



From Software to Intelligent Experience: Agentic AI and Virtualization Accelerating SDVs

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SW defined Vehicle | market drivers & consequences

New challenges & opportunities arise

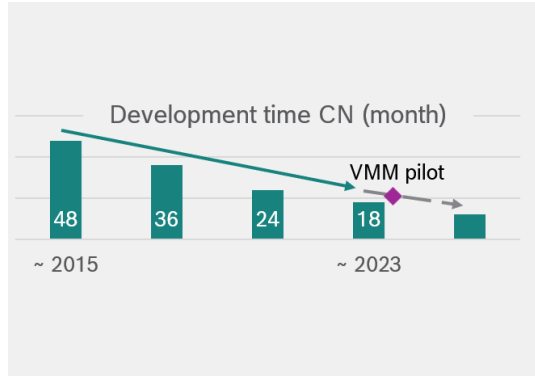
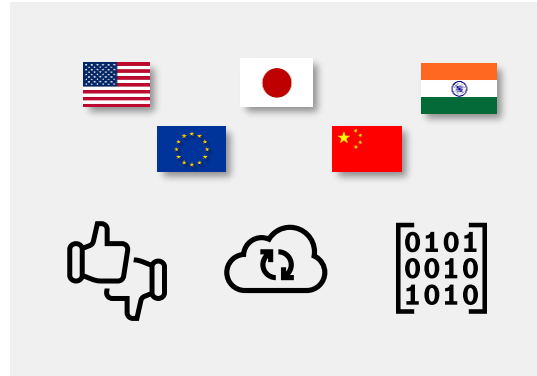
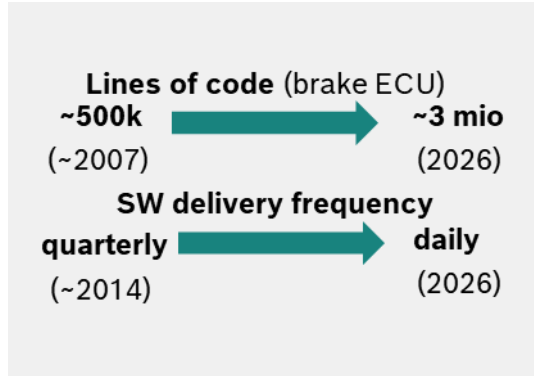
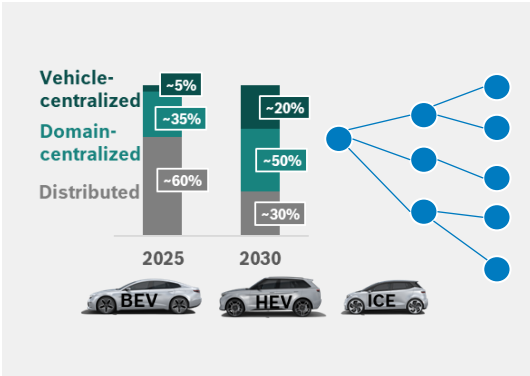


Rising **technological variance**

Increased SW- & system **complexity**

User centric cross-domain SW as **differentiator**

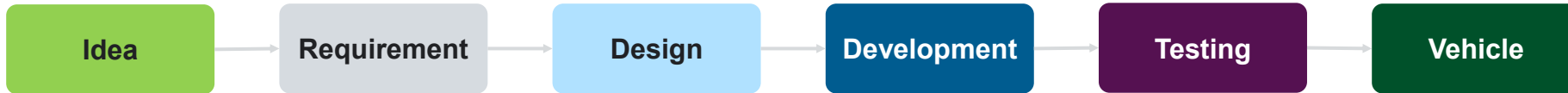
Iterative & fast **market introduction**



SW defined Vehicle | new challenges

Compress the SDLC

Software Development Lifecycle



The vehicle is becoming software-defined — but the development lifecycle is still hardware-constrained.

