HAL4SDV

Hardware Abstraction Layer for a European Software Defined Vehicle Approach

The HAL4SDV Project

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FEDERATE Eco-System Summit
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Pls. visit us at: https://www.hal4sdv.eu/
Cooperation with CSA FEDERATE: Video: https://youtu.be/4dG-NRMyOxo

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European Automotive Market in the Competitive, SW Defined Environment

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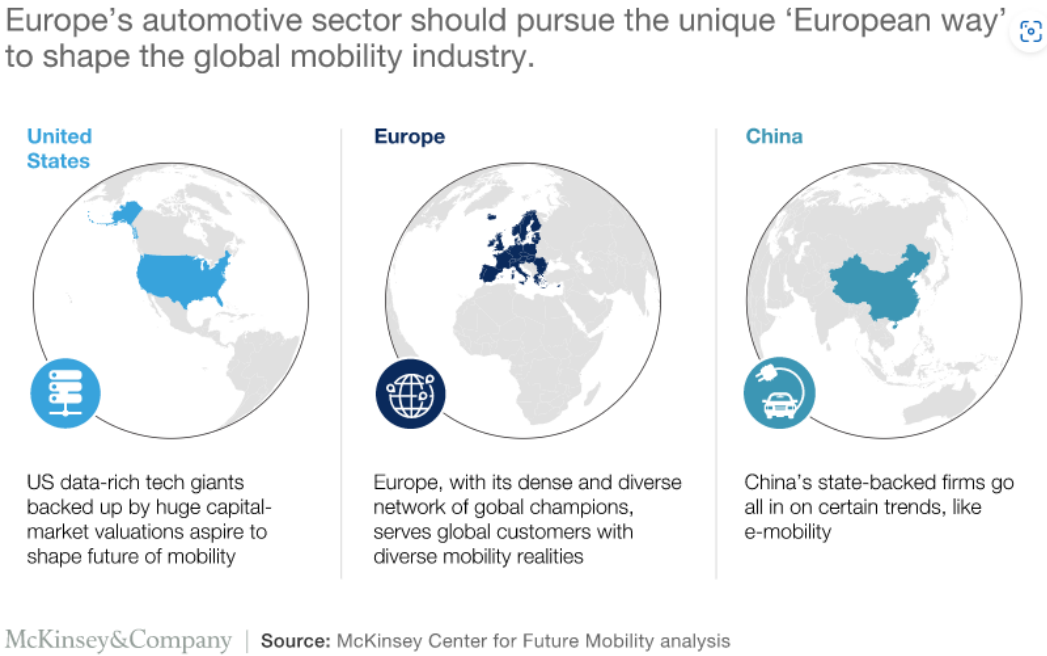
How does Europe fit into the competitive automotive market (the European Way shaping the global industry)?
(a McKinsey View)

"data rich tech giants" with gigantic market valuations to prosper, like Apple or Google, Tesla and the capital available …

"Serving their customers with diverse mobility realities" diverse and dense network of global customers with diverse mobility realities – disruptive services like mobility as a service, shared mobility/car sharing models, etc.

