

MathWorks  
**AUTOMOTIVE  
CONFERENCE 2023**  
India

# The Transformative Journey of Software-Defined Vehicles with Model-Based Design



Prasanna Deshpande  
Moderator  
MathWorks



Aaswad Kulkarni  
TCS



Sivakumar Uppaluri  
Volvo



Bhanu Prakash  
Padiri  
Continental



VOLVO



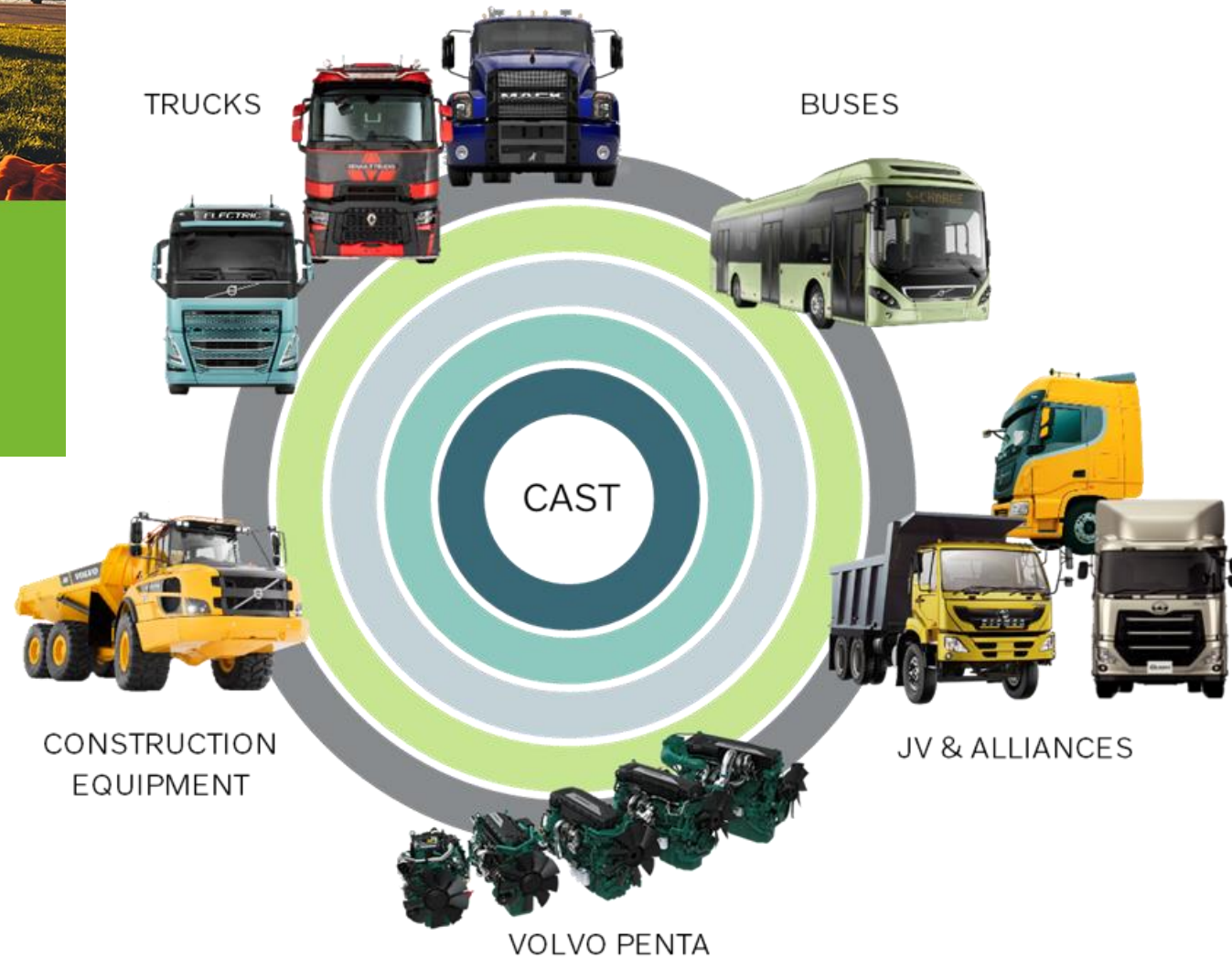
COMMITTED TO DRIVING PROSPERITY

100%  
safe

100%  
fossil-free

100%  
more  
productive

Common Architecture and Shared technologies



# Software Defined Vehicle

## Impact on Tier 1 suppliers



### Addressing Stakeholder Needs

- › Continuous Evolution (Digital Lifecycle)
- › V2X & Cloud Integration
- › Time2Market
- › Integration of 3<sup>rd</sup> party SW
- › Safety, Security & Privacy



### Impact to Architecture

- › Decoupling Hardware from Software & Services
- › Compute Centralization
- › Separate I/O from Compute
- › Cloud / IoT Integration
- › Platform & Interface Standardization



### Drivers, Differentiators & Portfolio

- › Driven by customer experience
- › Software as main differentiator, innovation driver & asset
- › Ability to provide solutions and integrate across IoT stack
- › Scalable platforms and re-usable building blocks

# Car as a Digital Product



## Feature on Demand

- Digital Service Catalogue
- Subscription based Services - AD & Connected features