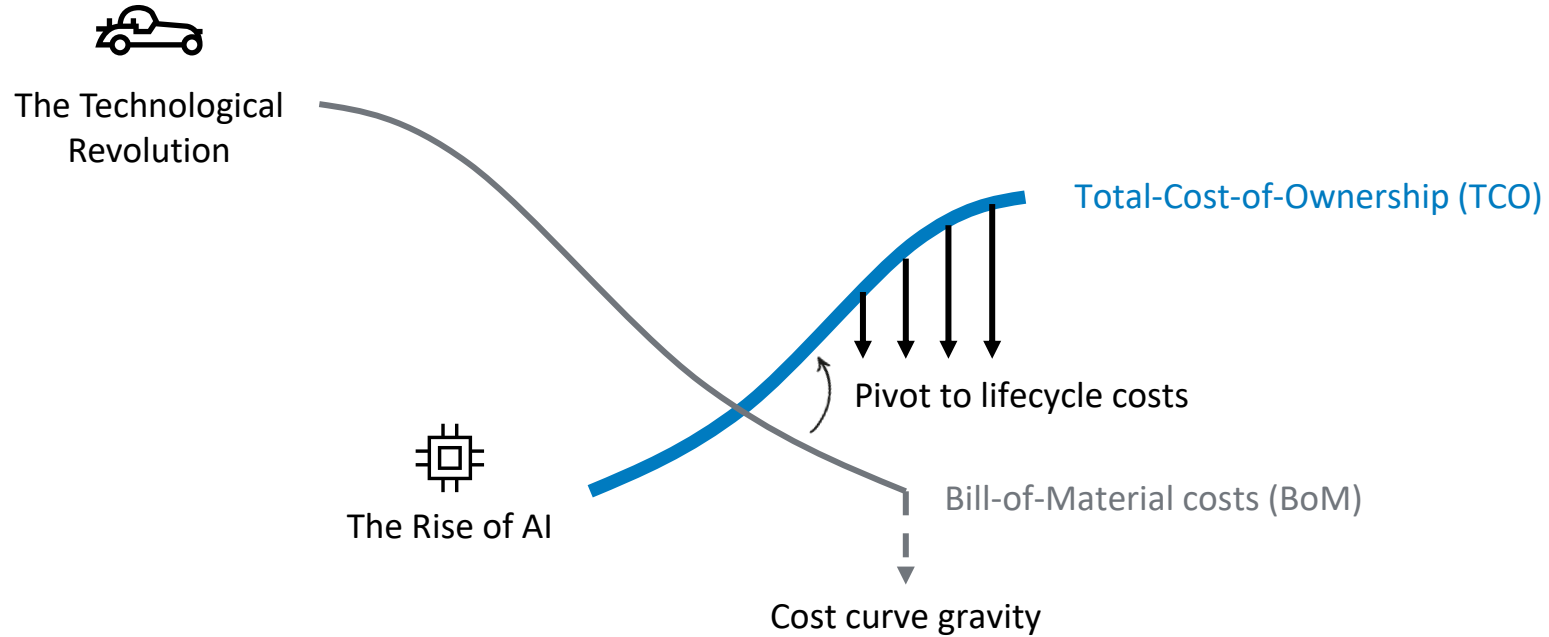
Today's SDV lifecycle is constrained by multiple bottlenecks

- hardware availability
- manual testing
- integration complexity
- late feedback
- physical prototypes

The competitive advantage shifts from developing software faster to accelerating the entire software lifecycle.

