

HAL4SDV

Hardware Abstraction Layer for a
European Software Defined
Vehicle Approach

The HAL⁴SDV Project

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The Autonomous, Spotlight Session,
Imperial Palace, Vienna, 2024-09-24

European Automotive Market in the Competitive, SW Defined Environment

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!

Europe’s automotive sector should pursue the unique ‘European way’ to shape the global mobility industry. 

United States



US data-rich tech giants backed up by huge capital-market valuations aspire to shape future of mobility

Europe



Europe, with its dense and diverse network of global champions, serves global customers with diverse mobility realities

China



China’s state-backed firms go all in on certain trends, like e-mobility

McKinsey&Company | Source: McKinsey Center for Future Mobility analysis

McKinsey study¹⁾

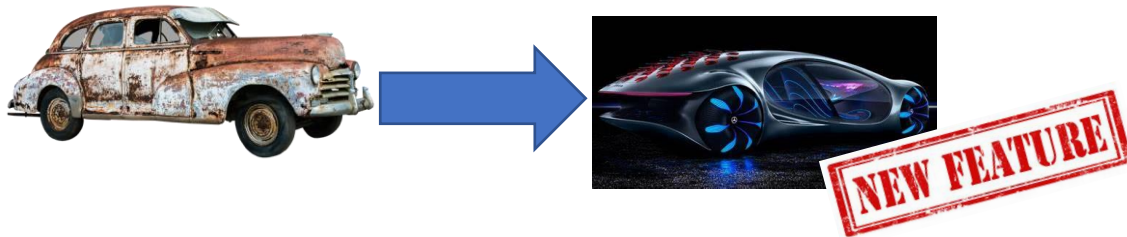
¹⁾ [A long-term vision for the European automotive industry | McKinsey](#)

HAL⁴SDV Change of USPs

Passenger Cars Business Model:

Today: “dump” old car – buy a new car
Business Model: new car with new features

Tomorrow: “next” car: buy SW/feature update
Business Model: same car with new features



Many buyers are private and are looking for:

- Higher driving performance (more “HP”)
- Fancy look of the body is important (image)
- Cost of purchase/operation (fuel consumption)
- Look of aluminum rims
- Comfort functions
- Safety