## Data Driven Service

- Mass personalization
- Intelligent feedback
- Software-defined performance

## Purpose Built Vehicles

- Extended Living Space
- Entertainment, workplace
- Last mile delivery

## Immersive Experience

- Integrated cockpit
- Enhanced heads-up display

## Major Impact

Business Model

Recurring Revenue

Organisation

In-house SW, Collaborations

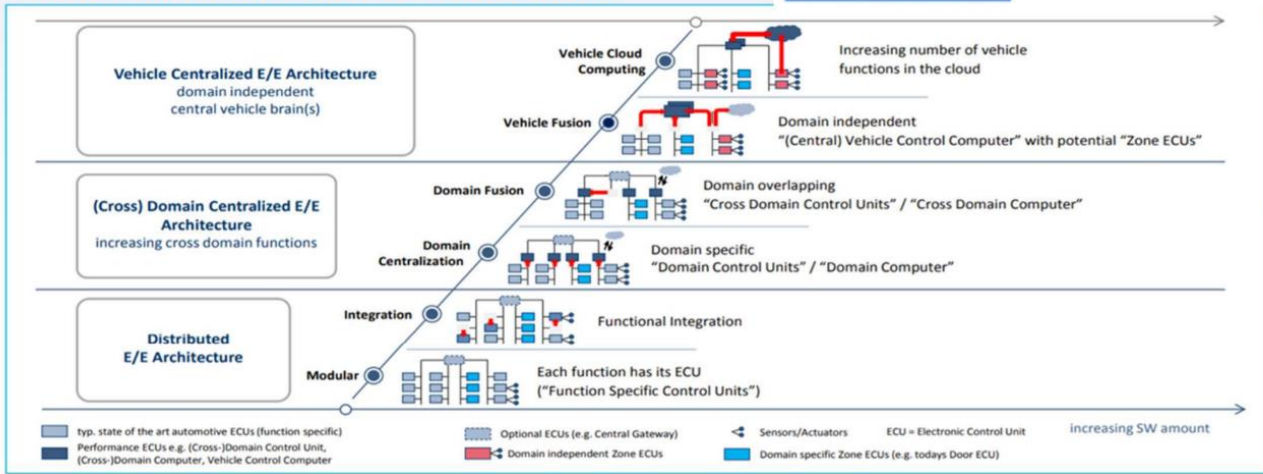
Technology

HPC, Edge, Cloud

Paradigm shift from Hardware-Focused to Software-Defined Vehicles

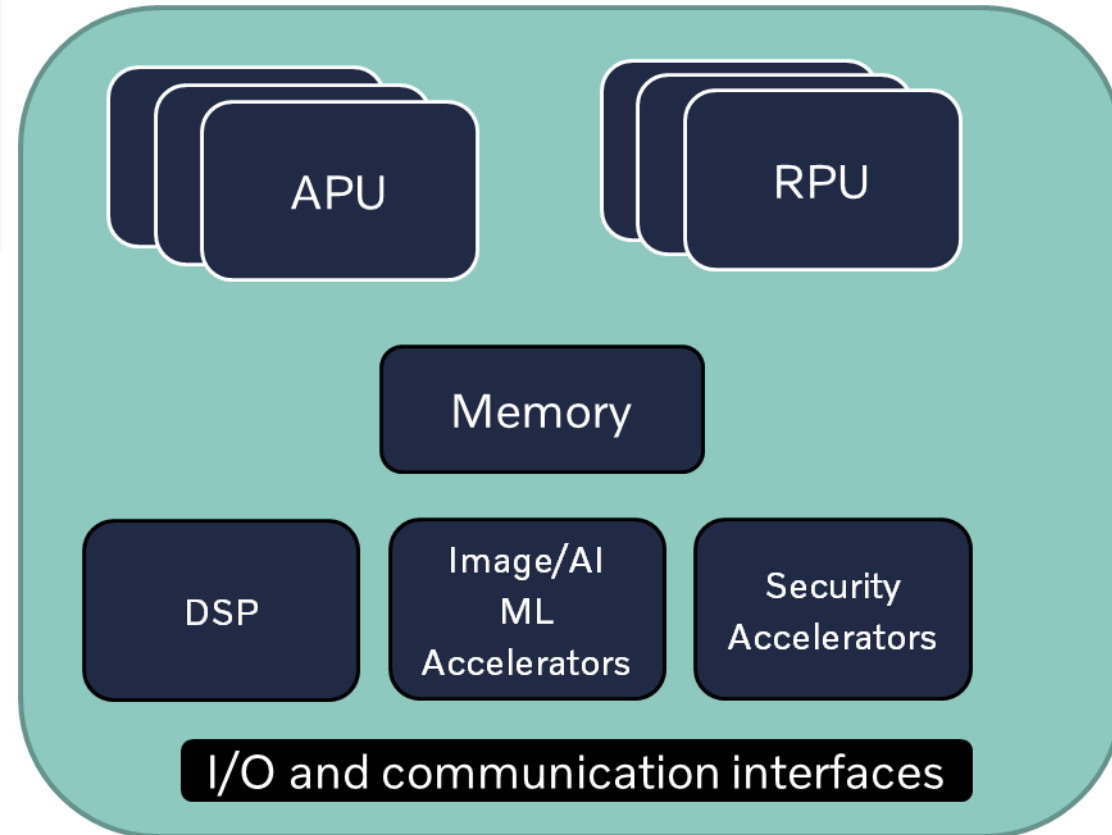
# Differences in the design philosophies

## Trends of Future EE Architectures...



Reference: <https://www.gsaglobal.org/wp-content/uploads/2019/05/Trends-of-Future-EE-Architectures.pdf>