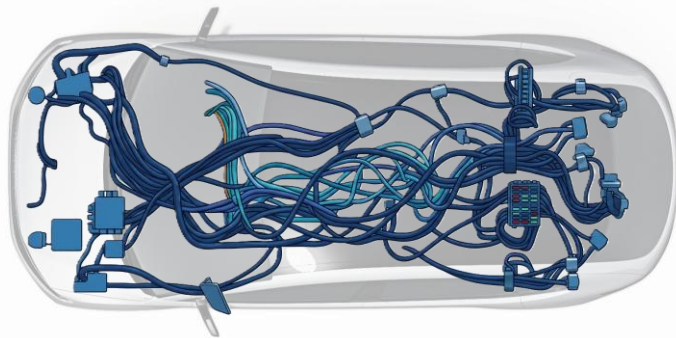
Develop once – deploy often

Pivot from software-driven to software-defined

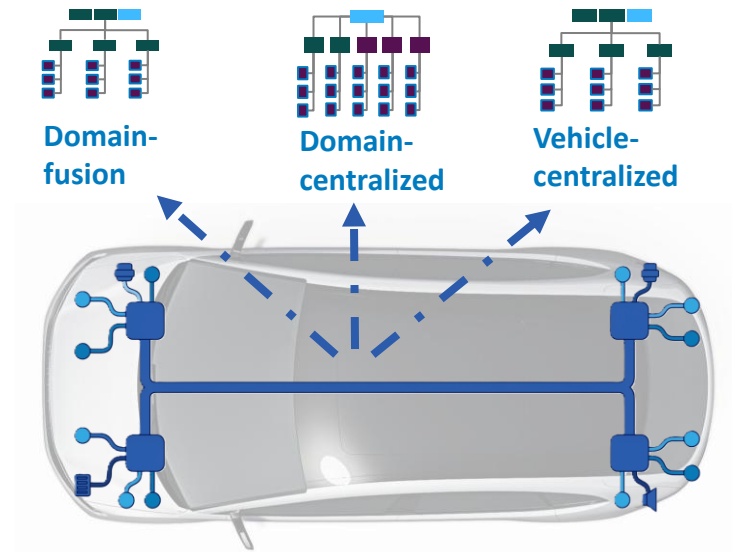


Develop once – deploy often

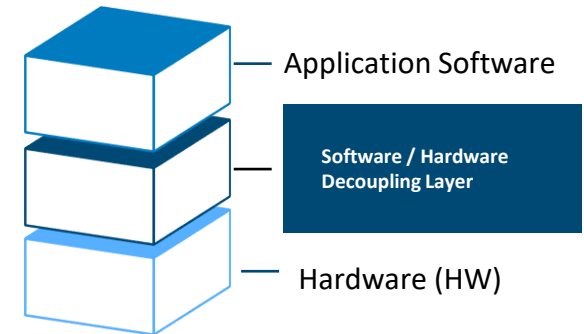
Industry Pivot Example no. 1



Traditional (Federated)



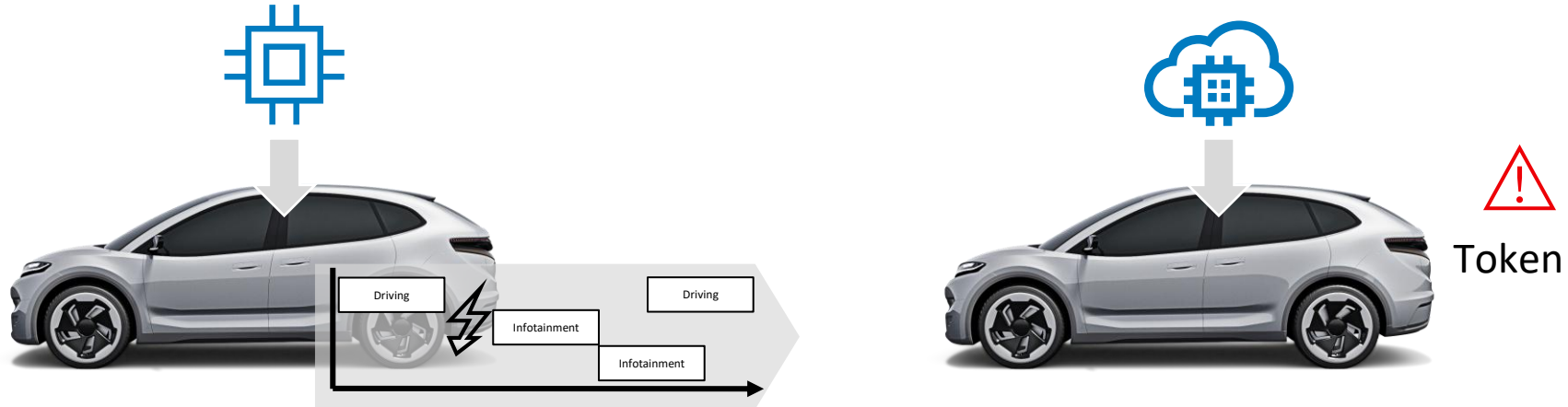
SDV (uP, uC)



The "savings" in physical copper and manufacturing time are "borrowed" from the software budget, because it expands the functional safety, e.g., ISO26262 & security, e.g., ISO/SAE 21434 and UN R155 scope, e.g., single point of failure, inside attacks in heterogenous compute environments.