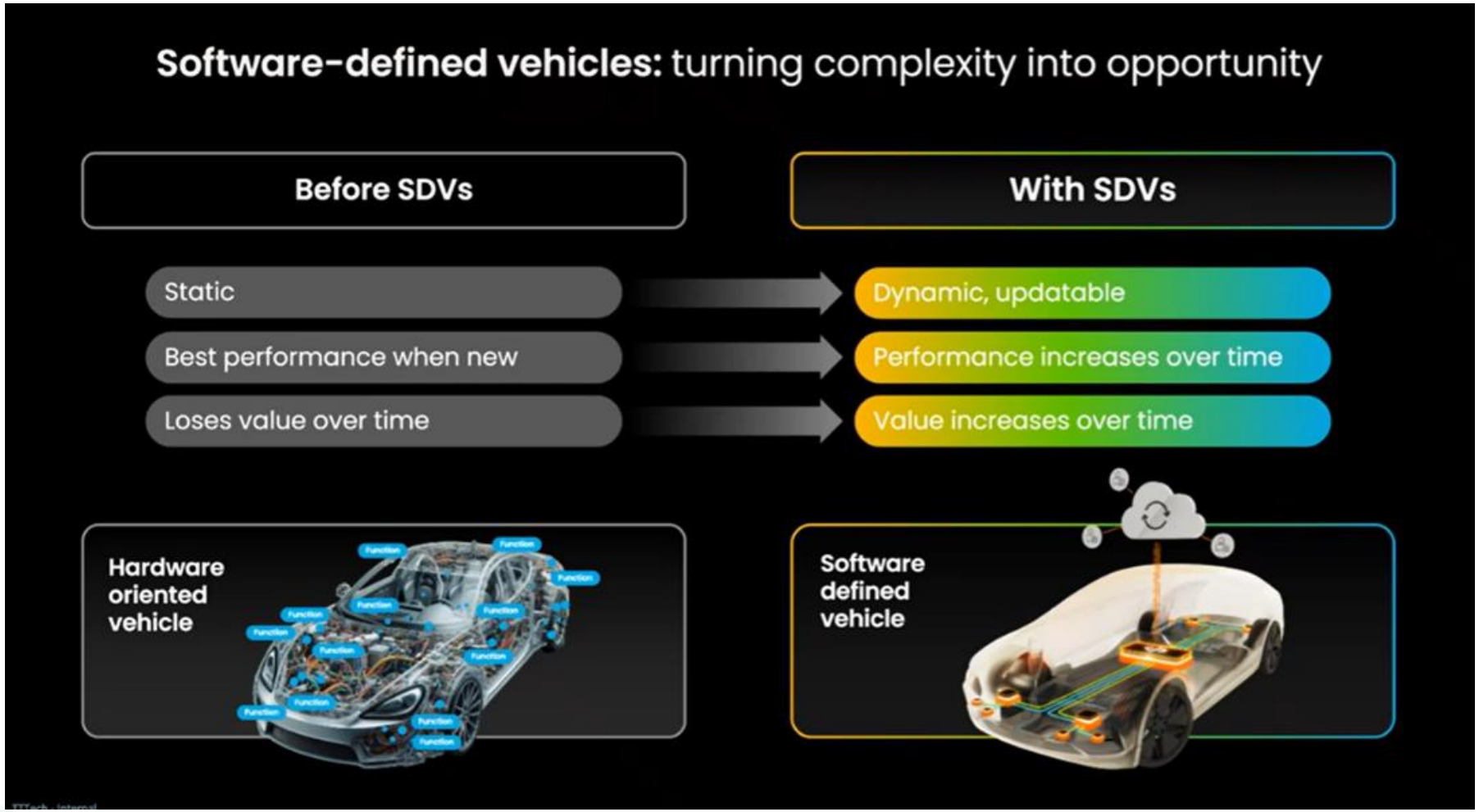
Engage governmentally regulated economy measures massively using huge "orchestrators" to digitize their industry (i.e. Provincial governments working with Alibaba in large scale, Tencent, Haier, etc. …)
SDV approach fits perfectly!



McKinsey study[1)]

[1)] A long-term vision for the European automotive industry | McKinsey

HAL4SDV What is a SDV?