## System on chip



### One HW - One Domain



### One HW - Several Domain's



# Major Elements for SDV realization



Cloud Services

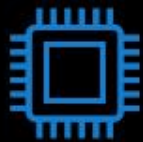


Vehicle Applications

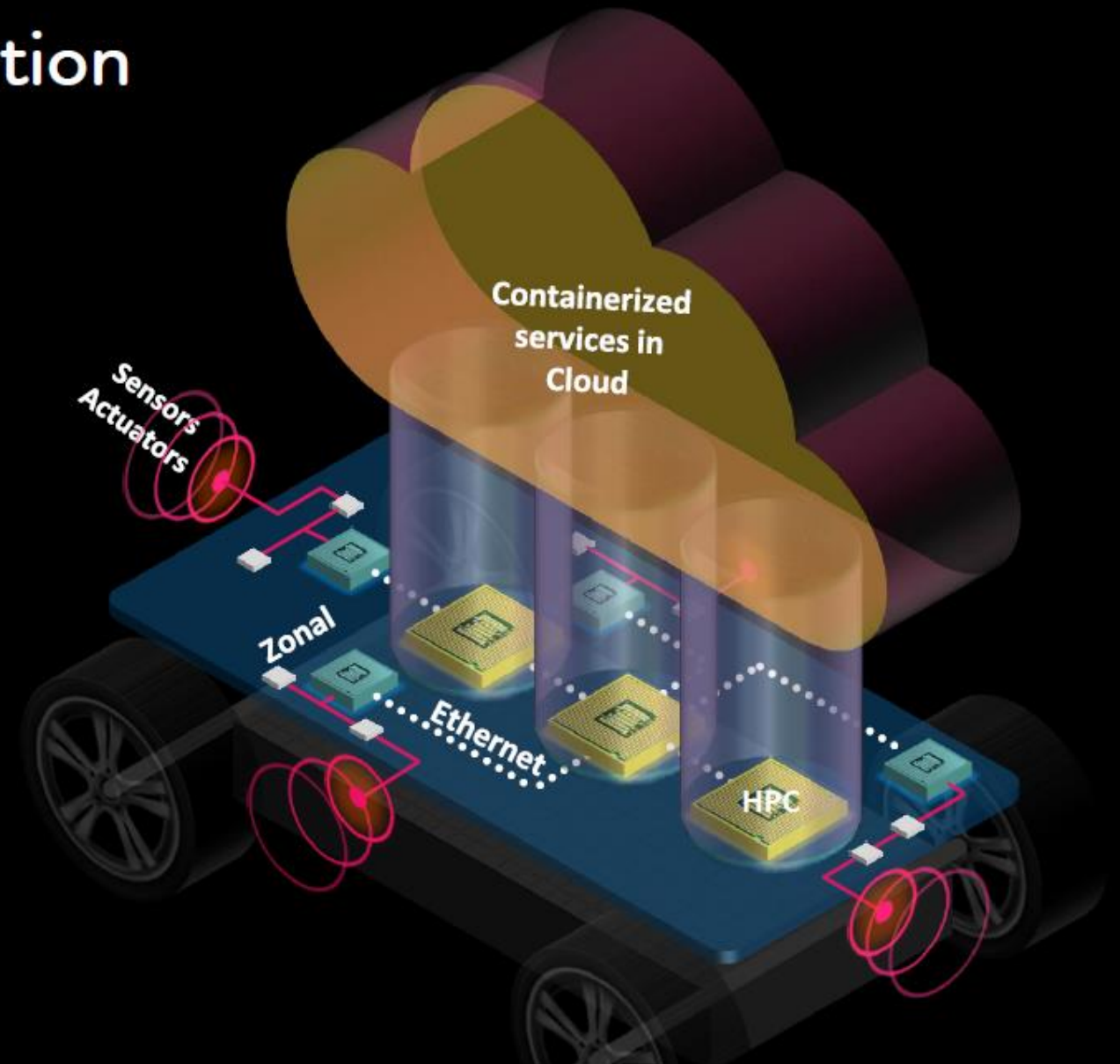


Platform

- Middleware, Diagnostics, Security
- Operating System & Virtualization



E/E architecture & Hardware