Develop once – deploy often

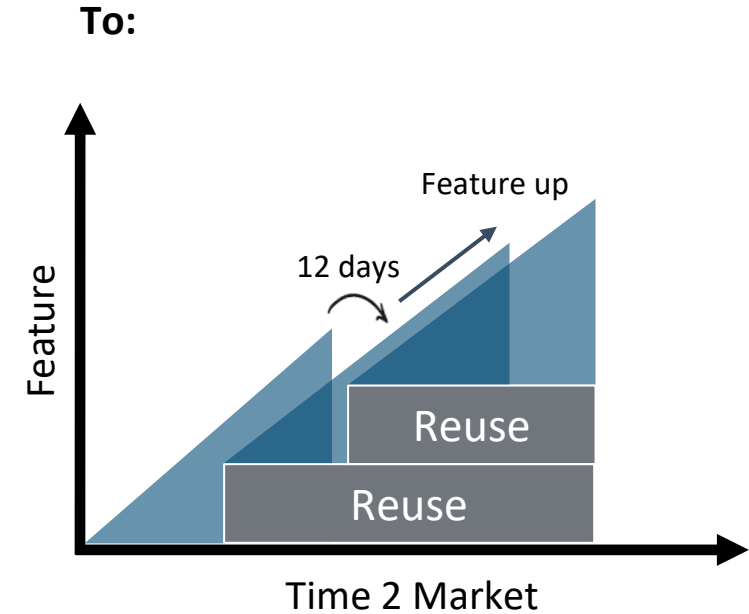
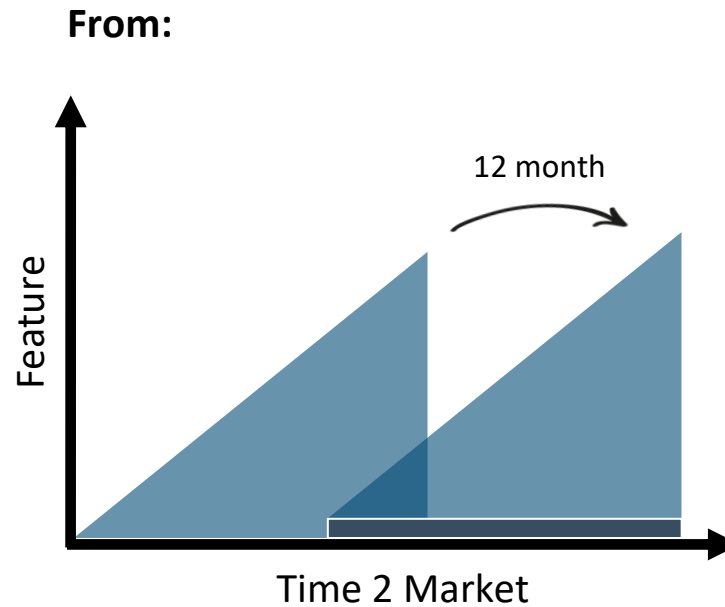
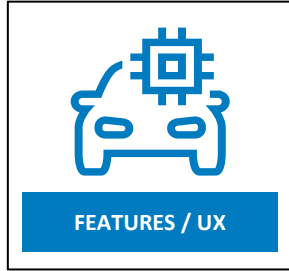
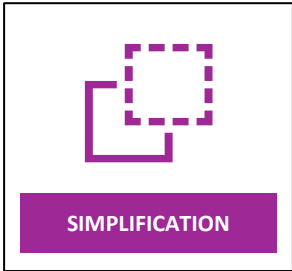
Industry Pivot Example no. 2



Upfront cost for AI accelerators (keyword: Bill-of-Material) is a trade off to token-costs over the vehicle lifecycle (keyword: Total-Cost-of-Ownership). Reliable scheduling of AI accelerators, e.g., Neural-Processing-Unit (NPU) is a key decision-factor.