HAL⁴SDV Change of USPs

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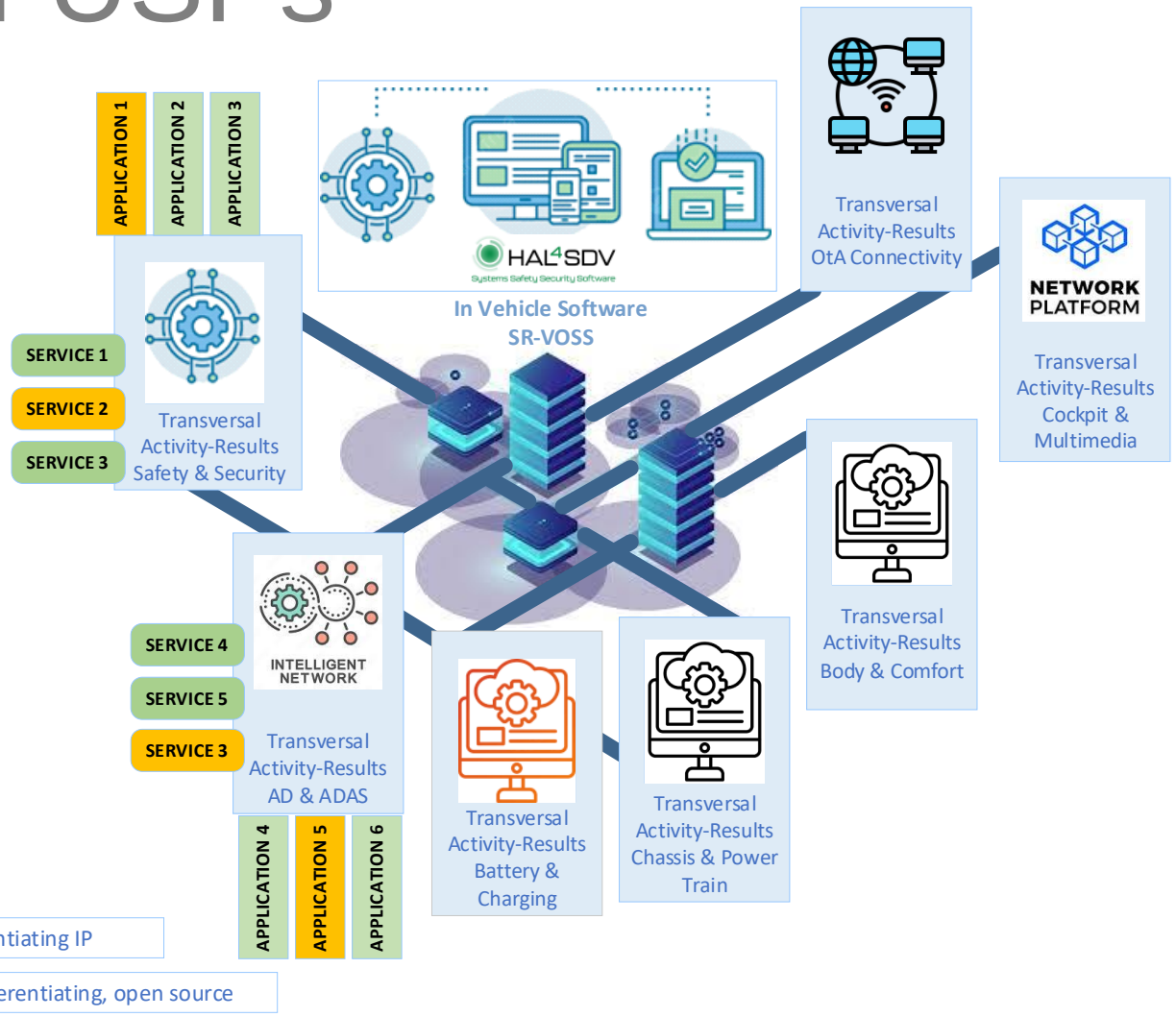
Vision of a Concept with Maximum Flexibility:

a) **Free configurable, flexible concept,** combining different modules resulting in an embedded system partly using Service oriented Architecture

b) **Enables open-source and IP approach** combining both worlds, non-differentiating, non-safety-related open-source and differentiating, safety-related IP

c) **Offers differentiating solutions for each OEM at maximum communality:** Platforms, Service Modules & all SW components can freely be selected on the supplier's market and composed to one unique, embedded, in-vehicle system



HAL⁴SDV in a Nutshell

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Coordination: Andreas Eckel, TTTech Computertechnik AG

