

# What is Product Line Engineering (PLE) and what's in for your company?

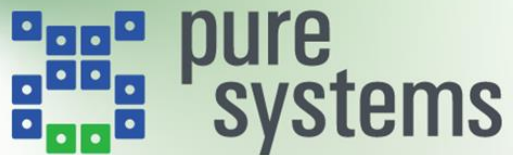


CSD&M, Beijing

October 30<sup>th</sup> 2023



# pure-systems acquired by PTC



# pure-systems at a glance – HQ in Magdeburg, Germany



Established 2001,  
Privately Held, HQ in  
Germany



Automotive,  
Aerospace/Avionics,  
Rail/Transportation,  
Industry Automation,  
Semiconductor



10+ OEM/Tier-1  
Automotive customer



Memberships  
AUTOSAR,  
INCOSE/GfSE,  
OASIS Open,  
prostep ivip,



Research projects  
SAFE, SPES-XT,  
VARIES, REVaMP<sup>2</sup>



Our partners in China:



**Teamlive**



**“The growing share of embedded software components  
brings high benefit,  
but also growing complexity to products”**

**“New challenges require new tools”**

**“Hardware and Software have different lifecycles”**

# Drivers for growing complexity

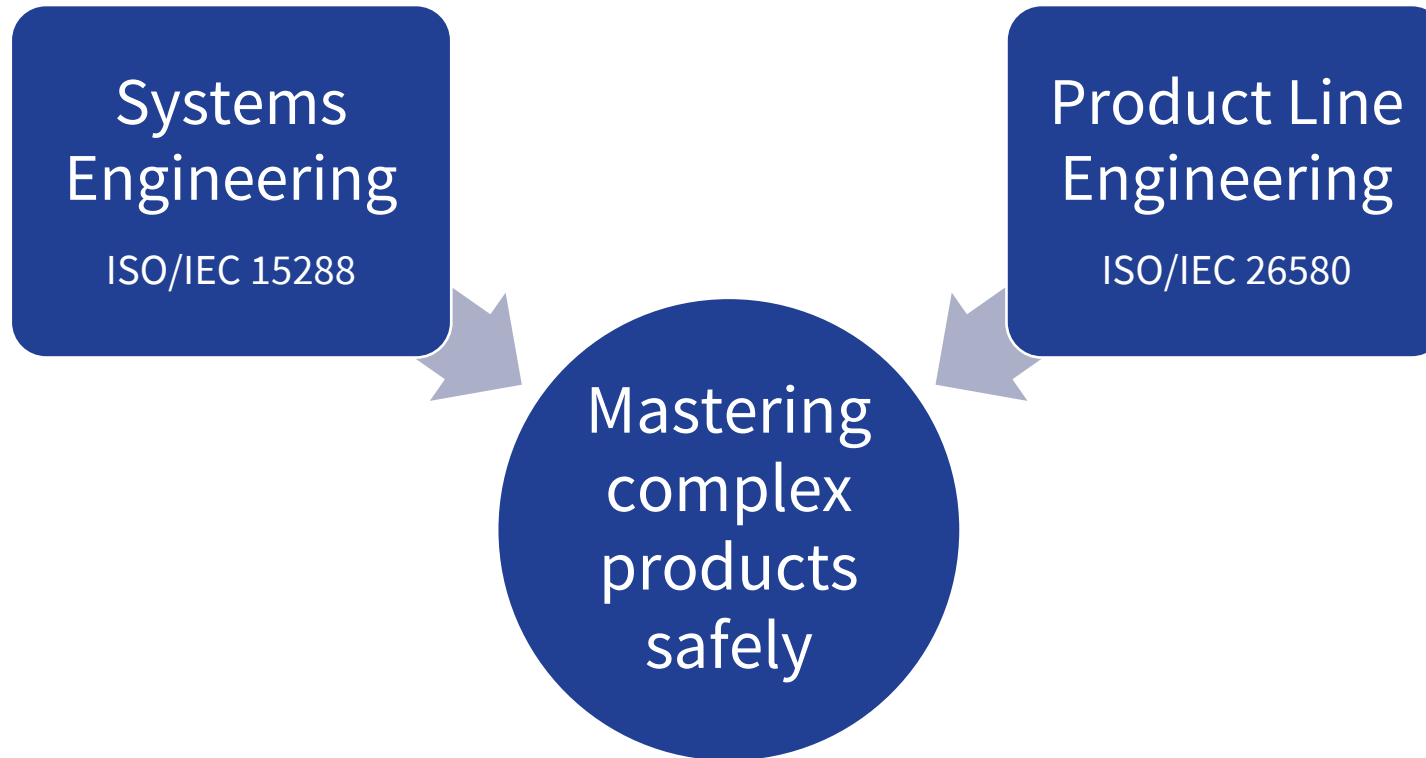


- Increasing demand for customized products
- Additional Features are more and more just a matter of software
- Customer expect improvements along the entire lifecycle of their product (E.g. Over-the-air Updates)
- New business models aim on upselling of new features & services for products which are already market.
- Considering laws and regulations for different international markets
- ...





# New challenges require new methods and tools



# Product Line Engineering



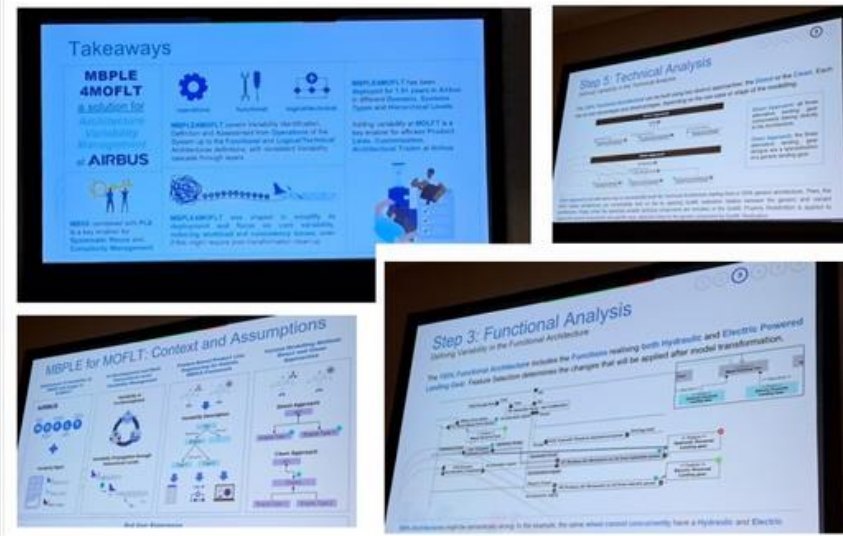
## Transforming Airbus through Product Line Engineering

"5 pillars provide capabilities to the business to create values on the program. The Product Line Pillar acquired for 2021 even higher priority in the realization of the Airbus Digital Transformation. The MBPLE foundation is developed to be applied to Airbus products, industrial systems and services."