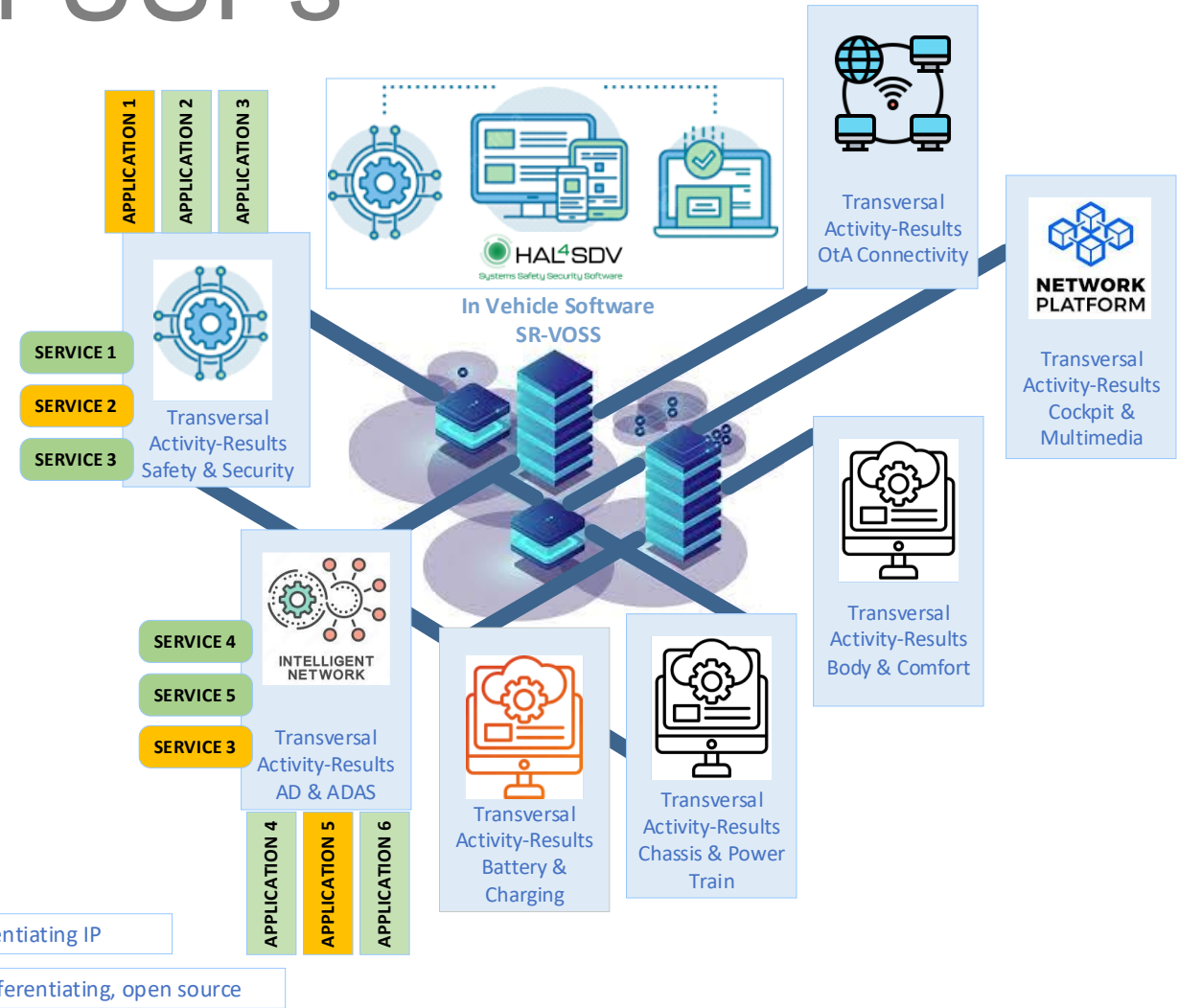
Many buyers are corporate and are looking for:

- Electric drive
- Cost of operation
- Longevity / average service cost
- Connection to internet and appropriate Apps
- Any kind of SW features and their upgradability
- Look of the body etc. is less important ...

HAL⁴SDV Change of USPs

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



Coordination: Andreas Eckel, TTTech Computertechnik AG

Project Office: Armengaud Innovate GmbH

50 Partners:

- 5 OEMs (Renault/Ampere, BMW, Mercedes, CARIAD, 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, Check, Germany, Finland, France, Italy, Lithuania, Netherlands, Portugal
Spain, Turkey,

