

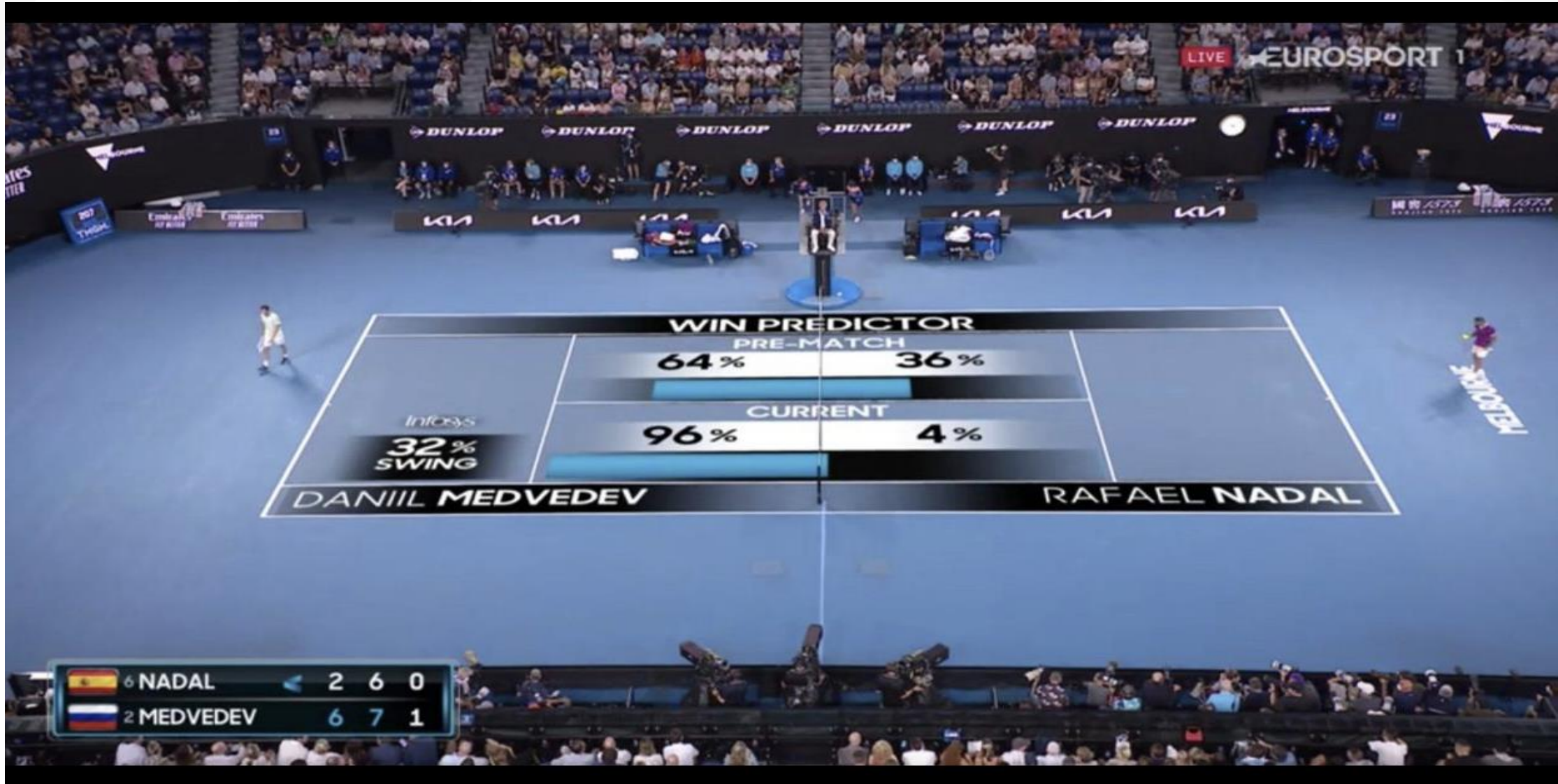


System and Software Development using MathWorks Products for Digital Product Development