**Marco Ferrogali**, VP Head of Modelling and Simulation DDMS at Airbus;  
**Marco Forlingieri**, Manager of Model Based Product Line at Airbus.

Source: 14th ESA Workshop on Avionics, Data, Control and Software, 22 October 2020

**Marco Forlingieri, IBM** (in 2022 Airbus) received the **INCOSE** Best Paper award for Variants modeling in **#PLE** (MBPLE) which was extended by **Raphael Henrique Madeira** and Davi Henrique de Sousa Pinto (both **Airbus**) with the title "Variability on System Architecture using **#Airbus** MBPLE for MOFLT Framework", while MOFLT is the Airbus layer of abstraction for Mission & Operational Analysis, Functional Architecture, Logical Analysis and Technical Architecture. It is a key enabler for efficient Product Lines, Customization, Architectural Trades at Airbus. 6 steps are necessary to be successful with this method. An easy example from a front aircraft front wheel was provided adding new variants in autonomous push back and wheel powered ground operation. Following the 5 steps of MOFLT in the 6 step the model transformation to generate 100% "clean" models representing the variants defined by feature selection is performed. **#incoselS** INCOSE EMEA





## Holistic Variant Management in MBSE Platform & Test Management

A successful reuse strategy for engineering assets largely depends on how well the knowledge about dependencies between configuration decisions and variability in engineering assets is explicitly managed. Feature-based Product Line Engineering as it is defined in the ISO 26580, is a mature approach to cover this topic holistically for the whole ALM development lifecycle.