Project Office: Armengaud Innovate GmbH

50 Partners:

- **5 OEMs** (Renault/Ampere, BMW, Mercedes, Ford Otosan)
- **6 Tier 1** (Valeo-FR, ETAS/Bosch, CONTI, ZF, AVL-AT, AVL-DE)
- **5 semiconductor manufacturers** (IFAG, NXP-NL, NXP-FR, NXP-CZ and ST-I)
- **8 Software and Technology providers** (TAAG, TCAG, Sysgo-DE, EB-DE, 3DS, CSW, TAES, TADE)
- **9 SMEs** (StatInf, RES, ROVI, STTech, Tensor, TERA, TrustInSoft, DIMECC and Unikie)
- **16 academic partners and research institutes** (CEA, CSIC, FZI, VIF, TUM, USTUTT, UniMore, ISEP, KIT, Polimi, Polito, Unibo, TUE, TUOstrava, UOULU, INRIA)
- **1 Foundation:** Eclipse

3 Affiliated Partners: UniCA, Sysgo-FR, NXP-FR

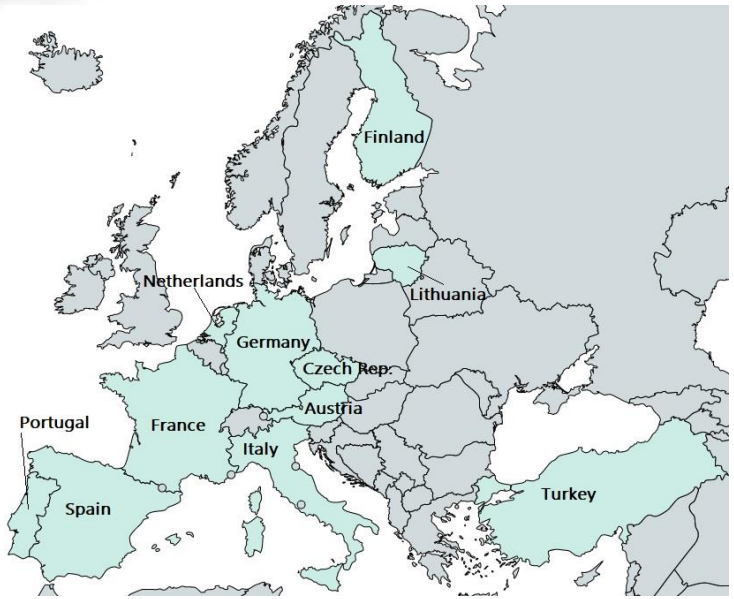
9 Associate Partners: Forvia, BSC, DLR, Volvo, FH-IKS, ARM, TUB, VDA, TWT