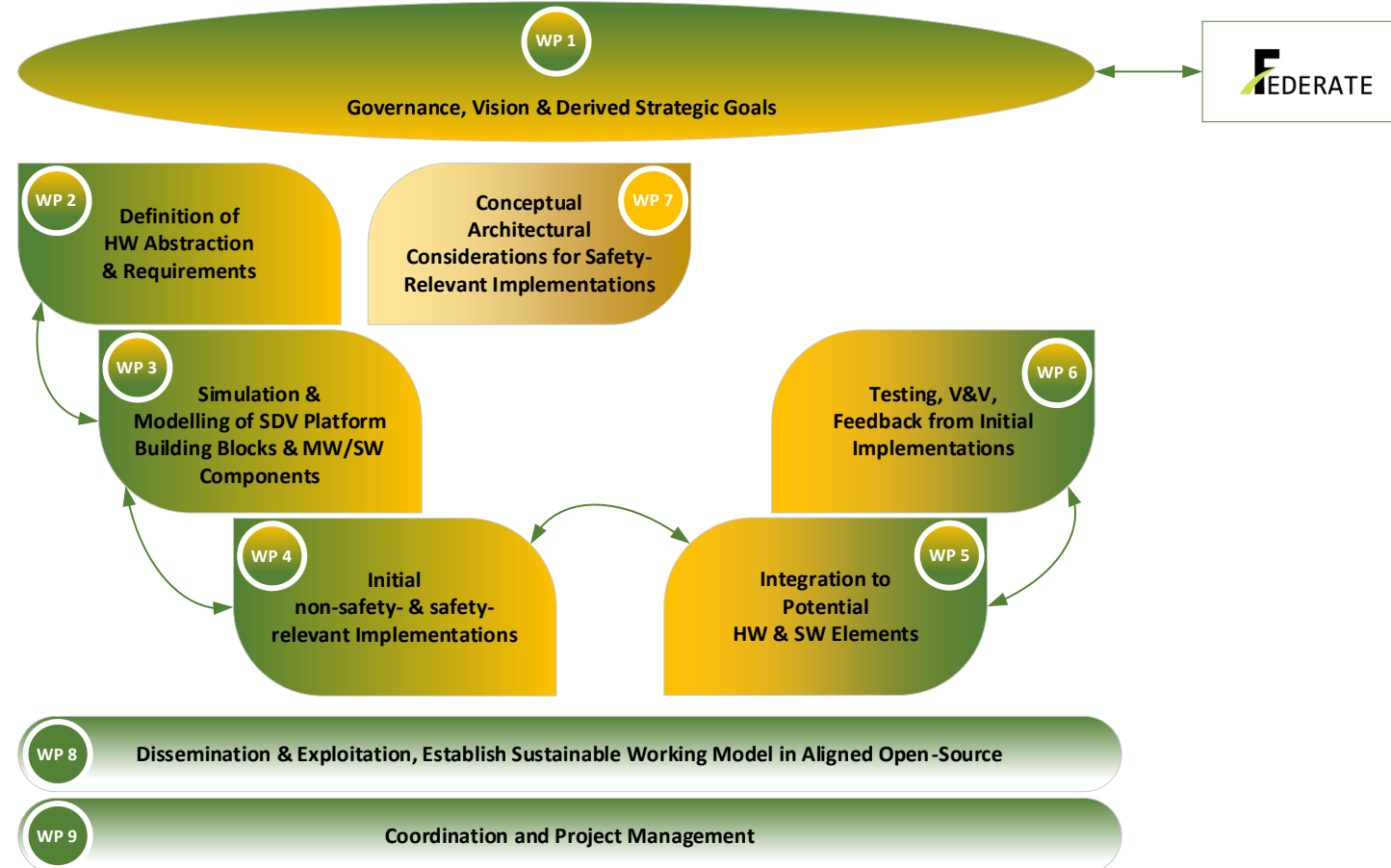
Project Start/Duration: 2024-04-01/36 months

