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# How COVESA APIs are Accelerating Service Development in Commercial Vehicles and Off-Road

2023 **BOSCH**

**COVESA AMM**

## How COVESA APIs are accelerating service development in CV and OR

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# COVESA AMM 2023 | 11.10.2023

## Global drivers of CV/OR market

CV/OR

TOP MARKET DRIVERS



### Transformation in powertrain – EV on the rise

**ICE continue to be dominant** (for CV and OR); BEV / FCEV expected to gain significant shares, OR ZEF to follow w/ delay; H<sub>2</sub>E discussed as zero emission vehicle; energy infrastructure (charging / H<sub>2</sub>) crucial for success of ZEV



### Advanced security & automation on the horizon

Security & ADAS solutions to fulfill (GSR-)requirements; **market trends (driver shortage & increasing wages)** push L4 – first 'hub-to-hub' pilots in US & EU

### Legislation & TCO main driver for OEM portfolio<sup>1</sup>

Global **CO<sub>2</sub> reduction** targets in focus – EUVII proposal still pending



### Future E/E architecture & SW technologies with increasing importance

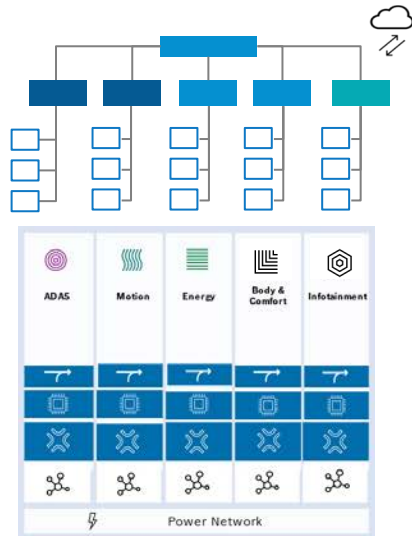
New E/E architectures incl. digitization/service solutions, OS and **SW-defined architectures** with **strong market demand**, for flexible solutions by separating HW & SW



<sup>1</sup>E.g. BEVs for long haul use, H<sub>2</sub>

## The future Truck will be a “smartphone/Living room” on wheels

### Domain-centralized EEA ...

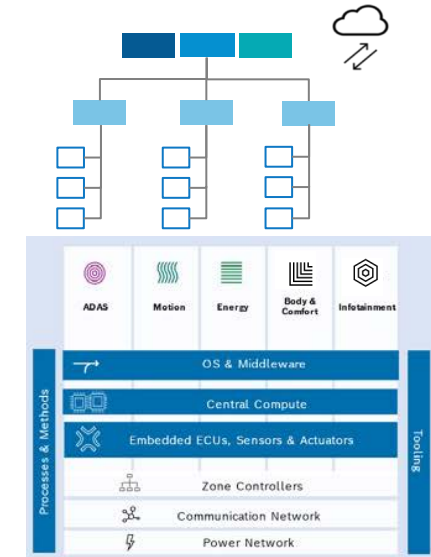


- Hardware-focused (management, organization, processes)
- Monolithic SW architecture leads to high integration complexity and testing effort
- Resulting in a wide range of software variants
- Increased number of features shifted to domain-centralized ECU

### ... continues to develop into ...

- Exponential increase in software and integration complexity
  - **Continuous deployment of** new, upgraded and updated **functions and features**
  - Connected functions
  - Automated driving
  - Seamless **digitalization of logistic value chains**
  - Support of increasing drive type variants
- New semiconductor and software technologies
  - Multi-core CPUs, GPUs and specialized AI co-processors
  - High-performance ethernet in trucks
  - Service-oriented software architecture and **virtualization of functions**
  - **Cloud integration and cyber security**
- MSA – Mobility System Architecture
  - Extension of the system architectural view from the vehicle into other ecosystems
  - E/E architecture enables an **ecosystem of services**
- **Intellectual property (IP)** related to software

