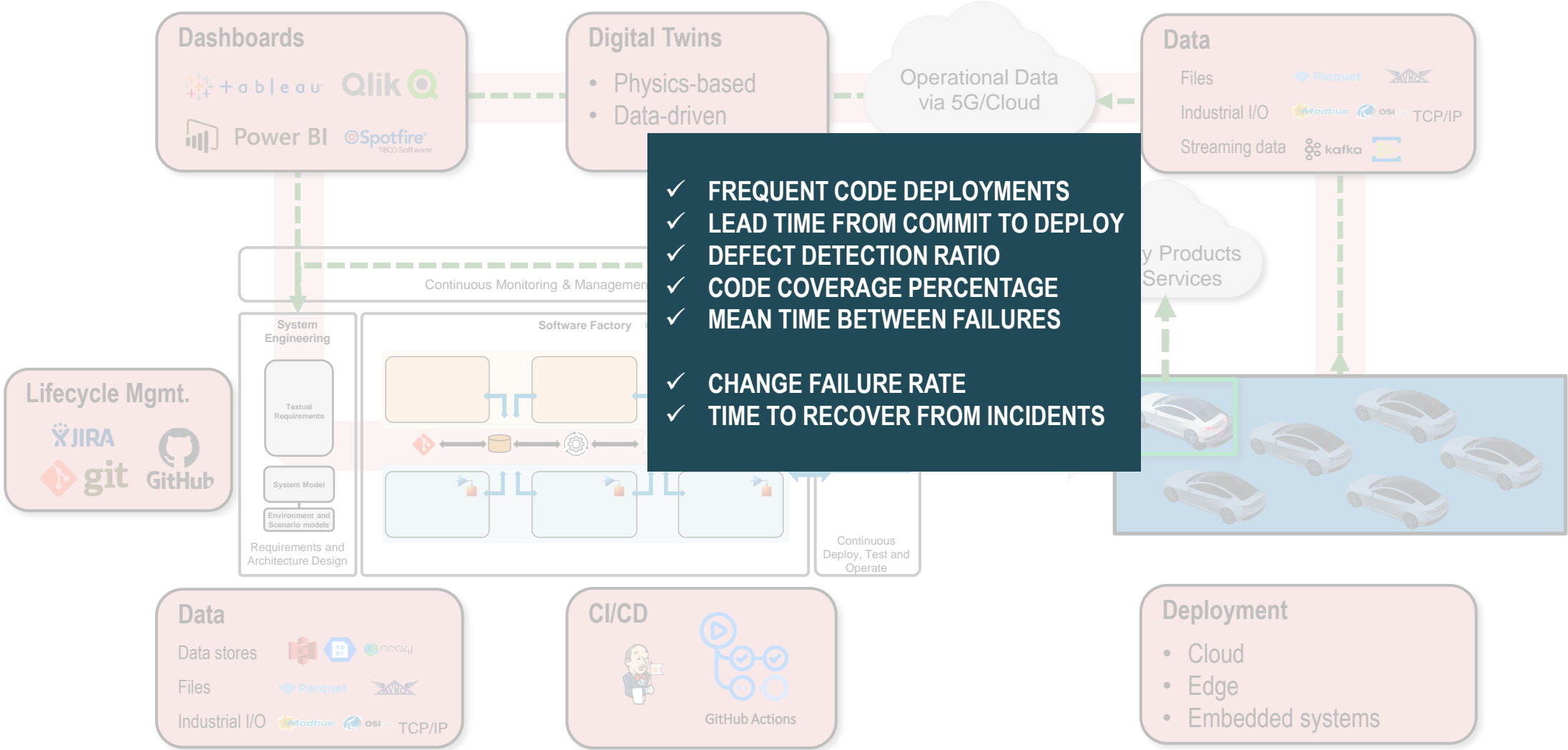
However, this only addresses part of the Big-Picture Goal