Therefore, the leading Product Line Engineering tool pure::variants was chosen for implementing holistic variant management in the MBSE and Test Management platforms, covering variability on both sides of the V-Model and consistently managing variation points on vehicle, system and component level. With its new web UI and its OSLC capabilities it seamlessly fits into the engineers' workflows in those collaborative platforms and increases the reuse rate of engineering assets in the Mercedes-Benz product lines.

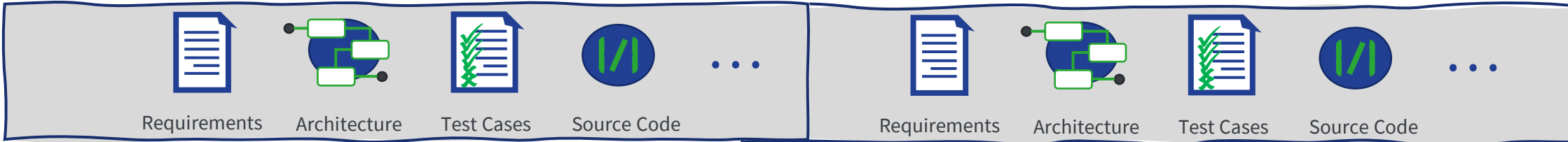
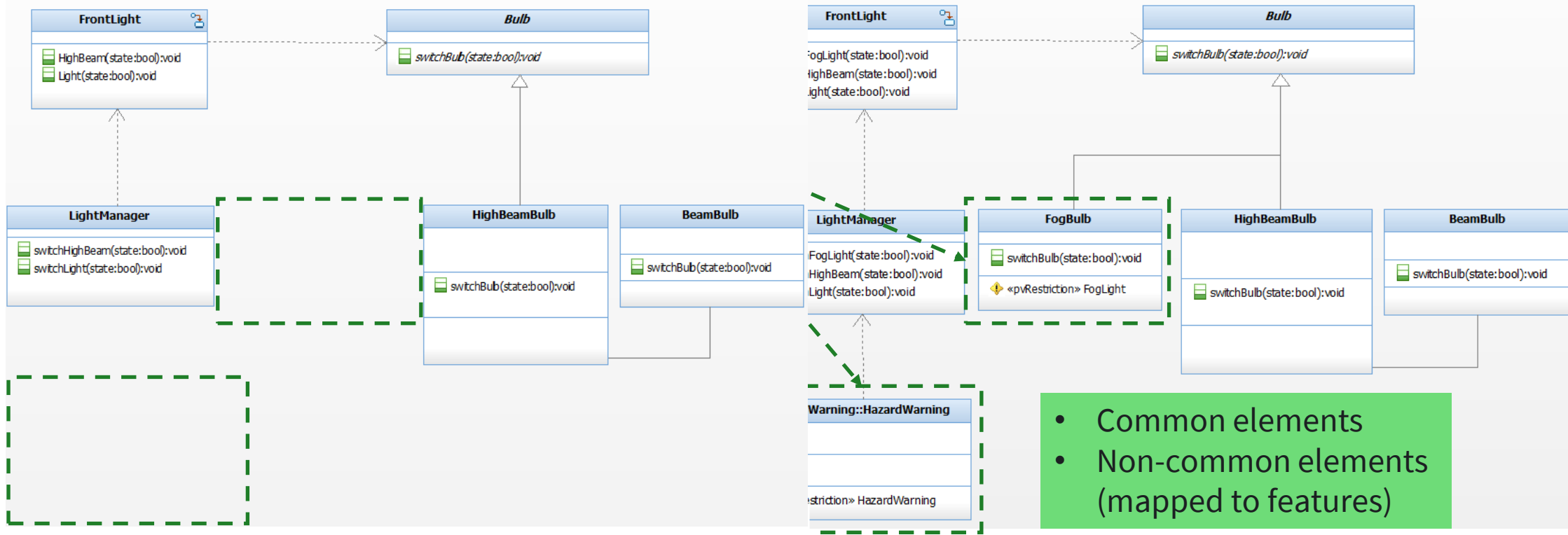