Discreet & Flexible Services enabling New ways of Customer Value

# Software Defined Vehicle

## Managing complexity through Partnerships



Google Cloud



aws

Cloud



Aurora

### MOBILITY SYSTEM SOLUTIONS



SOFTWARE

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AMBARELLA

HARDWARE

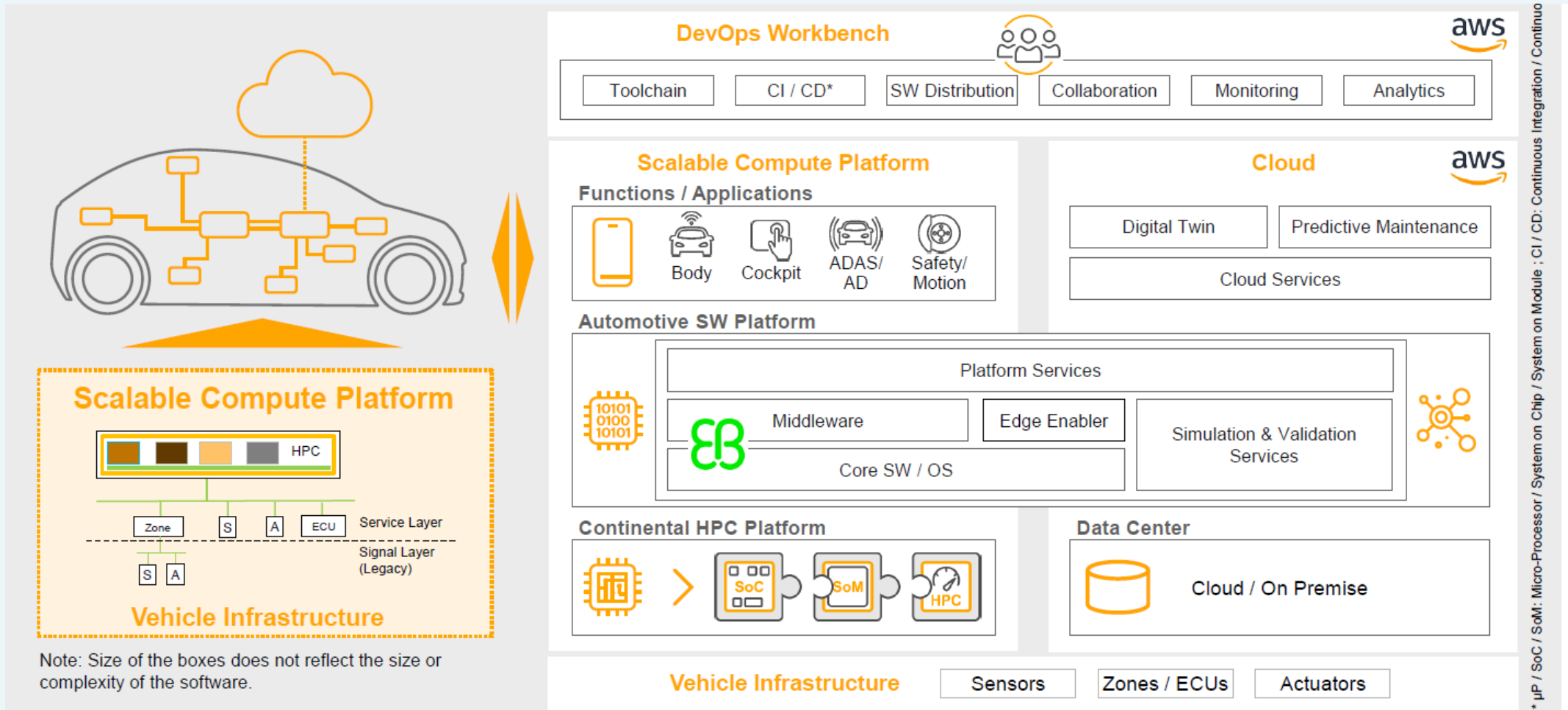
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SOCS/PLATFORM