11 Countries: Austria, Czech Rep., Germany, Finland, France, Italy, Lithuania, Netherlands, Portugal, Spain, Turkey,

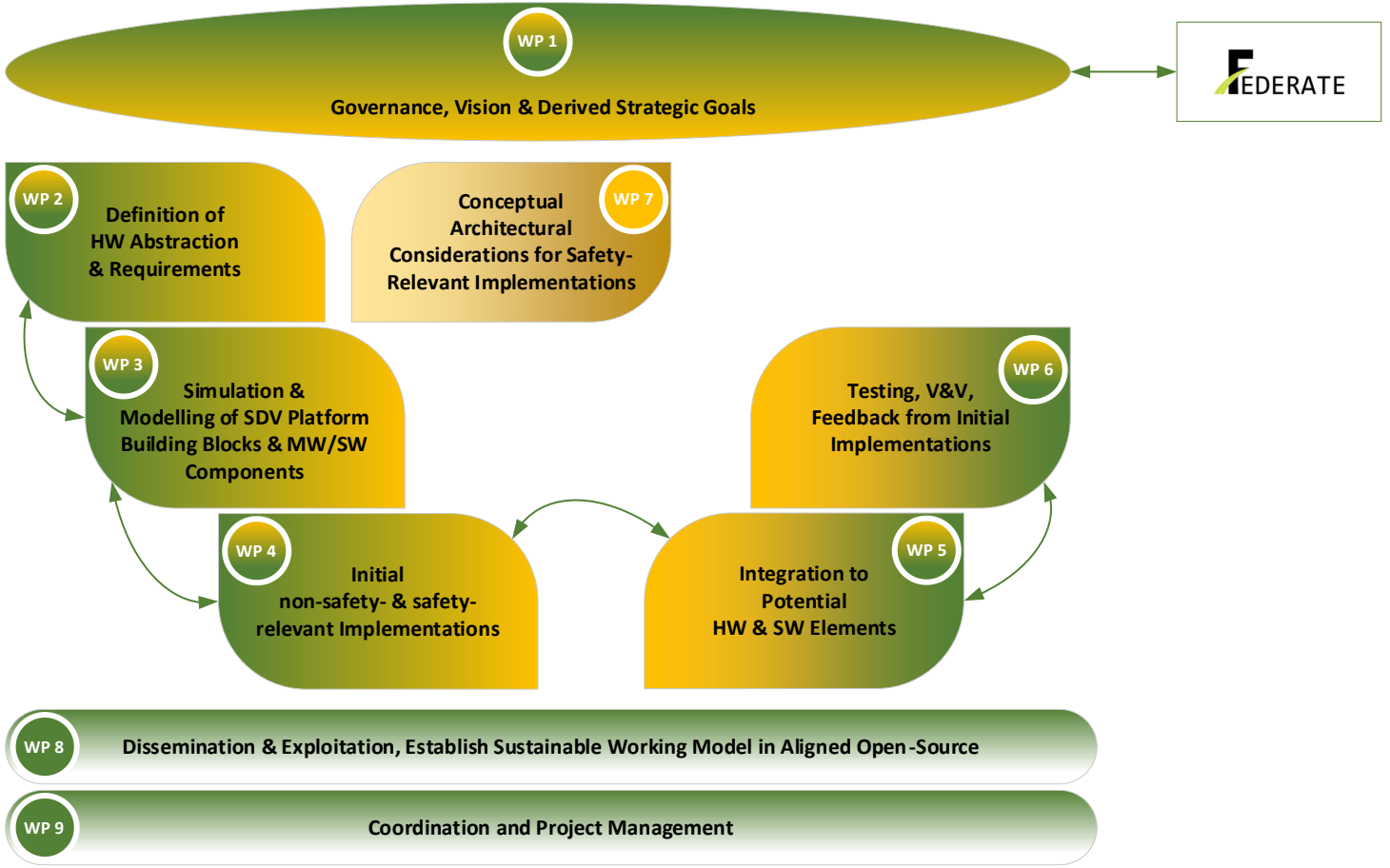
Project Start/Duration: 2024-04-01/36 months

Total Budget: ~ €64,5 Mio

EC Contribution: ~ €17,8 Mio



HAL⁴SDV Structure



“green color” within the WPs represents the **“non-safety-related, non-differentiating”** technical developments (widely open source), **“gold color”** represents the **“safety-related, differentiating”** developments generating proprietary IP

HAL4SDV Structure

HAL4SDV Content Overview

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a) **Building Block Activities** denote the central research and developments required for HAL4SDV

b) **Enabler Activities** understood in support of the BB-activities by dedicated processes maintenance, upgradeability, and strategies i.e.: how to use open-source etc.

c) **Definition Activities** support in definitions i.e.: how wide the term "SDV" shall be spread out over the layered structure of the HAL4SDV platform, will deal with Eco System topics and define the "mindset" within the HAL4SDV project.

d) **Use Cases Transversal Activities** cope with all dedicated Use Case related development activities to demonstrate the HAL4SDV results accordingly.

Building Block Activities

A HW/SW Abstraction
- A01 HW Abstraction - Hypervisor
- A02 Middleware besides AUTOSAR Adaptive
- A03 Communication Middleware (DDS and other solutions)
- A04 Defragmentation of Interfaces
- A05 Interface Concept for Service Oriented and Signal-Oriented Functions
- A06 Data Architecture for Automotive
- A07 Container/isolation for complex Applications (like HMI)

B API and Interfaces
- B01 DSS - Vehicle Signal Specification
- B02 Efficiently Integrating SDV
- B03 Mapping for Internationalization
- B04 Plug & Charge according to ISO Standards available as Open Implementations

C Mixed-Criticality Integration Platform
- C01 On-board Integration SW Environment
- C02 SoA for On-board Integration SW Environment
- C03 Mixed-Criticality Timing and scheduling
- C04 Shared-Memory access for On-board Integration SW Environment
- C05 Virtualization Service for On-board Integration SW Environment