# Product Line Engineering Approach

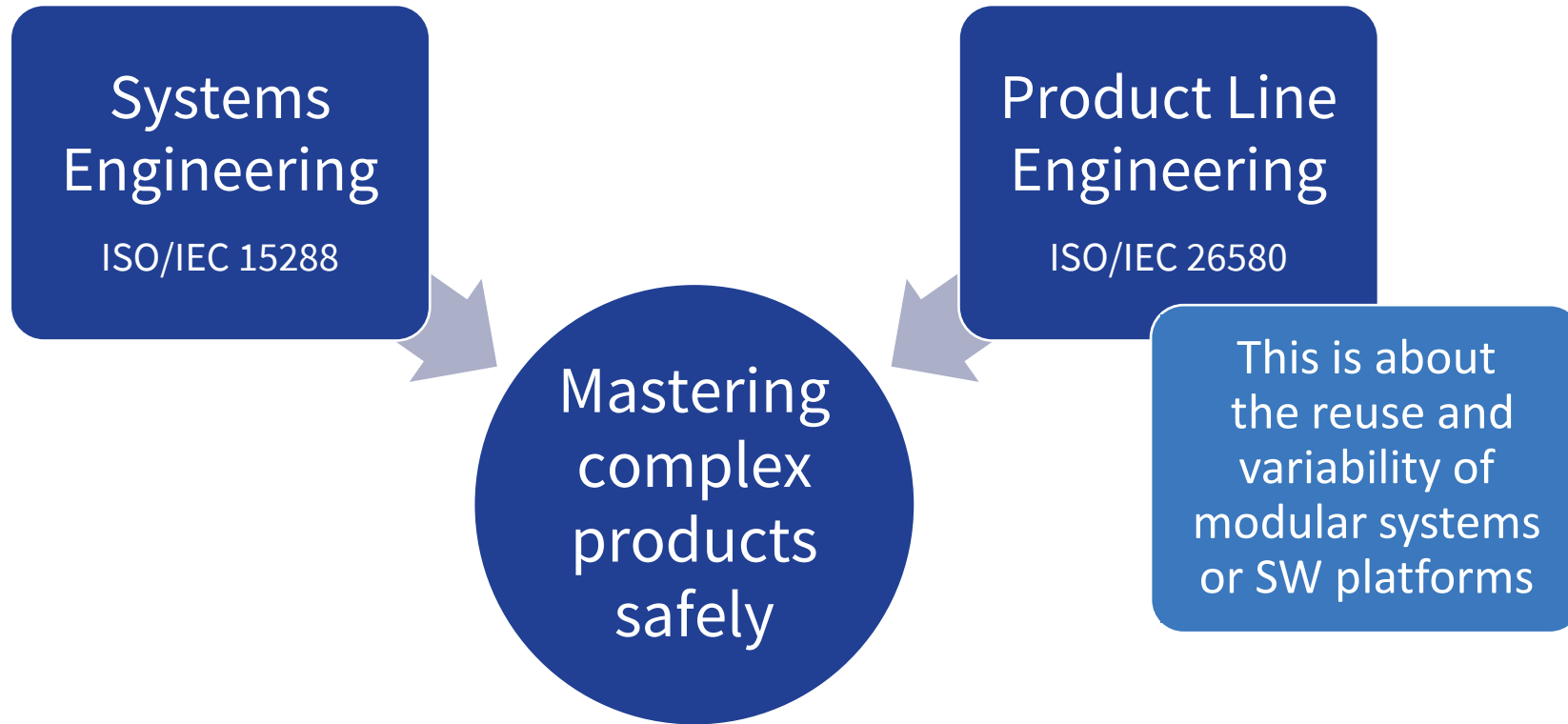


ISO 26580

## An Example of **Product Asset Instance** for Architecture Example of **Shared Asset Supersets** for