AMBARELLA SOCS + SDK

# Software Defined Vehicle

## Continental Automotive Edge Framework: Road to Cloud Ecosystem

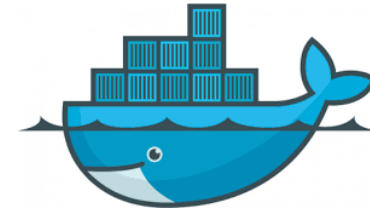
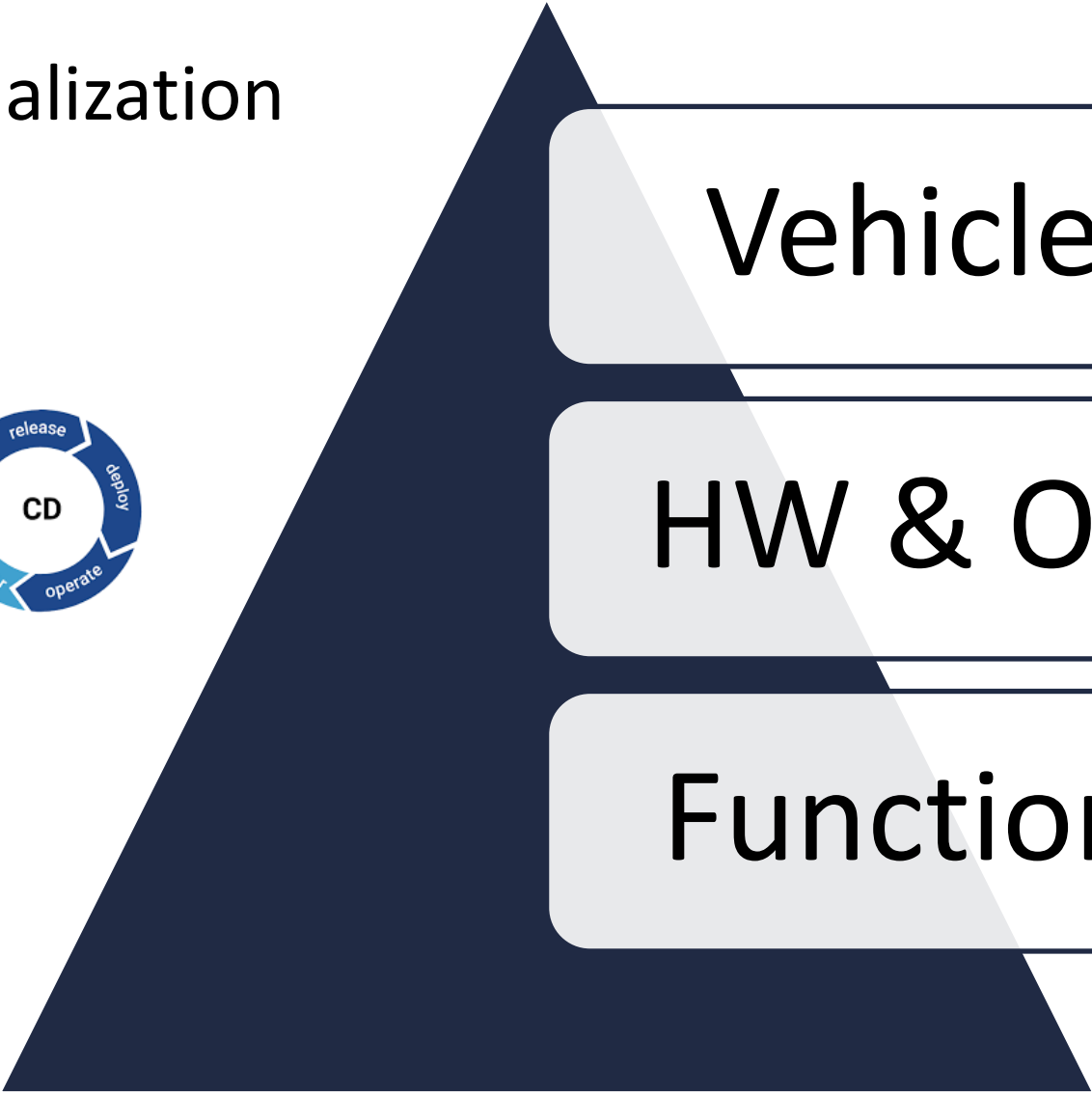
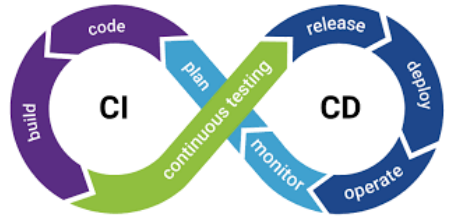