Develop once – deploy often

Drivers & Motivation



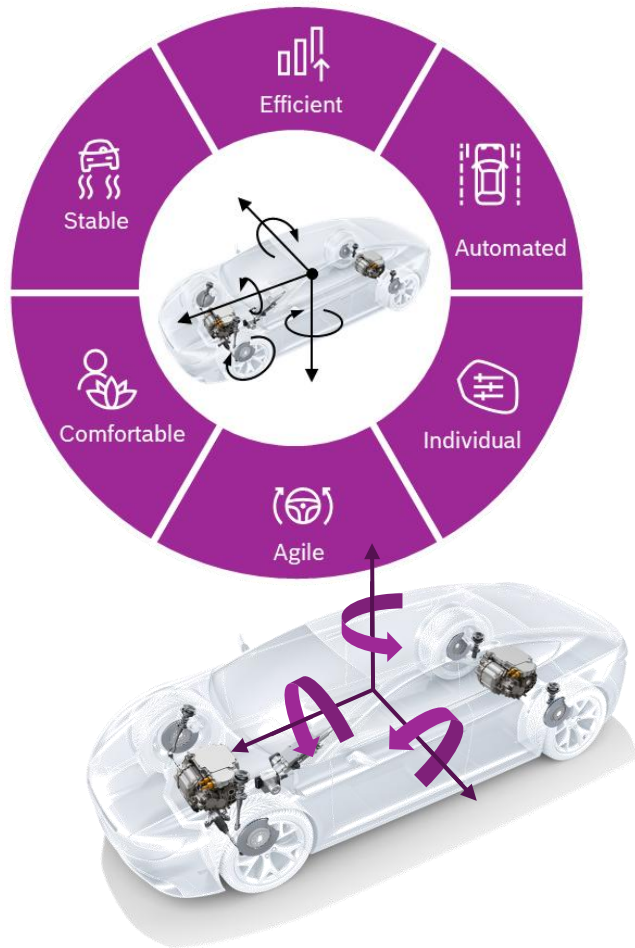
SW Defined Vehicle | The big picture

Bosch SDV Platform



SW Defined Vehicle | SDV.Features

Excite the user with cross-domain SW solutions



SAFETY IN MANUAL & AD DRIVING



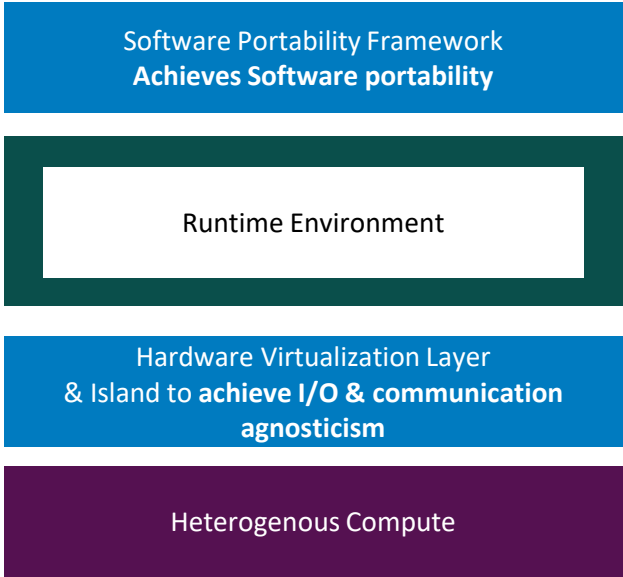
PERSONALIZED DRIVING EXPERIENCE



MA ABS: Multi-Actuator ABS

SW Defined Vehicle | SDV.OS

Develop once – deploy often



Up to 30% costs for integration & 50% costs for development are reduced = 80% overall cost savings



GitOps driven Variant- & Lifecycle-Management via Vehicle-As-Code



	Traditional Model (first time effort)	Development (first time effort)	Integration (first time effort)
Total Integration Effort	500 PD (Baseline)	- 250 PD	- 150 PD
Percentage Savings	0% (Baseline)	- 50%	- 30%