Architecture

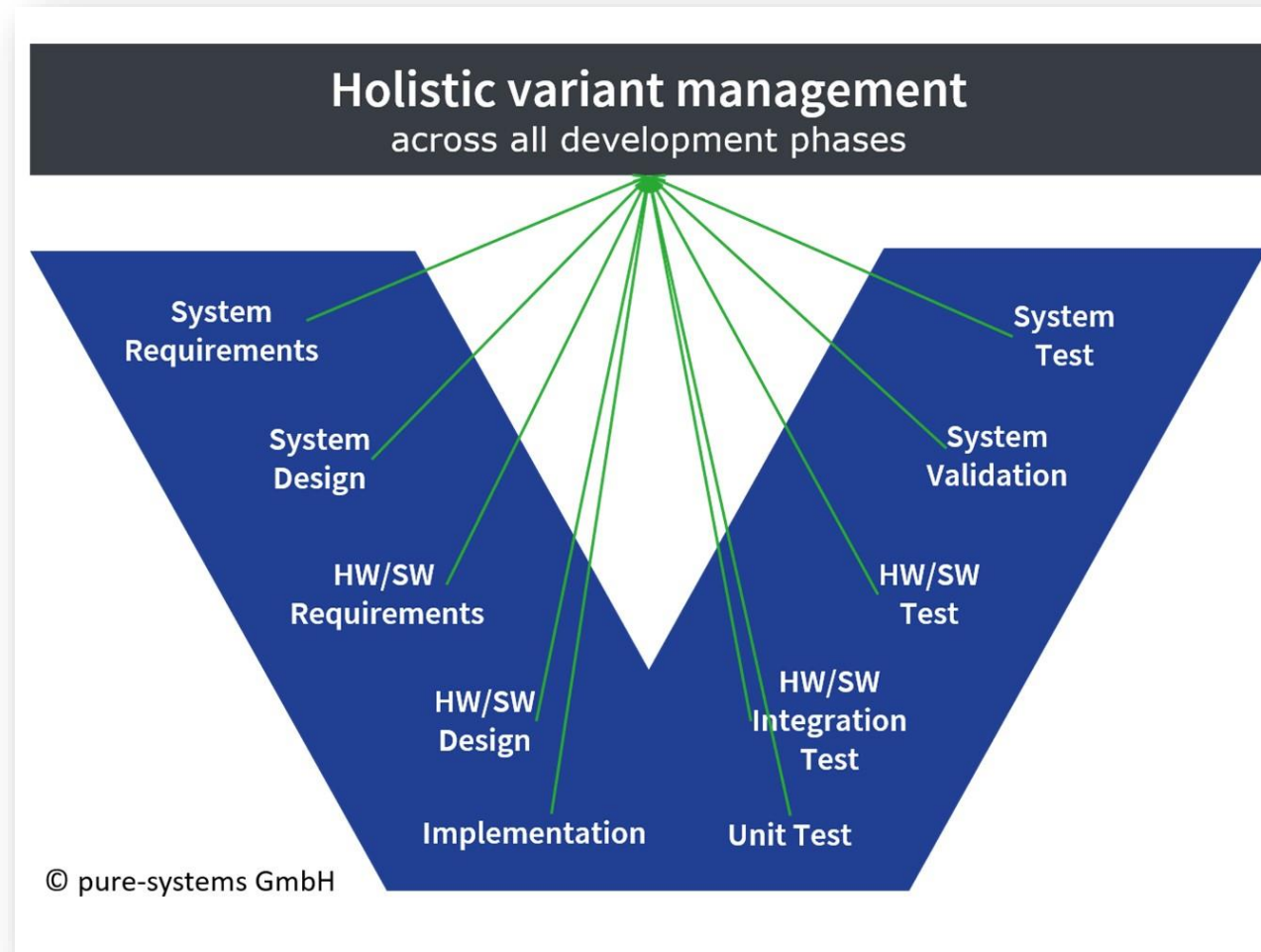


# New challenges require new methods



PLE requires a tool to manage a large number of variants in a traceable, safe and efficient way.