D Cyber Security Orchestration
- D01 Security Threat Analysis
- D02 On-board Security Service Gateway SW
- D03 Cloud Connectivity: Security Service Integration to On-board Integration SW Environment

E Development Process Tools
- E01 Linux Ecosystem for Safety
- E02 Memory Safe Languages for Critical Systems
- E03 Open tool for architecture-Modelling following a Model-based-systems-engineering Approach for Overall Vehicle Definition

F Integration, Testing & Simulation
- F01 Tooling for Performance
- F02 Tool Interoperability in Automotive SW dev. Area
- F03 Software Testing on Integration - Level
- F04 Virtualisation for Vehicle Subsystems
- F05 Reprocessing / Replay Simulation

Enabler Activities

G Software Maintenance & Updateability
- G01 Isolation of Applications
- G02 Sustainable Maintenance

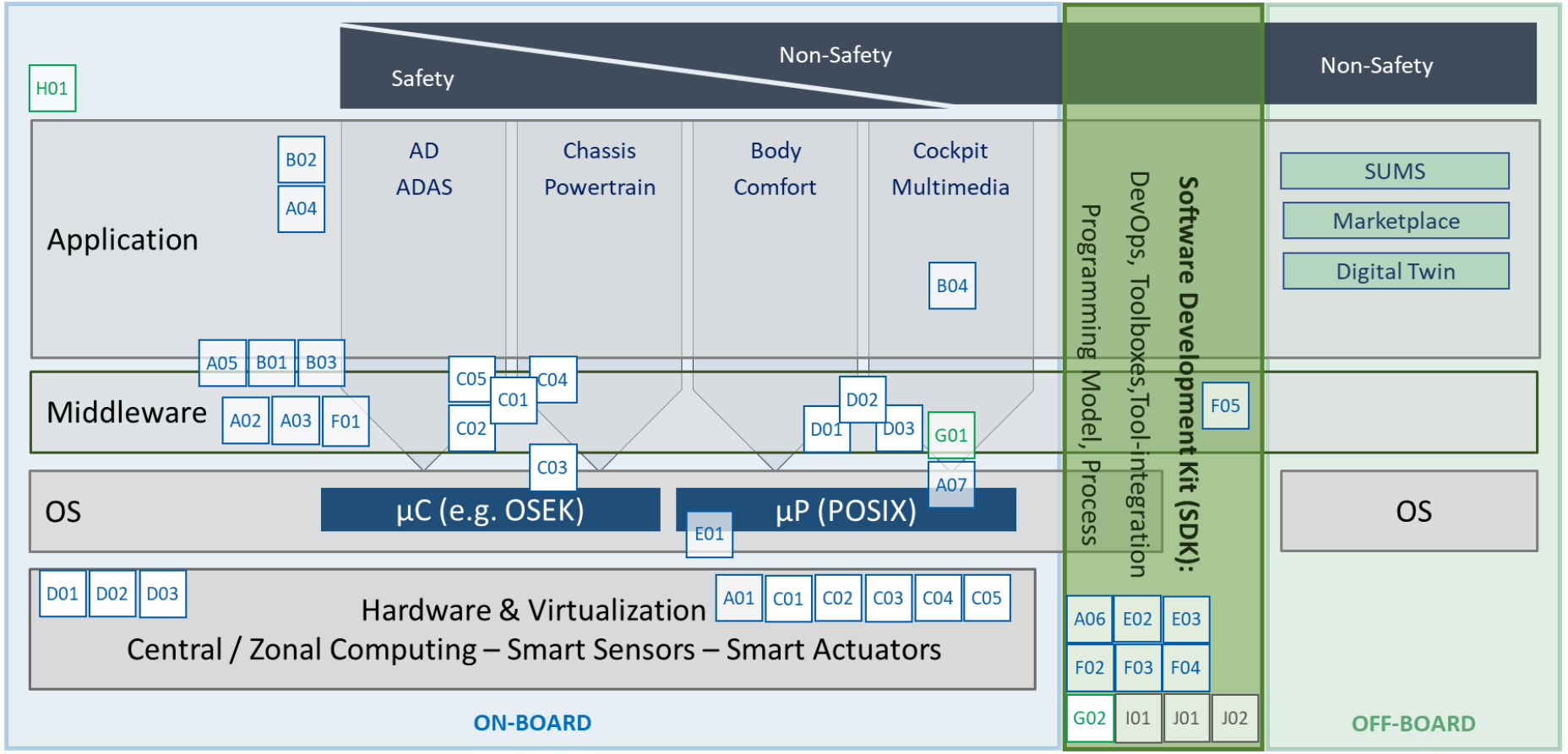
H Open Source
- H02 OSS Blueprints for Compliance with EU Regulations (e.g.: cyber security)