SW Defined Vehicle | SDV.Suite

Execution at Scale: Smart and modular integration framework

Multi-party collaboration



Share system / SW assets

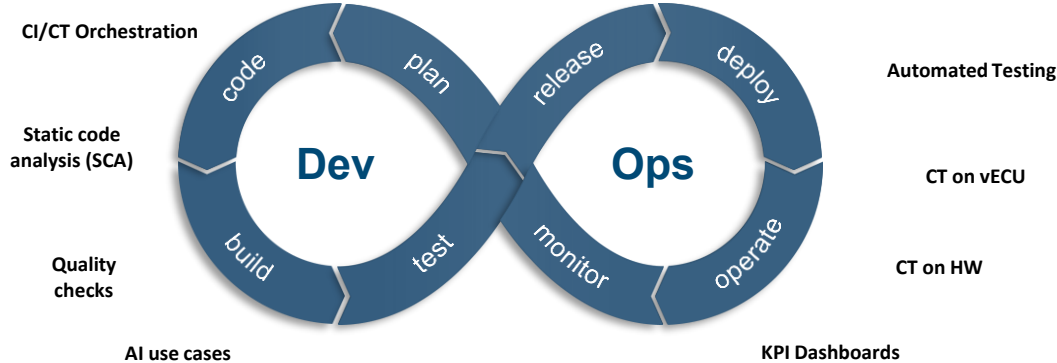
Project Onboarding

Preconfigured project templates

DevOps software factory

Integration. Testing. Release.

>40% less manual effort by AI-support methods



Virtualization services

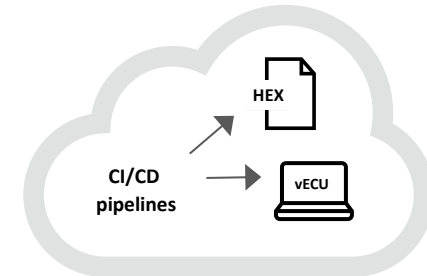
SiL testing

Multi-ECU virtualization

vECU Level 3

>30% reduction of HW costs by virtual SW validation

Infrastructure services



- Cloud-based or on-prem solutions
- vECU cloud-native

Data loop & lifecycle management

Data collector



Continuous improvement

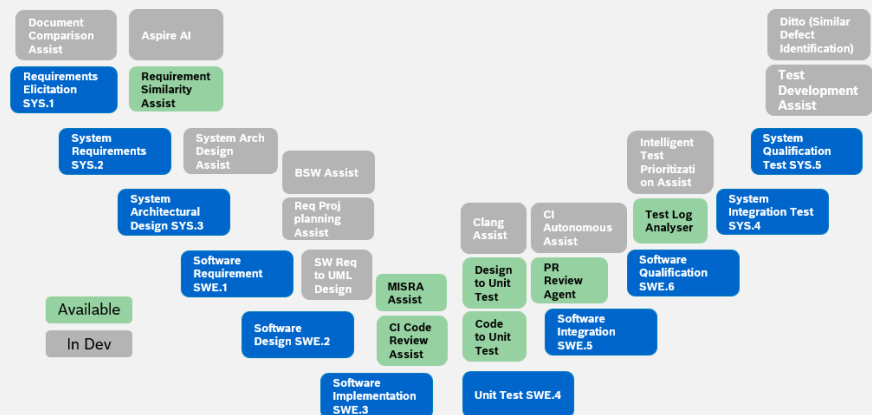
OTA enablement

Modular solutions across the full vehicle lifecycle – from design to updatability