### ... Software-defined EEA



- Feature orientation by separating HW and SW
- Implementation of service oriented architectures enables fast, frequent and reliable delivery of large and complex applications
- Independent development, maintenance and improvement of applications in agile teams based on predefined APIs

This Transformation is mainly enabled by the CASE-era  
(Connectivity, Automated, Sharing/Subscription, Electrification/Efficiency)

## SDV is the technology platform for CASE

### The CASE era...



#### Connectivity

Cloud data usage and function offloading in all vehicle domains



#### Automated

Subscription ADAS features with pre-installed hardware for higher-segment vehicles



#### Subscription / Sharing

More seamless integration of cloud-operated and digital services into physical vehicle experience beyond infotainment



#### Electrification / Efficiency

Energy efficiency improved through data-centric operating strategy optimizations

### ...and related challenges to SDV as technology platform

#### Business

- **SW first:** Customer experience defined by SW.
- Additional **cost for “SDV readiness”** need to be compensated by **additional revenues over lifetime**

#### Architecture

- **Service-Oriented Architecture** providing scalable/ dynamic environment (and thus long-term updateability)
- **Decoupling of HW and SW** via HW abstraction
- **Centralization** of functions and computers

#### Process

- **SW development process** must be simplified (enable independent teams) incl. establishment of enabling framework. CI/CD toolchain supporting DevOps paradigms.
- **Data-centric engineering** needs to comply to data protection requirements.

#### Organization

- **Collaboration** needs to move to cloud-based platforms with in-built V&V capabilities. Partner IP needs to be protected.
- **Increasing importance of “horizontals”** compared to “verticals”<sup>1)</sup>

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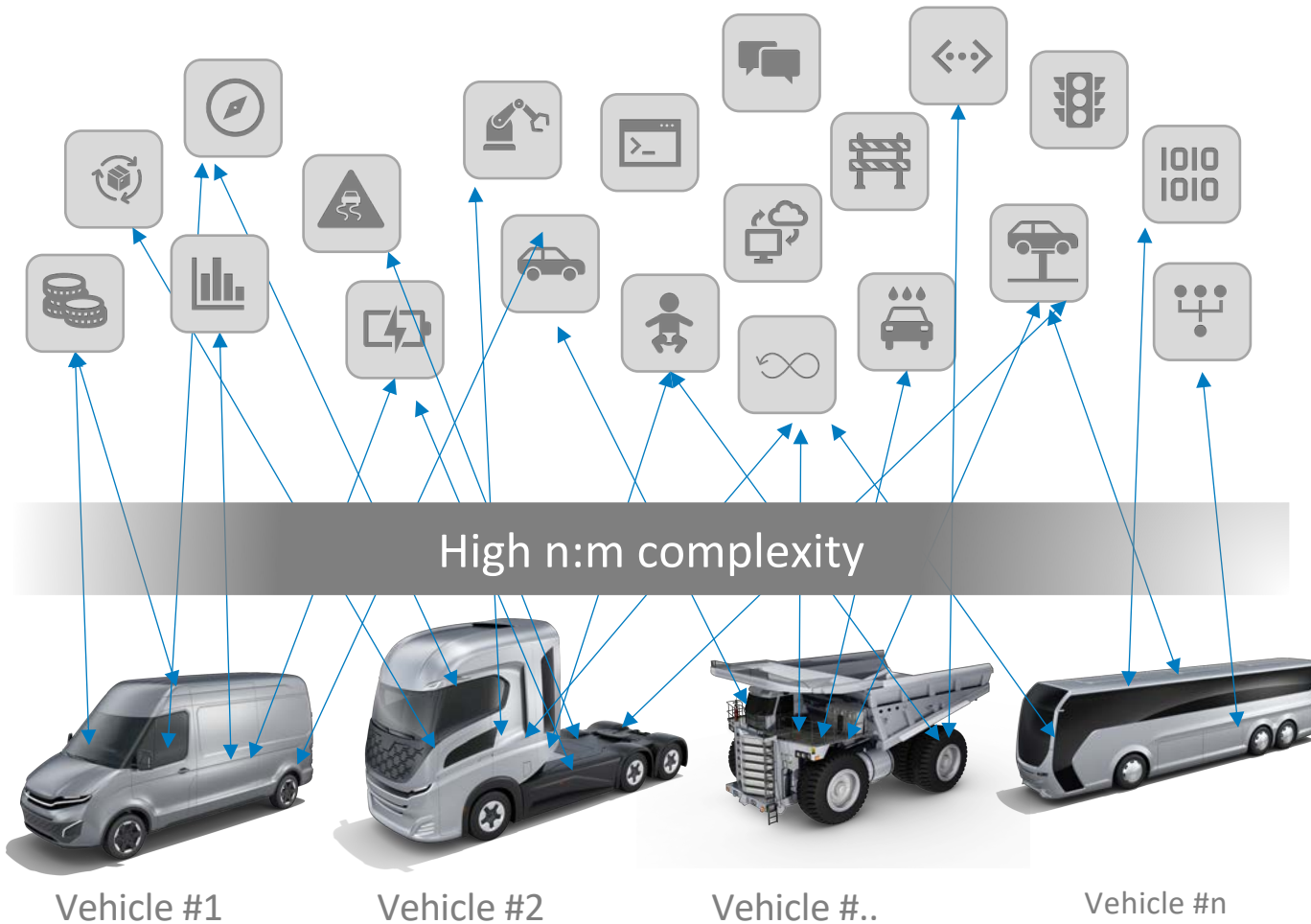
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# Pain points in a complex world of multiple variants