Total Budget: ~ €64,5 Mio

EC Contribution: ~ €17,8 Mio

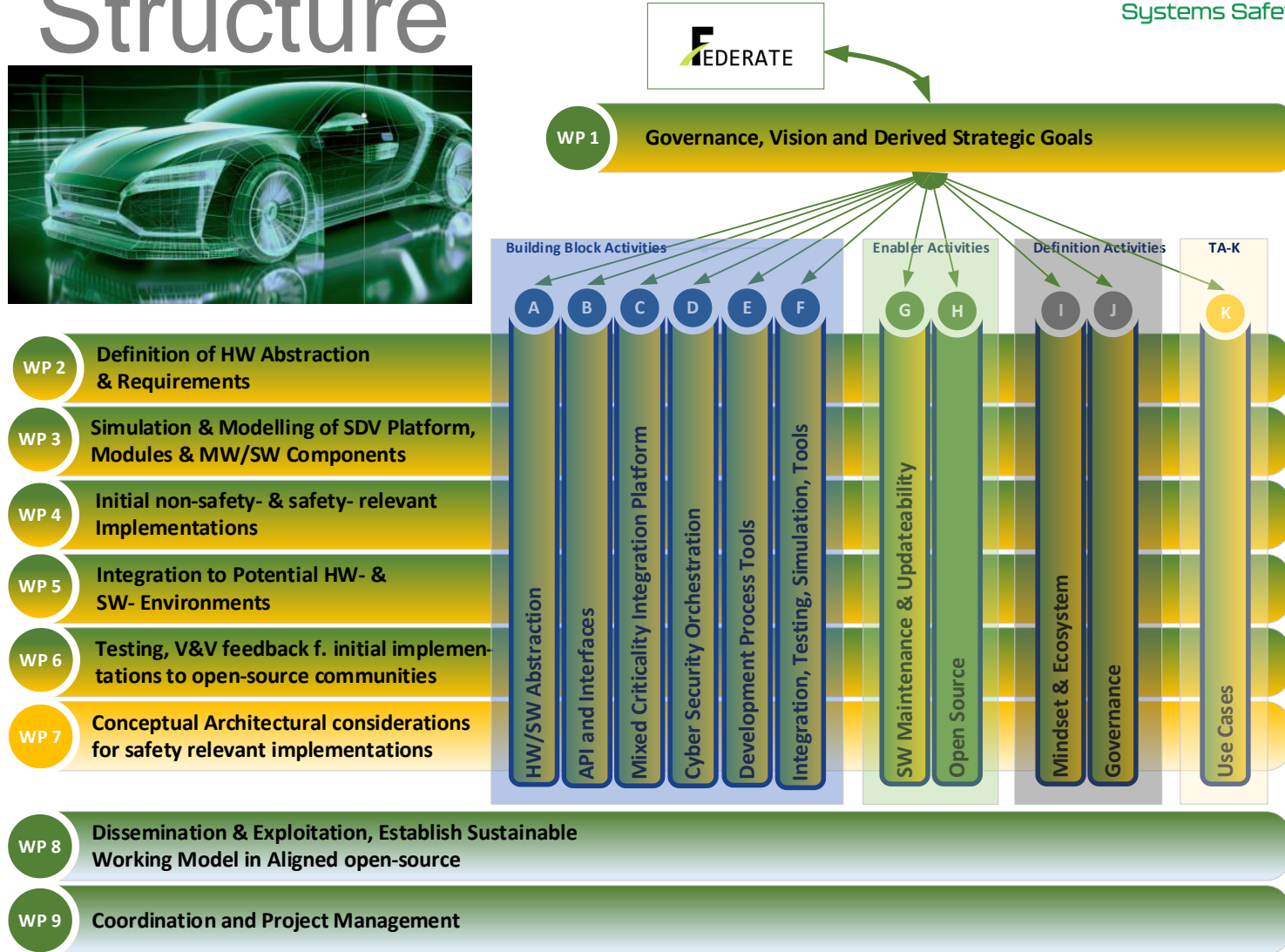


HAL⁴SDV Structure



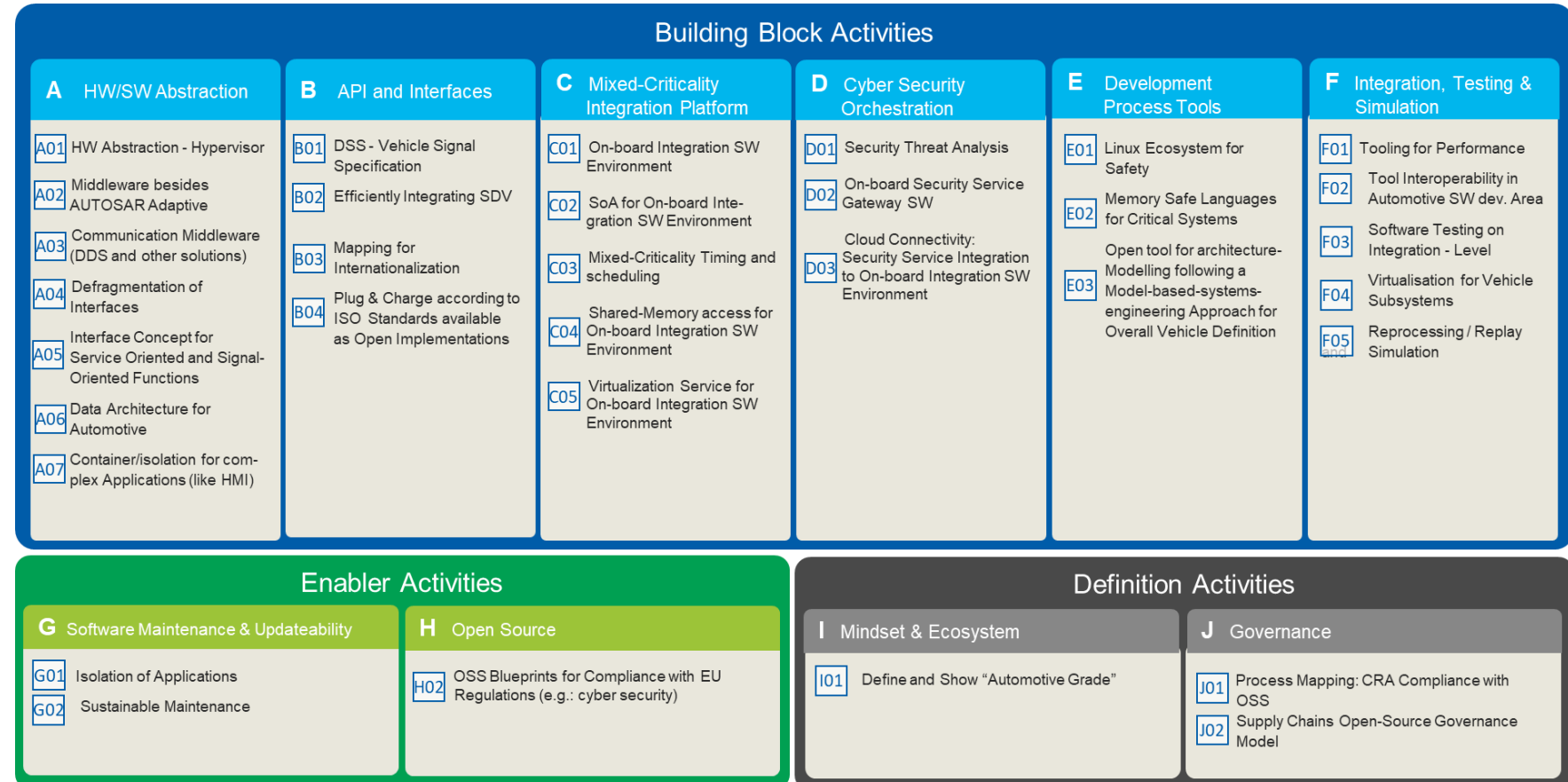
“green color” within the WPs represents the “non-safety-related, non-differentiating” technical developments (widely open source), “gold color” represents the “safety-related, differentiating” developments generating proprietary IP