SW Defined Vehicle | SDV.Suite

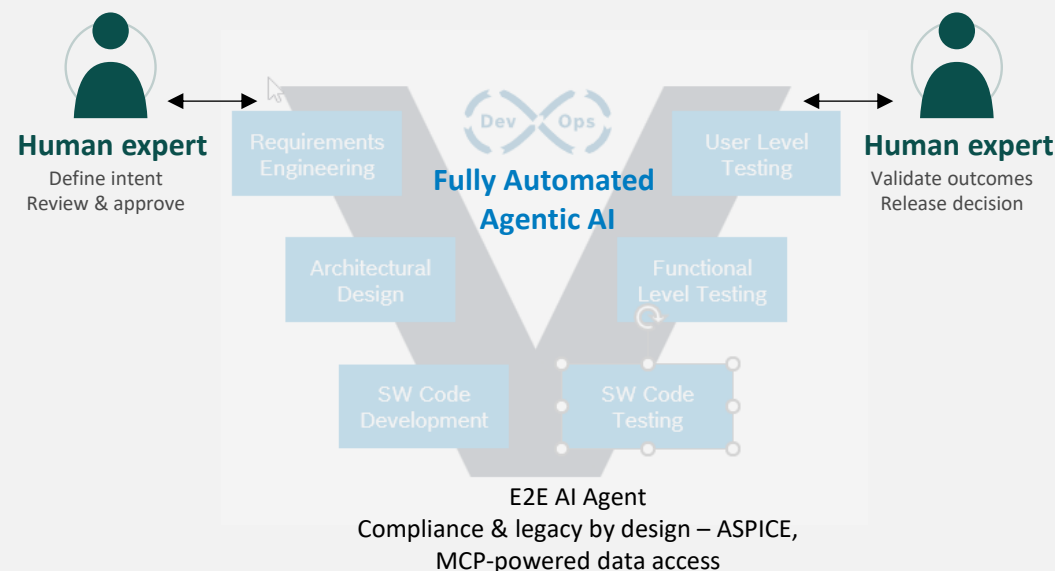
Agentic AI workflows

Current: Gen AI assist use case landscape



Agentic Workflows & MCP servers are gaining momentum

Outlook: Workflows of agentic AI with MCP*

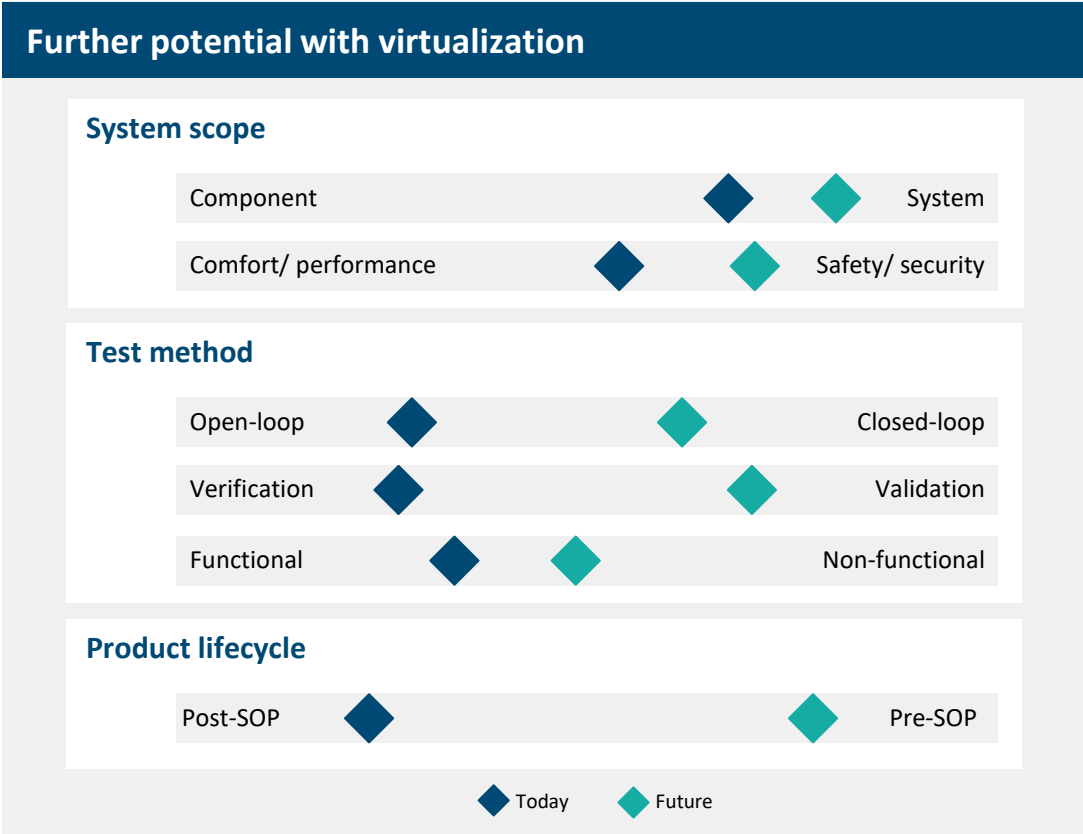
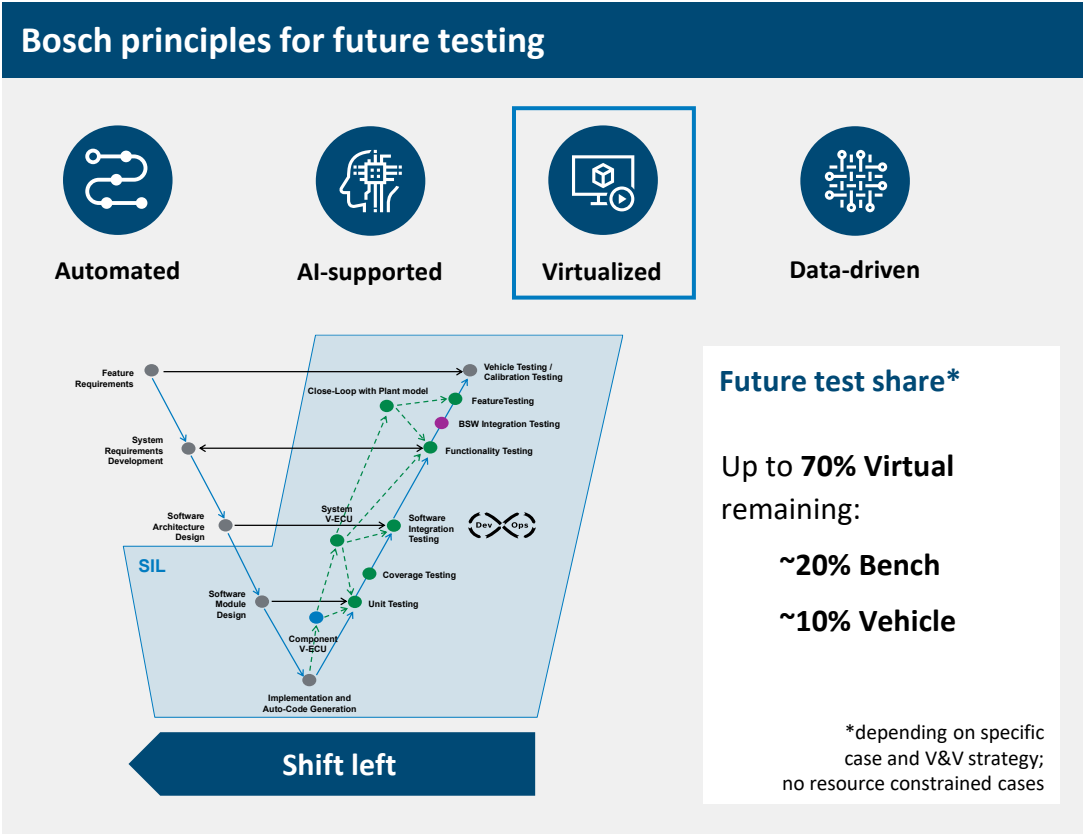