**Xopenness** (attract 3<sup>rd</sup> party developer)

**Xportability** (write once, run on multiple targets)

**Xmaintenance** efforts / Reuse

Numerous **data silos**

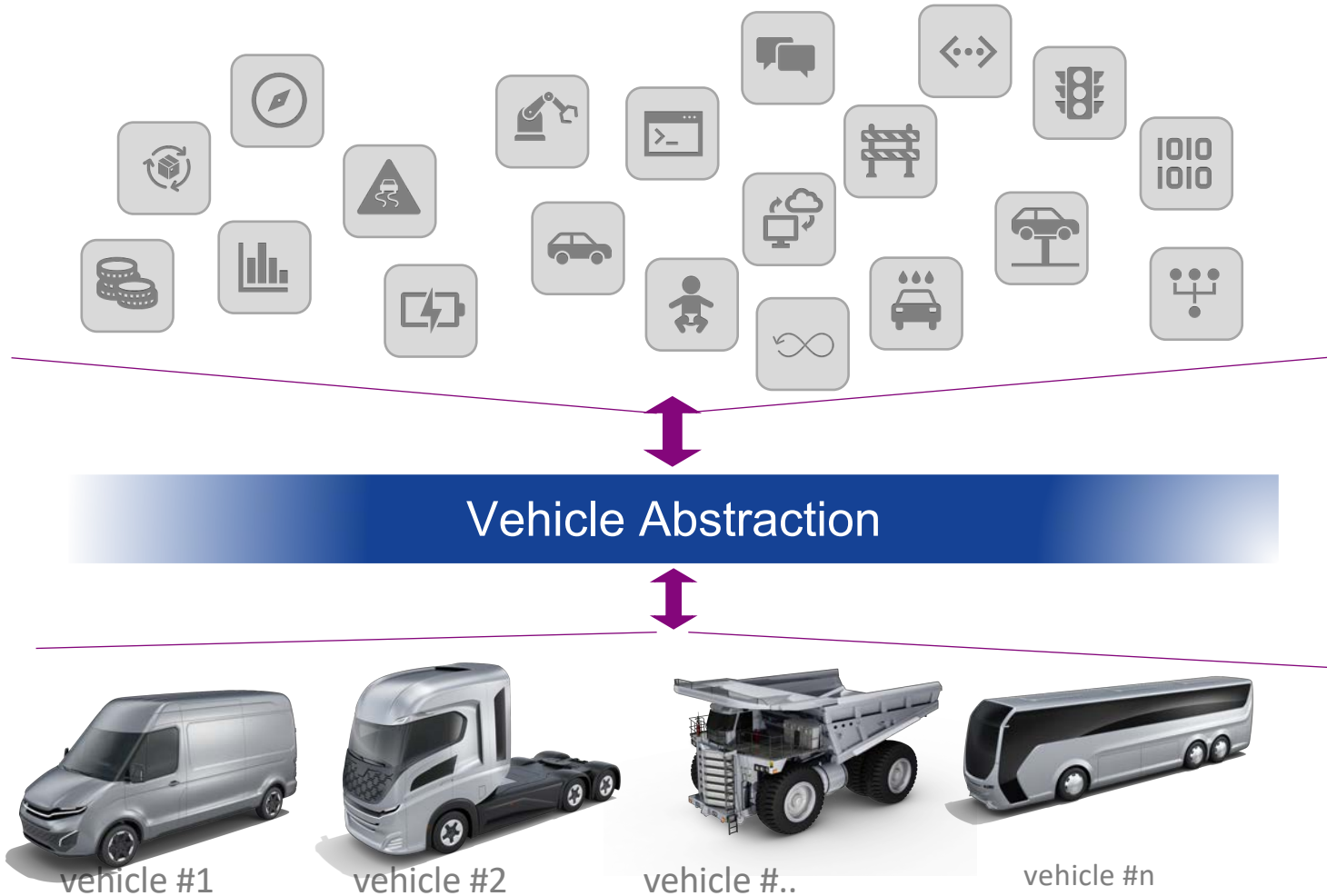
Different data **semantics**

**Multiple** interface **standards**

Overall high **complexity**