Innovations in the last 100 years



Volatility, Uncertainty, Complexity and Ambiguity



Future Mobility – Impact on Systems & Software Engineering



costs hybrid e-motor
eBike power electronics

electrified

plug-in eScooter range
fun-to-drive battery
charging infrastructure



legislation driver assistance
emergency braking autopilot

automated

highway-pilot sensors
redundancy electric steering
valet parking

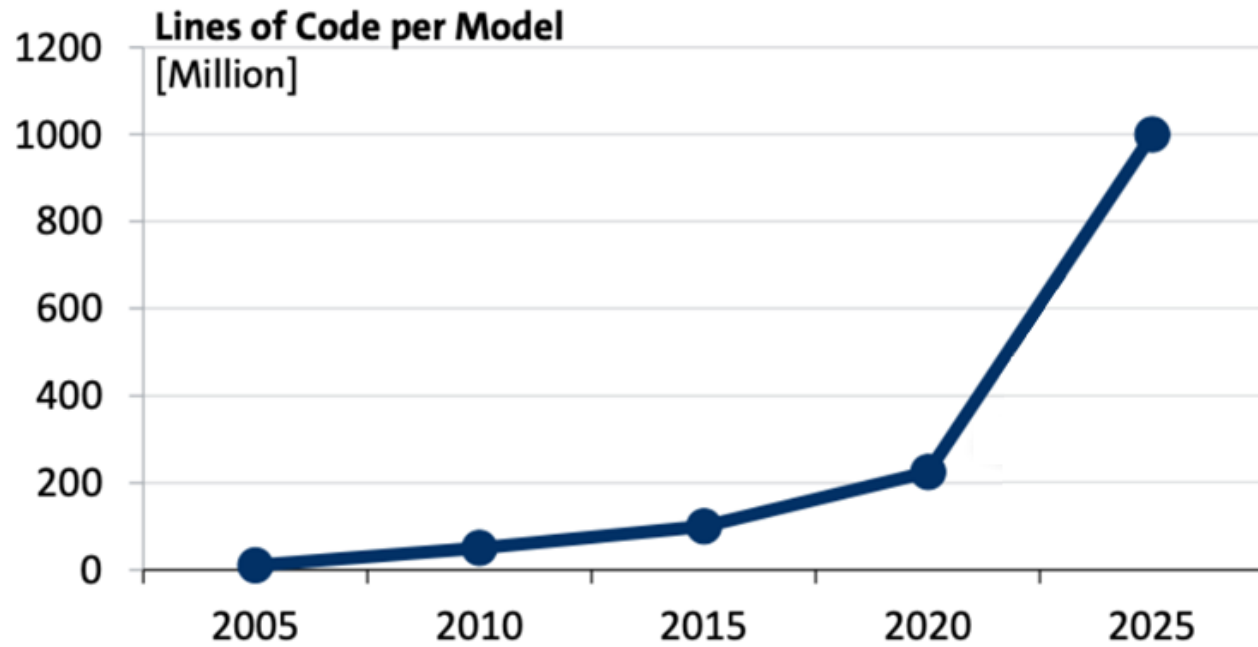


electronic horizon
smartphone integration