*Model Context Protocol

AI augments SDV execution across the entire V-model

SW Defined Vehicle | SDV.Suite

As a service: Virtualization (vECU), HiL/SiL testing as a service



SW Defined Vehicle | SDV.Suite (Virtualization)

Bosch Mobility Virtualization hub (vHub)



An example workflow of vHub for Automated Emergency Braking & dSPACE simulation tools

vHub

01 Setup

Business Logic
Architecture, Test concerns

Asset Catalogue
Component & simulation tool

Validation templates
(NCAP, AIS,)

Update setup

Configure &
Launch

02 Integrate

Vehicle configuration
(Model, Variant, ...)

Test configuration
(scenarios, calibrations, ...)

Simulation Credibility
framework

Launch integrated
simulation system

Repeat for variants

04 Validate & Release

Signal comparison and validation tool

Validate with
reference system

03 Simulate

config: v1.1.0

config: v1.2.1

vHub APIs

Instrumentation

Measurement & Calibration

Storage

ASM Bindings

ASM Interface
(Co-Sim Client)

vECU
Brake

VEOS Simulator



Virtual I/O

Simulation Time



ASM Bindings

ASM Interface
(Co-Sim Client)

vECU
Perception



dSPACE

Mobility Virtualization Hub



The Software-defined vehicle

Three shifts are particularly important!

→ **Decouple software from hardware**

Enabling software to evolve and deploy across different hardware platforms.

→ **Virtualize development and validation**

Moving more testing earlier in the process and reducing dependency on physical hardware.

→ **Bring Agentic AI into the engineering lifecycle**

Moving beyond individual AI assistants toward workflows that can support engineering across the V-model.

Let's stay in touch!

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Mobility



Let's
connect