Definition Activities

I Mindset & Ecosystem
- I01 Define and Show "Automotive Grade"

J Governance
- J01 Process Mapping: CRA Compliance with OSS
- J02 Supply Chains Open-Source Governance Model

HAL⁴SDV Architectural Overview



HAL4SDV Gantt Chart

				Year 1												Year 2												Year 3											
		Start	End	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
WP1	Governance, Vision and derived strategic goals (HW Abstraction)	M01	M36																																				
WP2	Definition of HW Abstraction & Requirements (i.e: open Source)	M01	M12																																				
WP3	Simulation & Modelling of SDV Platform, Bricks & MW/SW Components	M06	M24																																				
WP4	Initial non-safety-& safety- relevant Implementations (building blocks)	M12	M30																																				
WP5	Integration to Potential HW- & SW- Environments	M18	M36																																				
WP6	Testing, V&V, feedback from initial implementations to open-source communities	M24	M36																																				
WP7	Conceptual Architectural considerations for safety relevant implementations	M12	M36																																				
WP8	Dissemination & Exploitation, Establish sustainable working model in aligned open-source	M01	M36																																				
WP9	Project Management	M01	M36																																				

Achievements:

- Research on Architecture, investigation and definition, based on use case architectures envisaged
- Building Block definition (contributed to FEDERATE as well)
- Rich set of Requirements captured
- First implementation steps and target system definition including Use Cases high level definition conducted

HAL⁴SDV Objectives (1/2)

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Overview on the major research issues covered in HAL4SDV:

a) **Platform Architecture**: suitable architecture supporting in-vehicle functionality: to “keep the HW the same” “new car” via SW update & function enhancement for, **safety-relevant** & **non-safety relevant SW-Components** building on results from COVSEA and SOAFEE and other accompanying projects/activities.

b) **Abstraction from HW/Virtualization/Memory Management/AI: measures/services for HW abstraction:**

- define all interfaces, APIs etc. (sensors & actuators can easily be exchanged i.e.: different providers w/o impact on the remaining system
- SW/MW handling management of assigning tasks to different computing elements, supports virtualization, shared memory management support, AI support, etc.

c) **HW Support:** offer support for different HW components & microcomputers, safety controllers, GPUs, etc. including RISC-V based components on automotive level

d) **Integration:** provide automated, in-vehicle integration support of applications, hypervisors, different OSes, built on a service oriented architectural approach for mixed criticality applications etc.

HAL⁴SDV Objectives (2/2)

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Overview on the major research issues covered in HAL4SDV (ctd.):

e) **Support of Safety Features** (i.e.: freedom from Interference, etc.)**:** define and provide the basis for a platform serving SDV approach plus, in the long run, highly automated driving functionality, potentially also up to SAE level 5