Hard to **realize synergies** on SW side (Multiple concepts e.g. security)

# Managing complexity by introducing a vehicle abstraction layer



✓ **openness** given (attract 3<sup>rd</sup> party developer)

✓ **portability** given (write once, run on multiple targets)

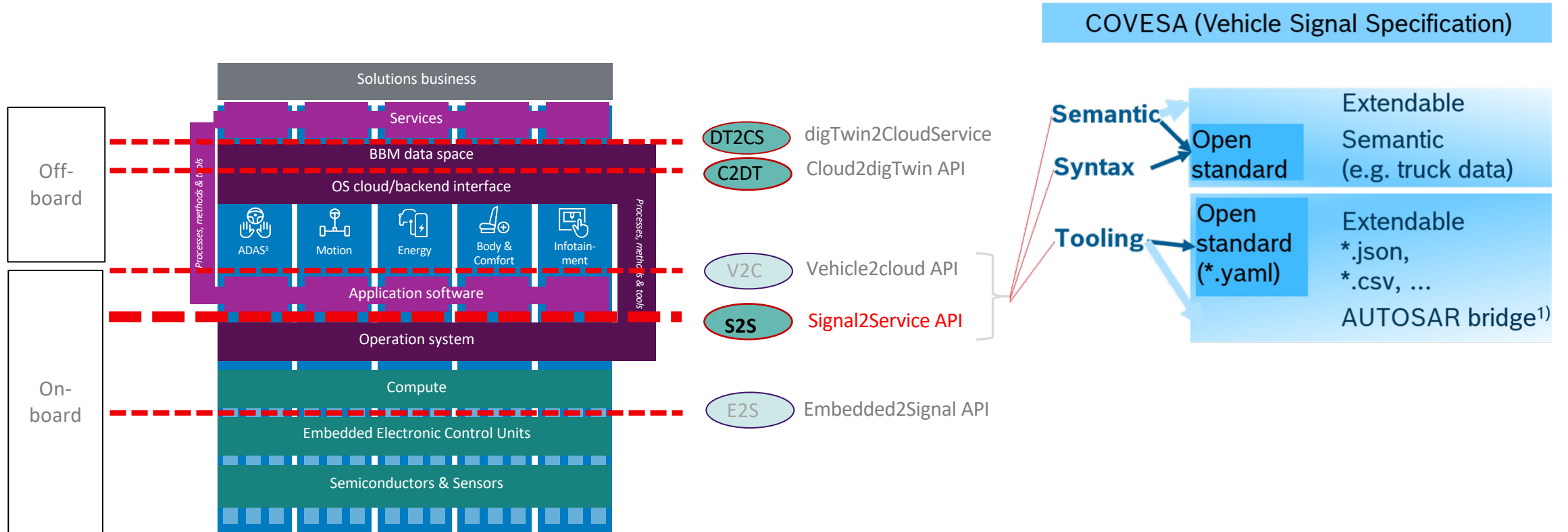
✓ **lower maintenance** efforts / high reuse