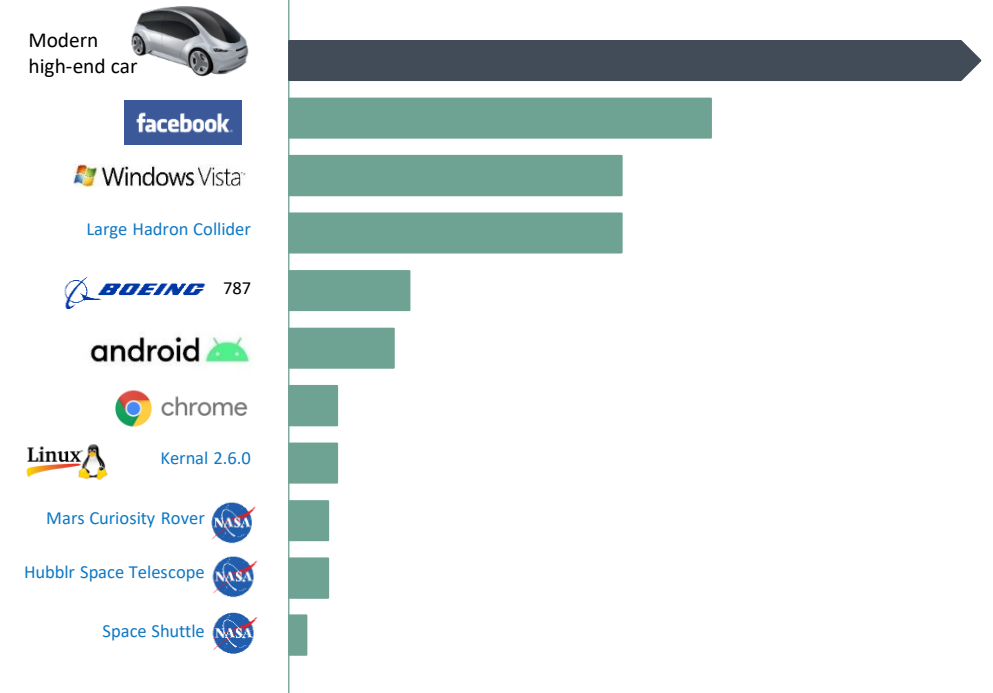
connected

eCall cloud
services fleet management
car2car augmented reality

Future Mobility – Impact on Systems & Software Engineering



Source: Volkswagen



Source: ATZ "The EE Architecture for Autonomous Driving, A Domain-based Approach"

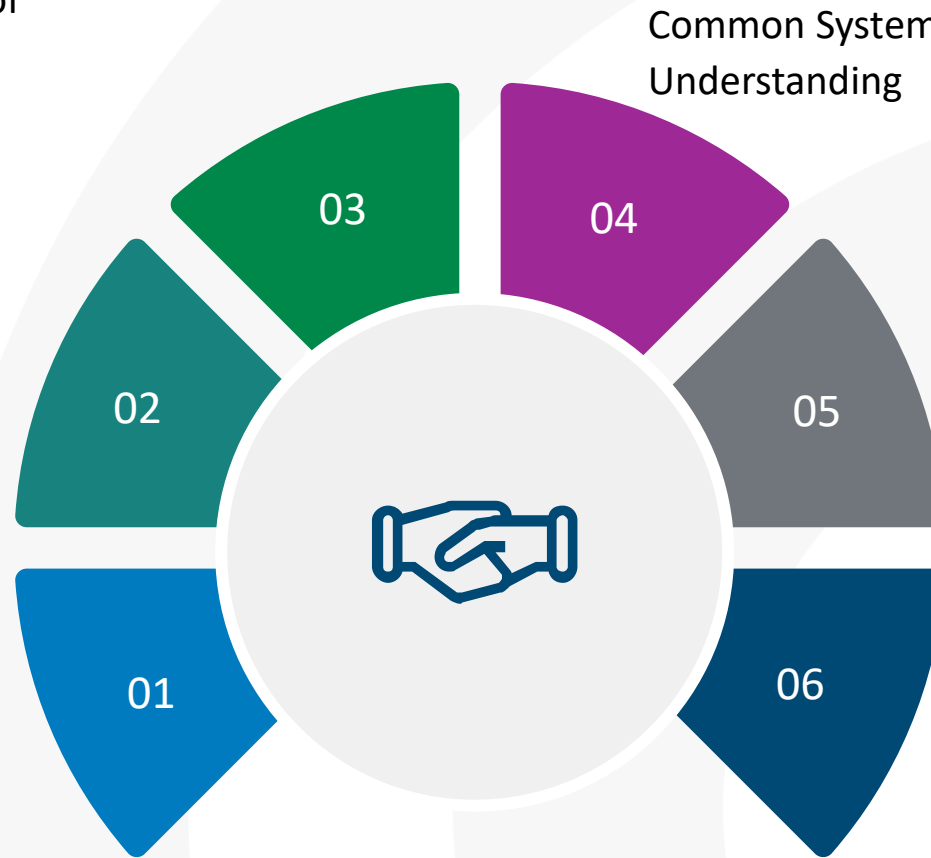
Key Challenges

- ▶ Challenges in transforming from document centric to model centric way of development
- ▶ Synchronization between Systems & Software Engineering