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# Virtualization



# Software Defined Vehicle

## Virtual ECU's

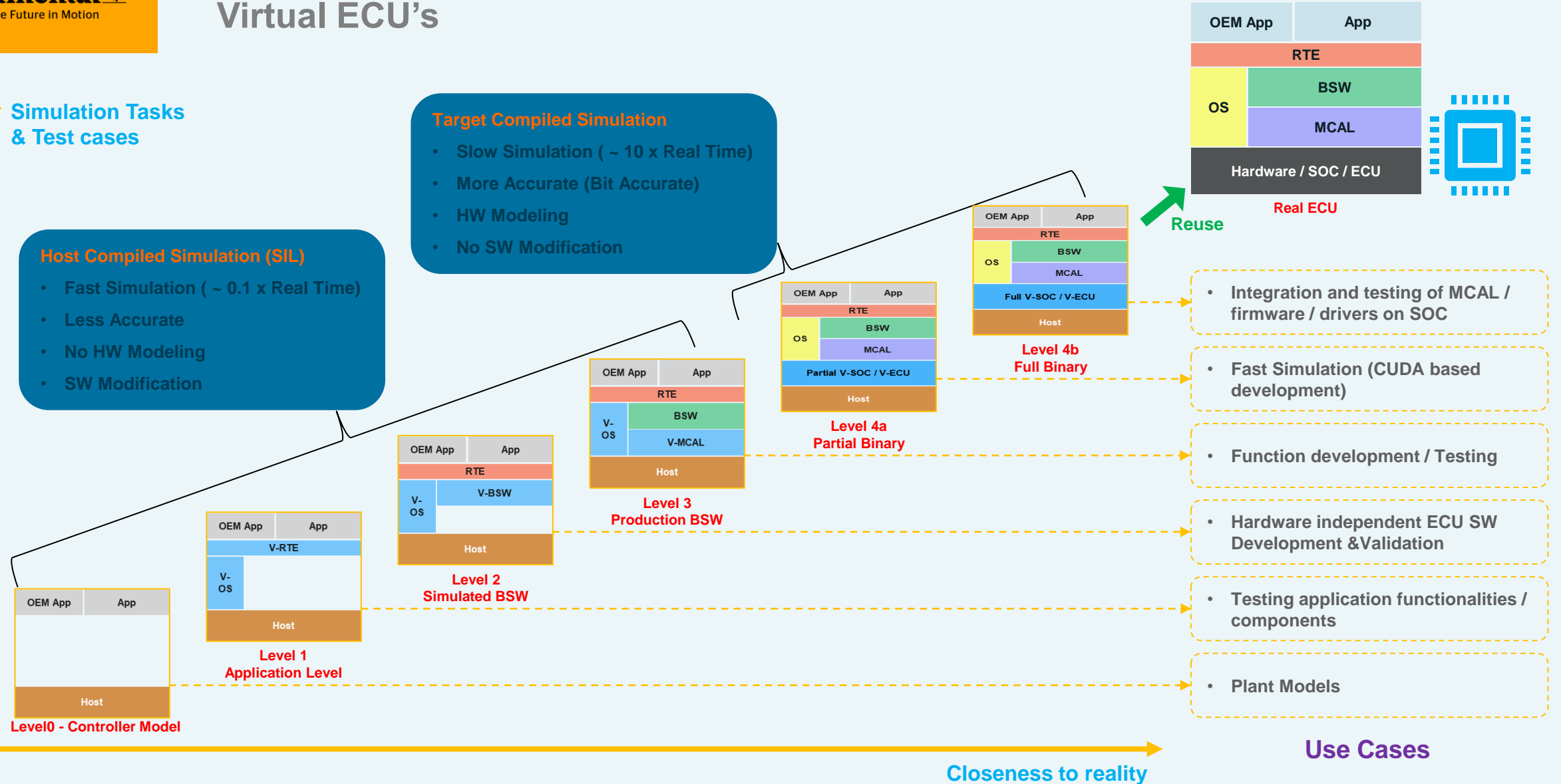
### Simulation Tasks & Test cases

#### Host Compiled Simulation (SIL)

- Fast Simulation (~ 0.1 x Real Time)
- Less Accurate
- No HW Modeling
- SW Modification

#### Target Compiled Simulation

- Slow Simulation (~ 10 x Real Time)
- More Accurate (Bit Accurate)
- HW Modeling
- No SW Modification