- + Consistent data access
- + Common data semantics & standards
- + Complexity abstracted on northbound API
- + Higher chance to realize synergies

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Vehicle abstraction is realized with APIs on different levels of the TechStack



Based on Slide 19 in [Leadership information Package\\_final\\_De.pptx \(bosch.com\)](https://www.bosch.com/leadership-information-package-final-de-pptx)

Mobility System Architecture includes cloud layer and neighbor-eco-systems:

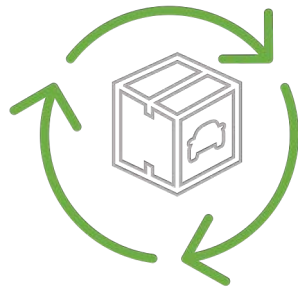
- Cloud2digitalTwin API
- Vehicle2cloud API
- Signal2Service API
- Embedded2Signal API

to harmonize syntax/semantic of different cloud sources in one digital twin  
 to harmonize syntax/semantic of accesses from the cloud to the vehicle  
 to harmonize syntax/semantic of the in-vehicle signals  
 to harmonize syntax/semantic of signals from the embedded ECUs.

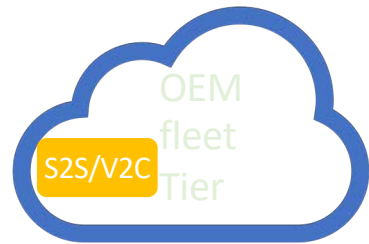
Abstraction - Coverage from an in-vehicle architecture up to infrastructure and several cloud shapes