Increased Number of Interfaces & elements

Each engineering task creates a new copy of a part of the product knowledge

- Product description is inconsistent
- A lot of duplicated work



Common System & Software Centric Understanding

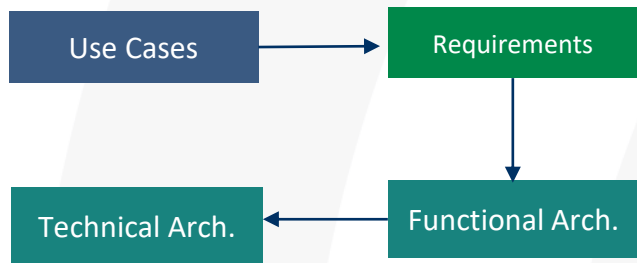
Shorter Time to Market

Interdisciplinary Communication & Collaboration required

Advanced Engineering Methods & Tools required to address complexity

MBSE is a proven approach to develop complex systems Successfully

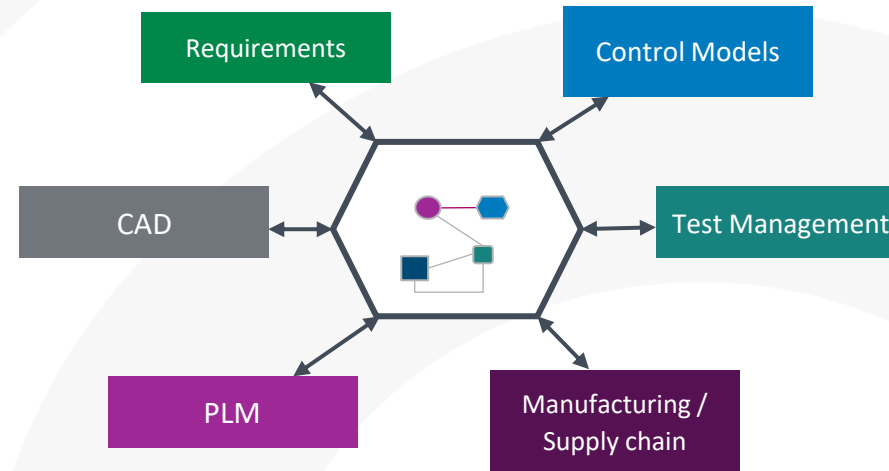
Approach to Drive Engineering Transformation