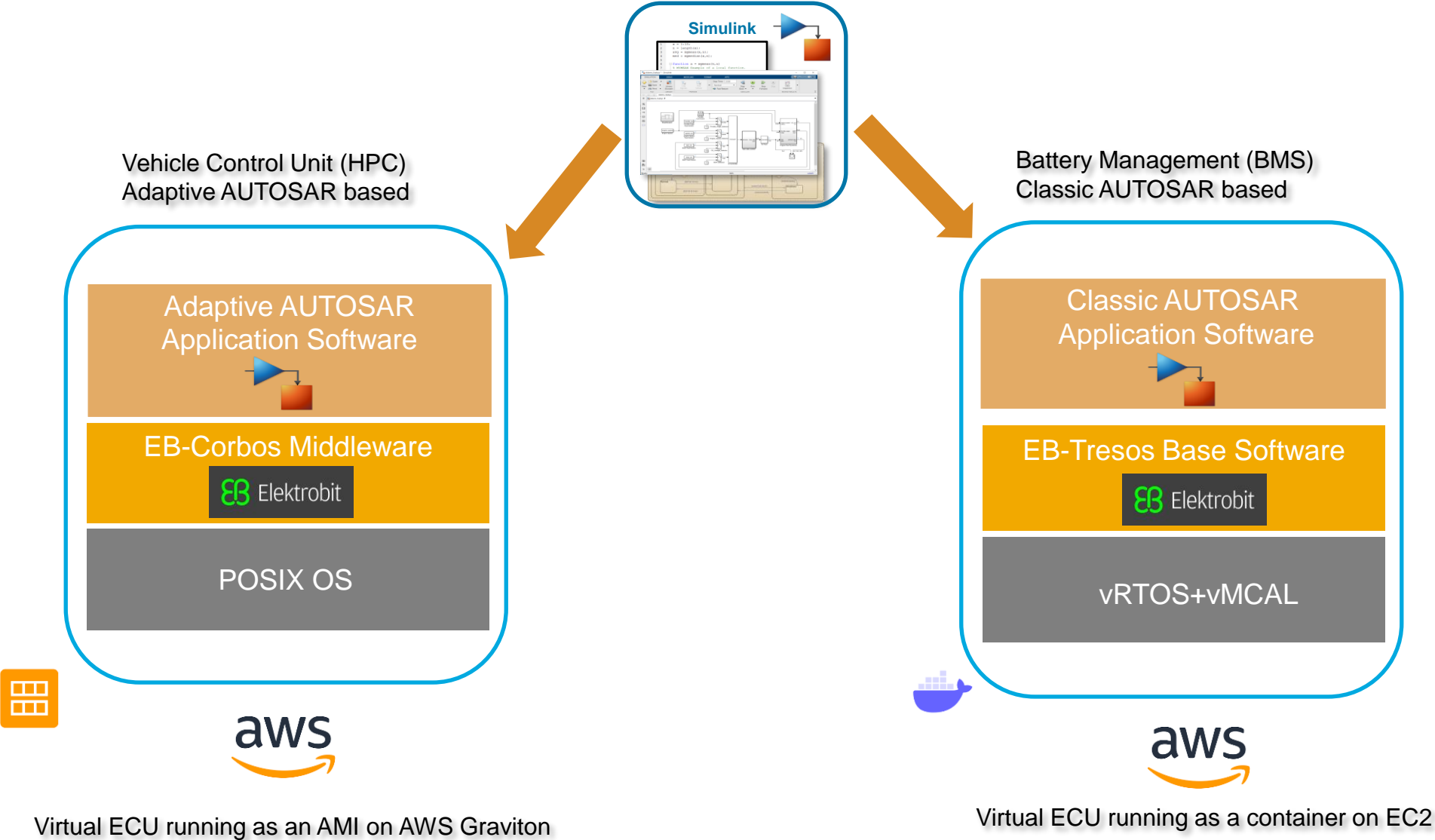
Accelerating Time to Recover from Incidents



A Broader Set of SDV DevOps KPIs



SDV Development in Action (Demo)



The path forward requires four strategic clusters of action:

1. **Process**

- Align software development and system engineering approaches

2. **People**

- Collaborative, building synergies with new teams
- Domain skills, re- and up-skilling the existing work force

3. **Methods**

- Agile, DevOps
- Parallelize and virtualize development
- “Software factory” mindset of development-process automation

4. **Standards**

- Legislative regulations, functional safety, cyber-security, AUTOSAR compliance, etc.