Free deployment of features on vehicle, infrastructure or cloud



Enabled by



API Abstraction

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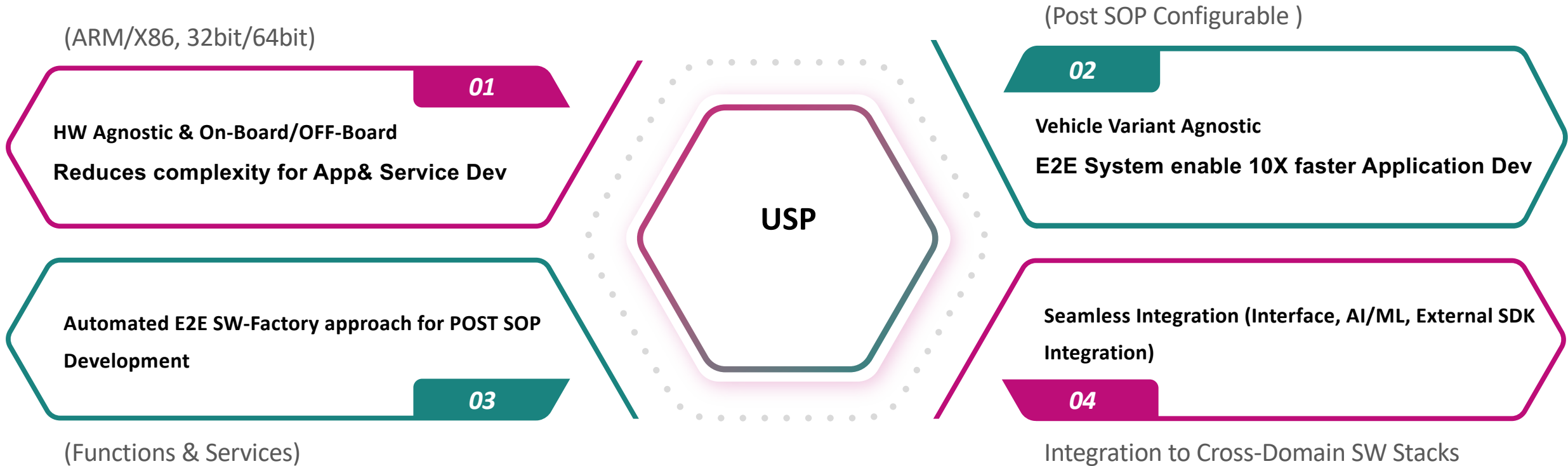
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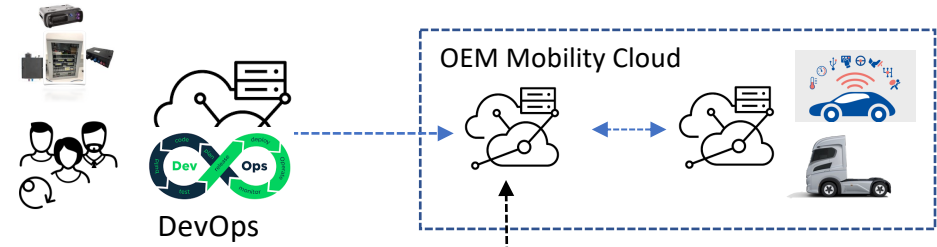
## Lattice – Ecosystem environment providing Elements to support APIs



HW – Small to Big to enable Step up approach to OEM/Supplier Application Development (>256 MB Ram Single Core)

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## Lattice – Ecosystem environment providing Elements to support APIs



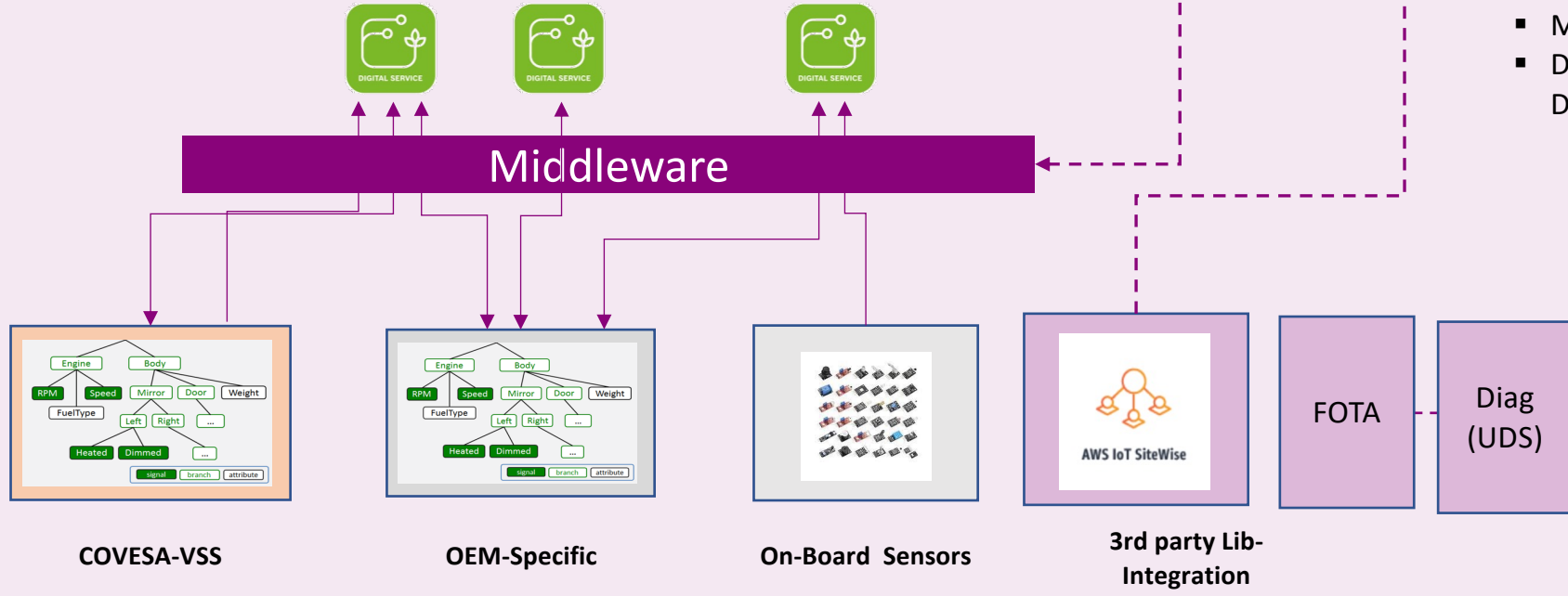
Grouping of applications is based on OEM distribution design