# Mastering variability significantly better





 pure  
variants

Start video



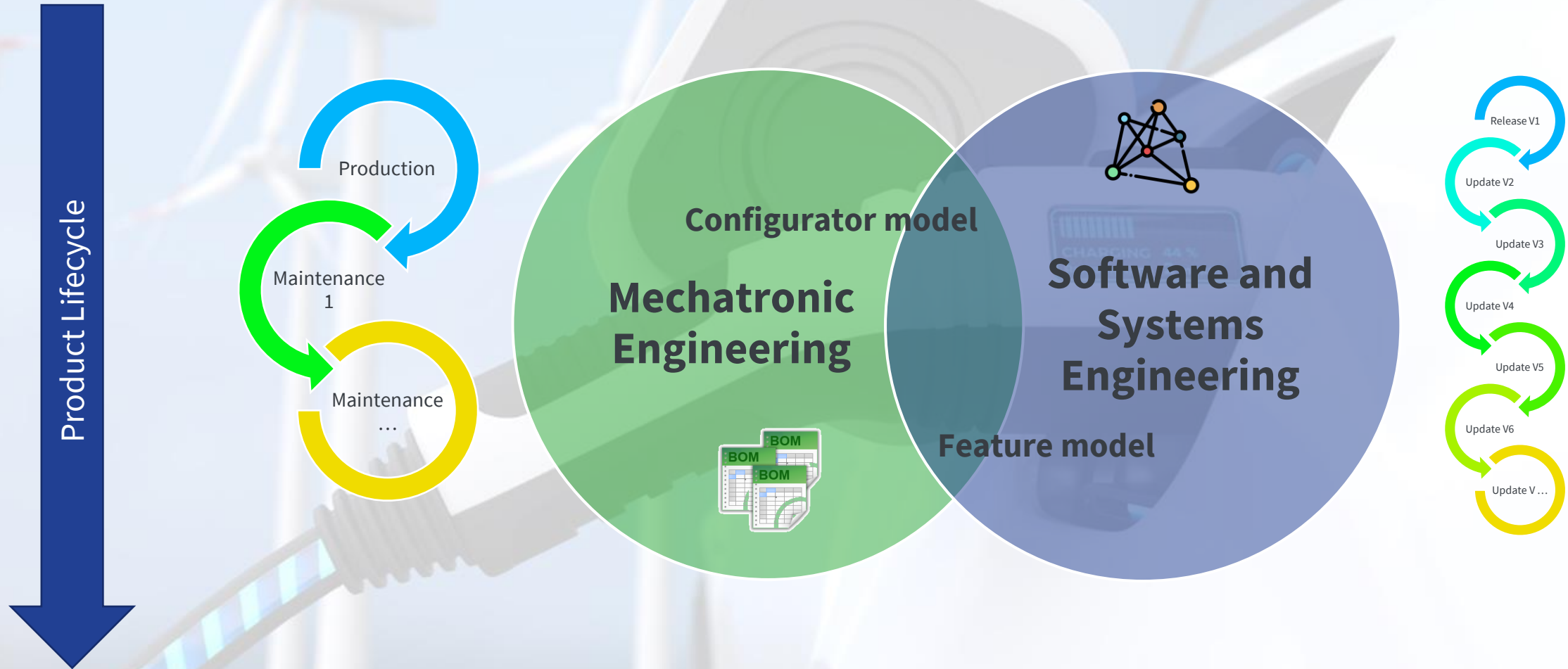
# Standard Connectors to leading engineering tools