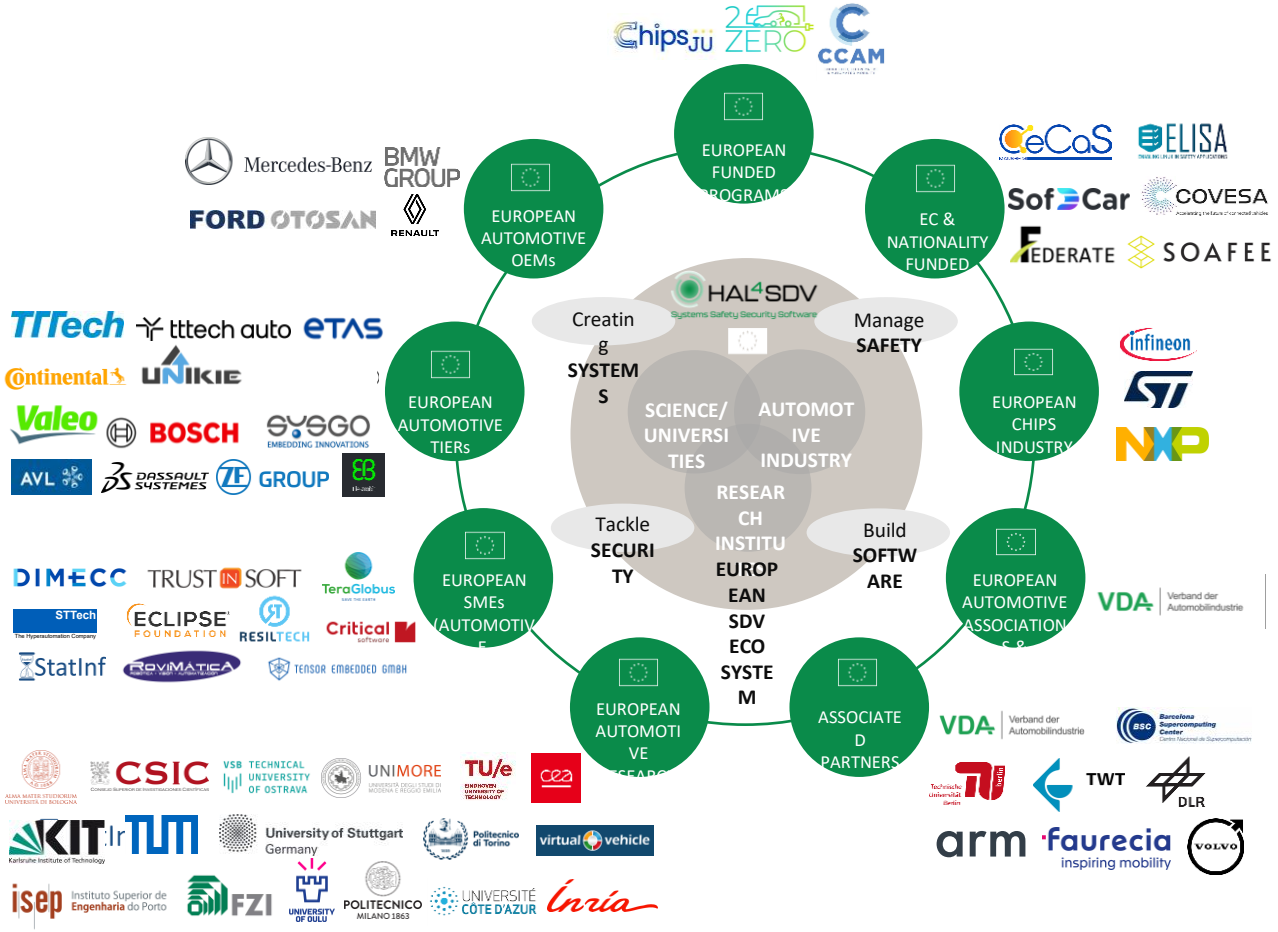
f) **Security:** provides dedicated SW measures to guarantee a suitable security level to allow safety-relevant features to be updated, downloaded, enhanced and added via the edge

g) **Use the Edge:** provide means to also “outsource” functions to the edge and use “results” provided “Over the Air” within the vehicle

h) **Tools:** all kinds of configuration and development tools for the HAL4SDV platform

HAL⁴SDV Expected Impact

1) **Building a European Eco System:**
   reduce critical mass
2) **Enhance green- & digital- transformation:**
   - Reuse & use longer mechanical vehicle HW
   - "New cars" by SW updates & enhancements/new functions
   - Drive "circularity"
3) **Enhance/stimulate research & innovation**
4) **Stimulate open source for product implementation**
5) **Accelerate market uptake of technologies**



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Thank you for the attention!

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Pls. visit us at: https://www.hal4sdv.eu/

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