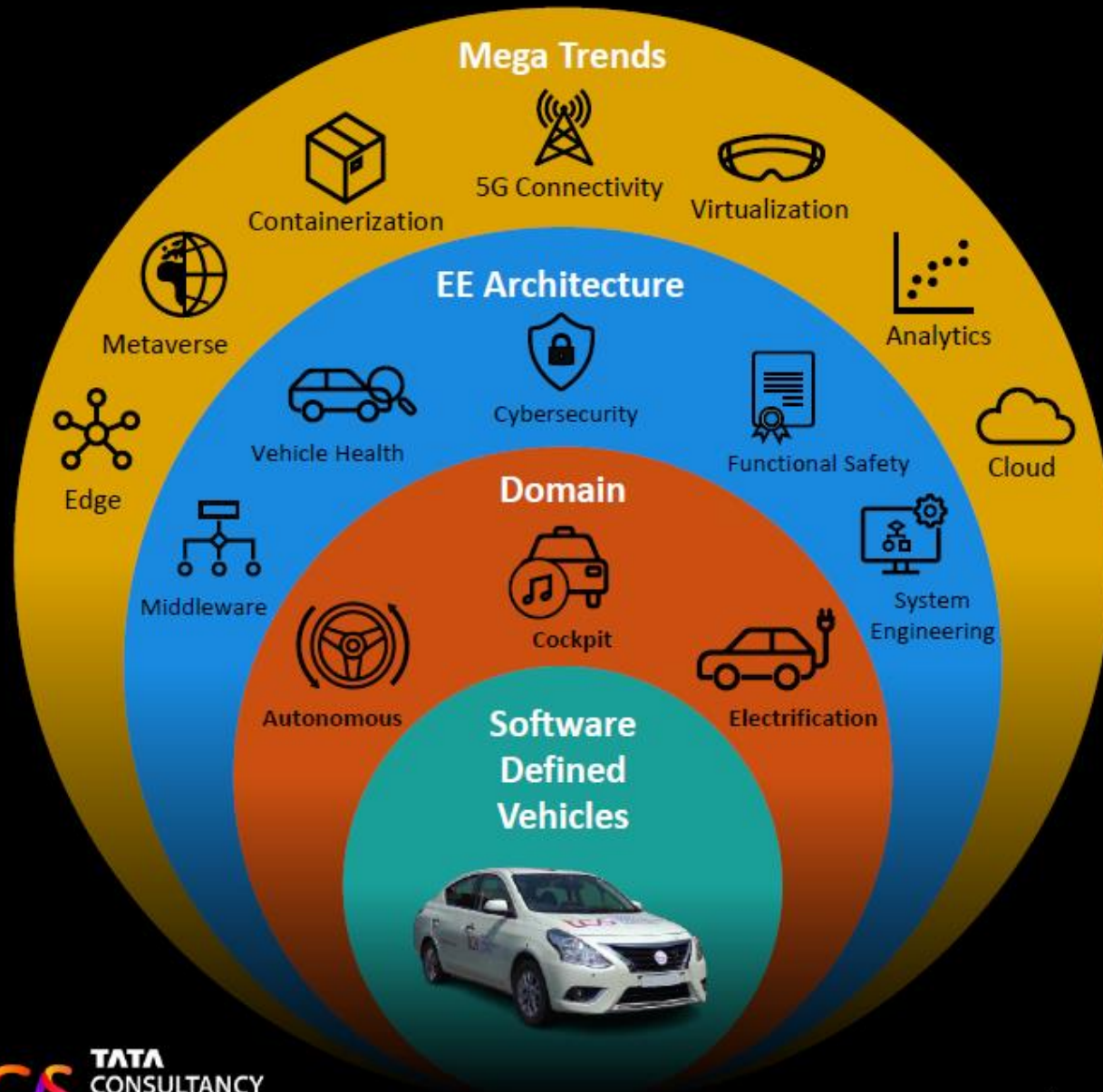
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# TCS Automotive Research & Innovation Group



- **Readiness** for futuristic technology & market trends
- **Innovation Lab**: Conceptualization & development of demonstrators
- **TCS Solutions & platforms** to accelerate future mobility

*We believe in driving digital innovation and steering automotive journey to transform lives for **Safe, Secure & Sustainable mobility***

**Driving the Future of Mobility**

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**Thank you**