Move Towards MBSE



System Model is at the center of Product Development



Model Centric Development

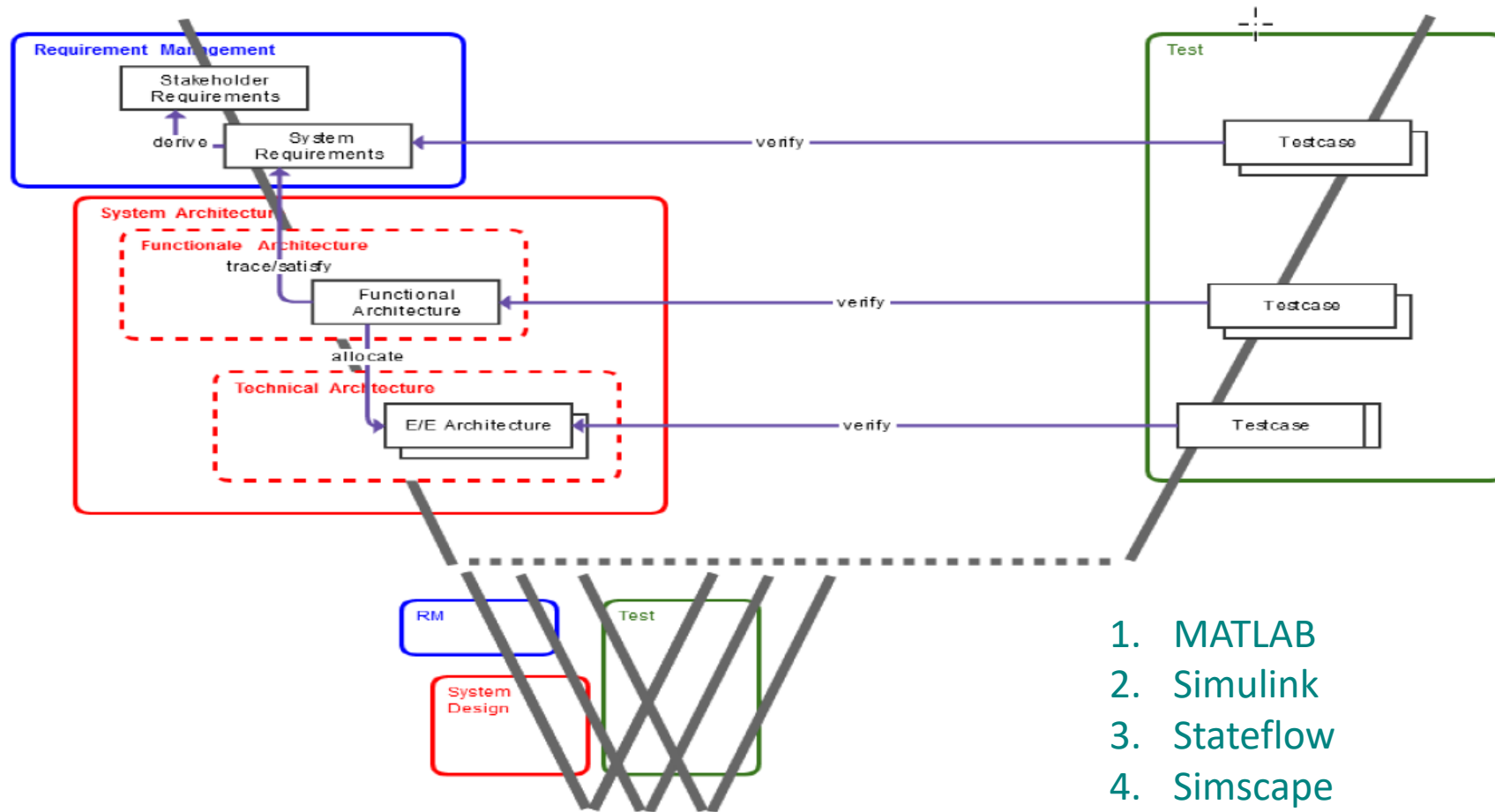
Tools Used

Simulink
Requirements

System
Composer

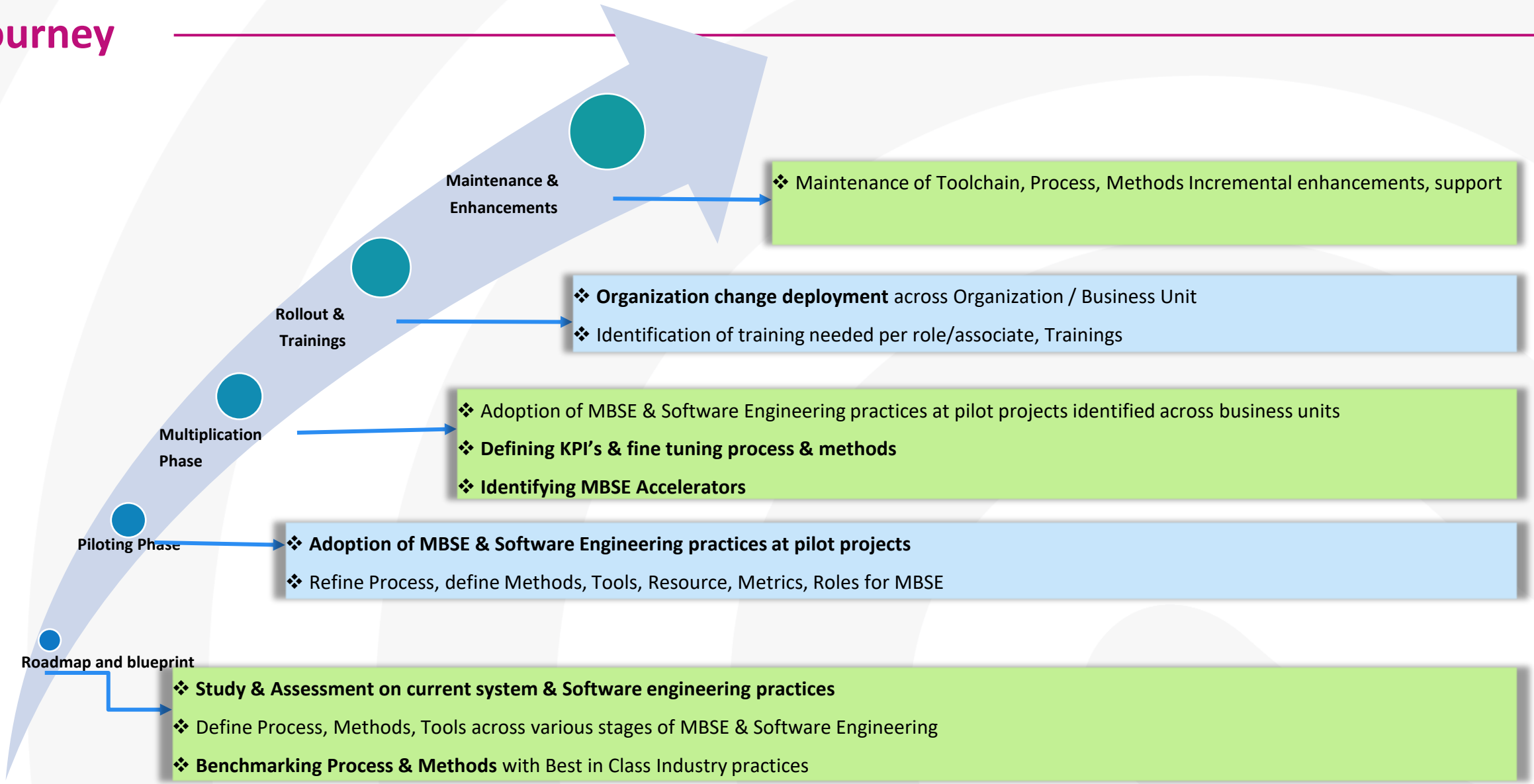
Vehicle Level

Component Level



1. MATLAB
2. Simulink
3. Stateflow
4. Simscape
5. Embedded Coder
6. Simulink Test
7. Polyspace Code prover
8. Simulink Design verifier

Journey



Realization of System & Software Development using MathWorks Products

Benefits

- ❖ Systems Engineering Methodology adopted to provide a structured approach to solve complex engineering challenges
- ❖ Tools from MathWorks like System Composer is been used to define digital blueprint for our engineering systems
- ❖ Dynamic behavior of our systems are verified using MATLAB – Simulink during early stages of our development life cycle via modeling & simulation techniques
- ❖ Generated production code from models to improve efficiency & quality
- ❖ Easily achieved traceability between System & other multi disciplinary elements (Software – Hardware & Mechanical). Eliminated manual traceability & improved with new features like suspect linking & others
- ❖ Overall development time was reduced by 30-40%

Adoption of System Composer & Toolboxes from MathWorks Products Family

Thank you!

Bosch
Global
Software
Technologies
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