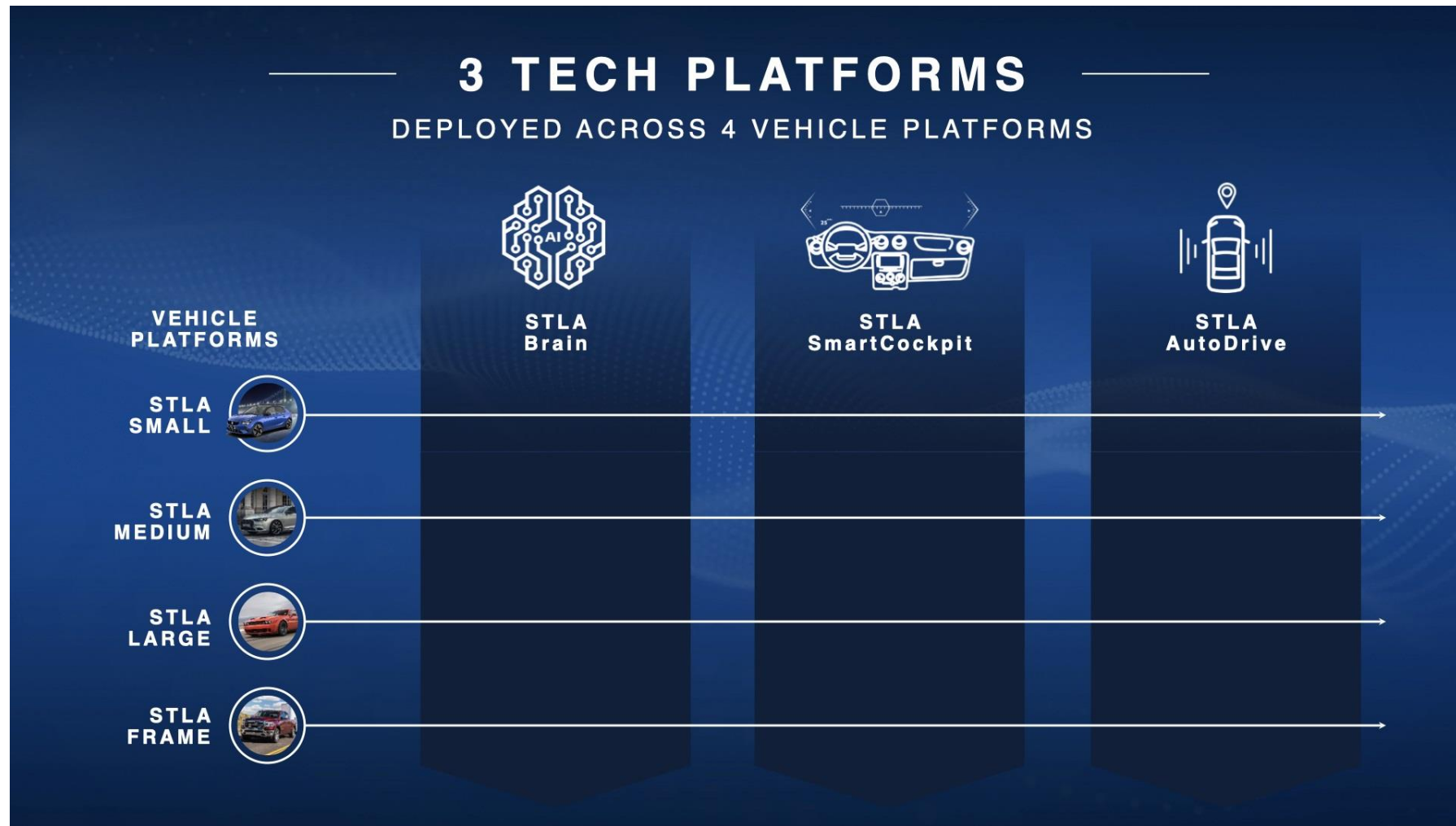
# “Hardware and Software have different Lifecycles”

# Hardware and Software Variability – Two sides of the same medal



Picture: Freepik.com

# Example: Stellantis Software Strategy



Source: Stellantis Software Day 2021



# What's in for your company?



- ✓ Reduce time to market
- ✓ Increase reuse rate of engineering assets
- ✓ Increase quality of engineering assets
- ✓ Persistent knowledge
- ✓ Scalable approach
- ✓ Enable data-driven decision making
- ✓ Reduce engineering maintenance effort

# Thank You!



We are looking forward to  
meeting you on our booth!

[www.pure-systems.com](http://www.pure-systems.com)



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