HAL⁴SDV Structure

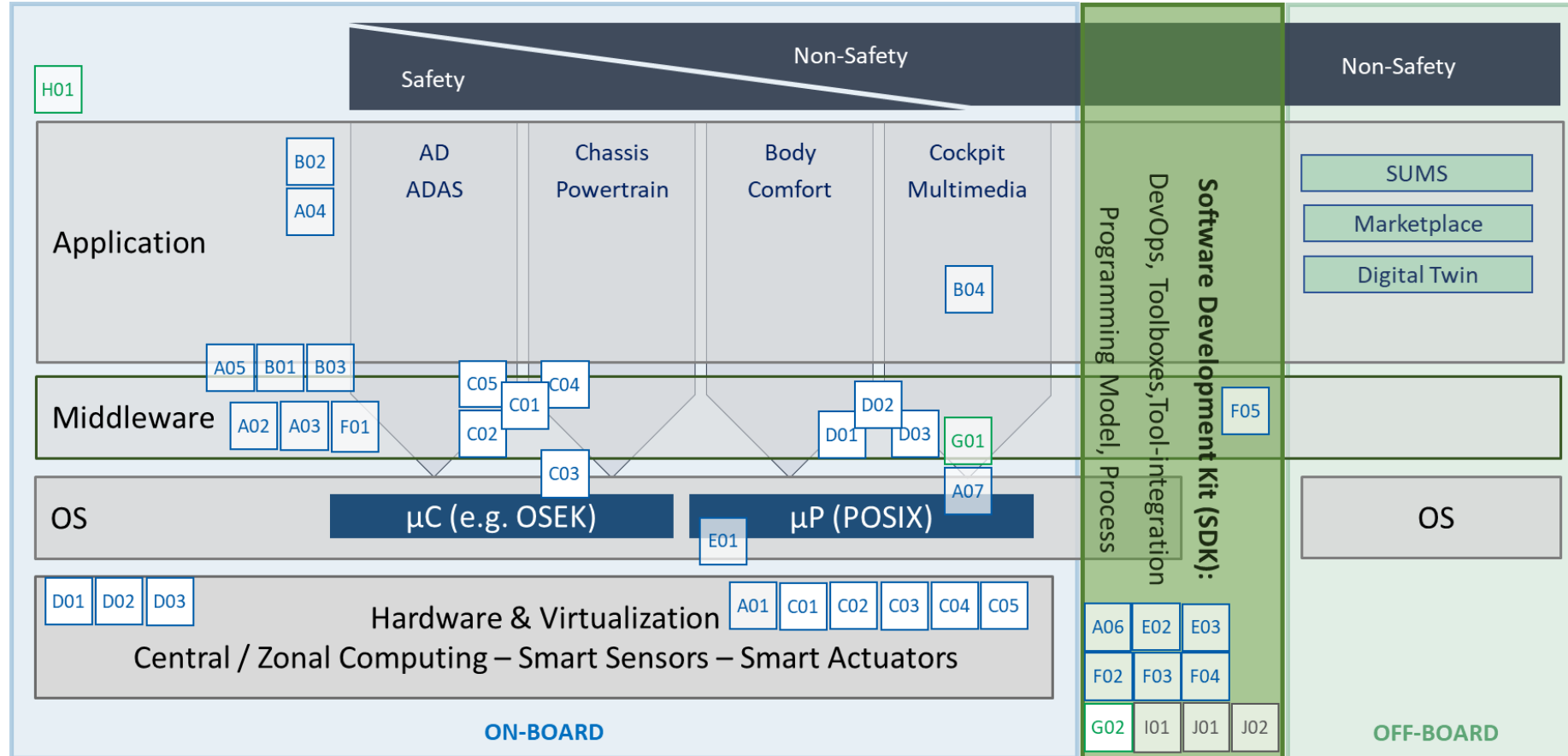


HAL⁴SDV Content Overview

- 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.



HAL⁴SDV Architectural Overview



HAL⁴SDV Objectives (1/2)

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.