Grouping of API's is based on OEM distribution design

Applications

Plugins & API

### Middleware

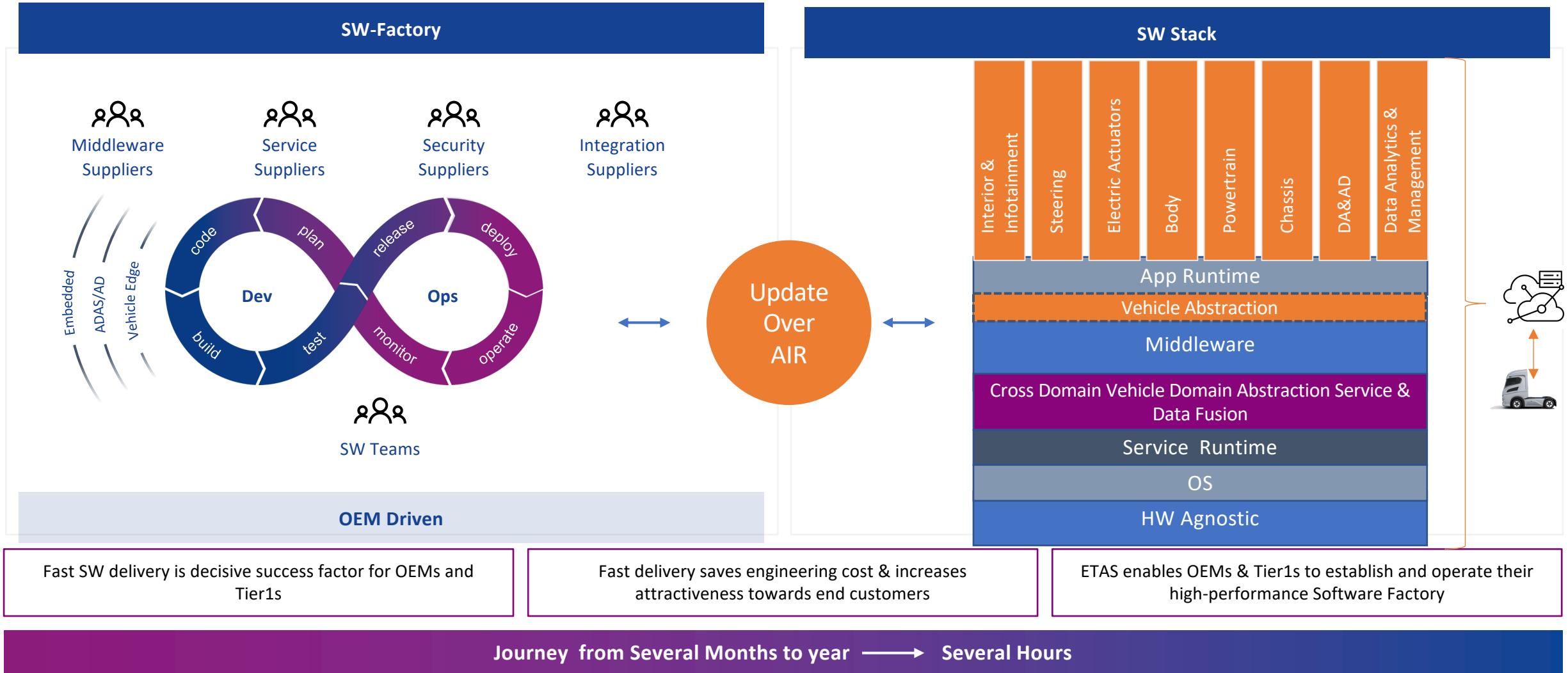


- Digital TWIN
- APP-Store
- OTA
- Remote Configuration
- IOT Client (Message/File)
- Monitoring
- Device Provisioning , dynamic DTC Error

- Telephony
- Battery Mgt Services
- Driver Pattern Services
- Body Status/Control
- Location Based Service
- Driver Alerts
- AI/ML lib Integration
- ....etc

OTA Updatable Pluggable components

# Lattice – Ecosystem for SDV





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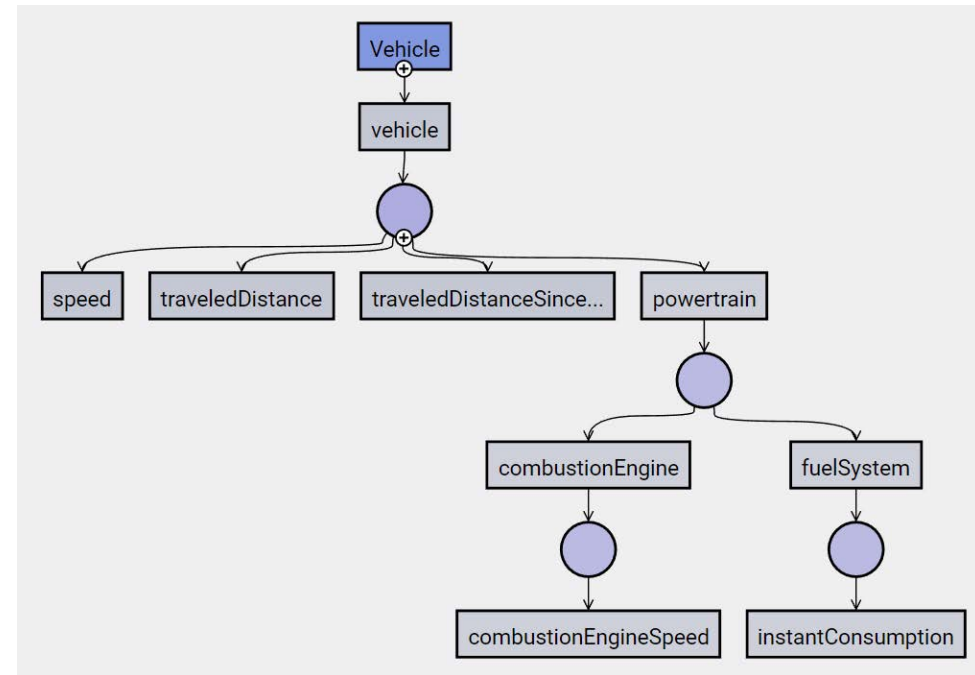
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# Use Case description – Driver Motivation Points



- Build driver motivation points based on a reference value depending on route



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# Demos – Driver Motivation App (with Truck)



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## Demos – Driver Motivation App (with Car, Truck and Tractor)



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# Summary

## PAINS

- Complexity & integration pain
- Maintenance & variant costs
- Scalability of current architecture
- Support of various powertrain configurations

## GAINS

- New value proposition of optimized TCO
- New revenue streams and business models
- Shorter innovation cycles