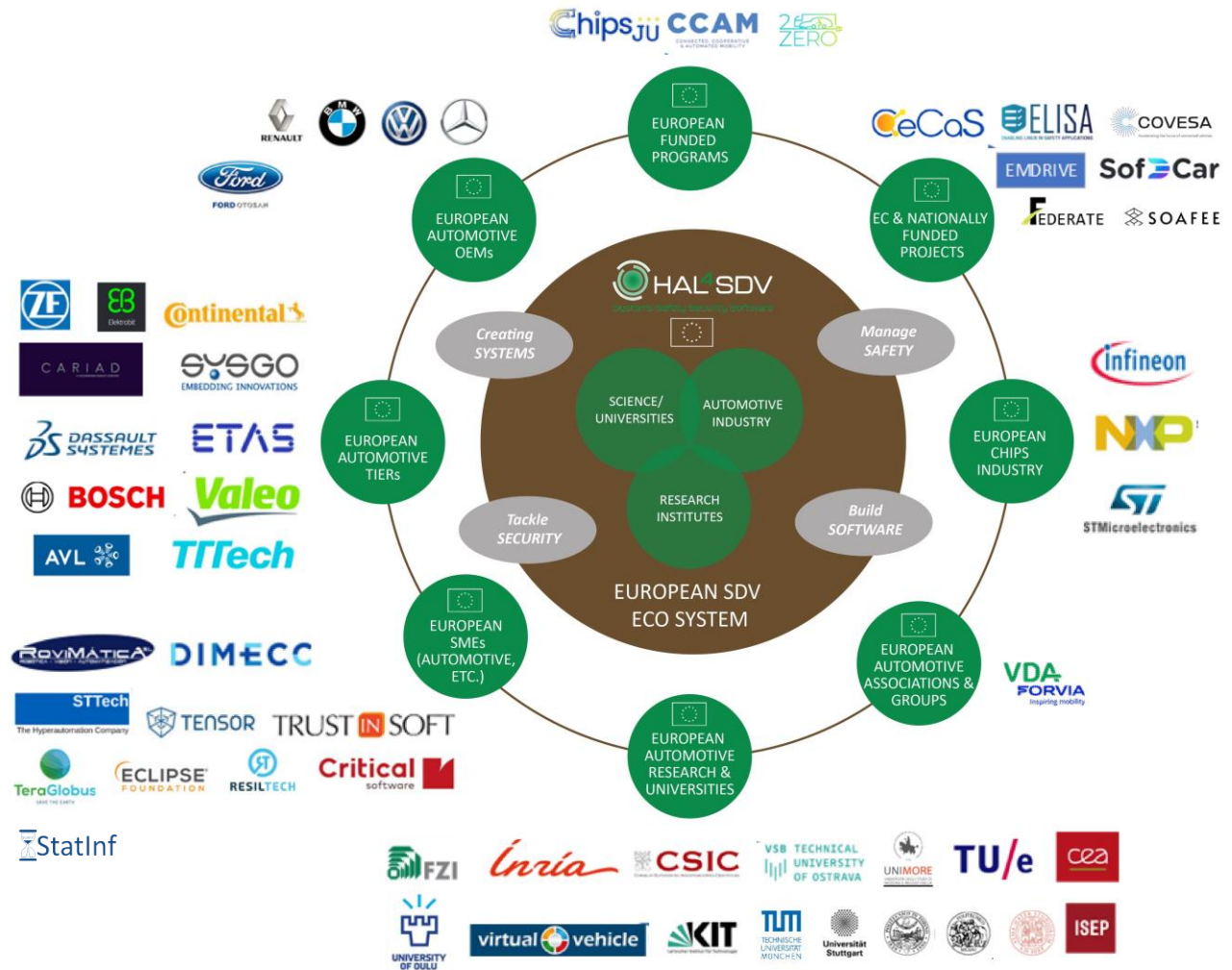
HAL⁴SDV Objectives (2/2)

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**



HAL⁴SDV Planned Cooperation

HAL4SDV will establish contacts to external Projects/Initiatives for potential exchange of concepts/results to build on results and join forces for mutual benefits

	<p>CSA project to build eco system with other related projects and initiatives to join forces and avoid “double development/reinvention of the wheel”</p>
	<p>Alliance for open standards, HAL4SDV intends to exchange approaches e.g.: in VSS open-source for non differentiating cross OEM Use Cases</p>
	<p>automotive software architecture & open-source reference implementation, real-time & safety needs with cloud-native: exchange planned</p>
	<p>Contribution to open-source Middleware Components: cooperation planned, in particular with WP 7 and TA-A/B</p>
	<p>Hardware platform concept for FinFET-based supercomputing units: Interest to cooperate w.r.t. potential Interfaces & APIs for related SW</p>
	<p>Framework & processes, guidelines & tools to support the certification process for safety critical open-source systems based on Linux: exchange planned</p>
	<p>Hierarchical computation architecture, a non-intrusive monitoring infrastructure: Interest for exchange in TA-D (security)</p>

HAL4SDV

Thank you for the attention!

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