



# HAL4SDV

Systems Safety Security Software

## Hardware Abstraction Layer for a European Software Defined Vehicle Approach

### D8.6 Initial project exploitation report

Teraglobus

15.10.2025



Deliverable		D8.6 Initial project exploitation report
Work Package(s)	WP8	
Task(s)	T8.4	
Dissemination Level	Public	
Due Date	30.09.2025	
Actual Submission Date	15.10.2025	
WP Leader	Teraglobus (TERA)	
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Document History		
Revision	Date	Description
V0.1	12.08.2025	Initial version
V0.2	23.09.2025	Updated version
V0.3	24.09.2025	Version for the review (PSB)
V0.4	08.10.2025	Version for the review (PGA)
V1.0	15.10.2025	Final and reviewed Version

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### Acknowledgement

The project is co-funded by the Chips Joint Undertaking (Chips JU) and National Authorities under grant agreement n° 101139789.



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## Table of contents

<b>1</b>	<b>Summary .....</b>	<b>7</b>
1.1	<i>Executive Summary.....</i>	7
<b>2</b>	<b>Introduction and Scope .....</b>	<b>8</b>
2.1	<i>Purpose and target groups .....</i>	8
2.2	<i>Contribution of Partners .....</i>	8
2.3	<i>Relation to other activities in the project.....</i>	8
<b>3</b>	<b>Description of the Technical Work .....</b>	<b>9</b>
3.1	<i>Key Concepts and Objectives .....</i>	9
3.2	<i>HAL4SDV exploitation strategy.....</i>	9
3.2.1	The commercial exploitation model .....	10
3.2.2	Research exploitation model .....	10
3.2.3	The technological exploitation model .....	10
3.2.4	Cross-project use model .....	11
3.3	<i>Consortium’s exploitation workshops.....</i>	11
3.4	<i>Plan for reporting on exploitable results .....</i>	11
3.5	<i>Intellectual Property Rights.....</i>	12
3.6	<i>Routes to Exploitation.....</i>	13
<b>4</b>	<b>Cooperation with other projects – the most effective exploitation .....</b>	<b>15</b>
4.1	<i>The specific Industrial situation and setting .....</i>	15
4.2	<i>A new movement: the cooperation between different funded projects.....</i>	17
4.3	<i>HAL4SDV current technical contributions for such exploitation approach.....</i>	18
4.3.1	Common software architecture .....	20
4.3.2	Large collection of requirements .....	21
4.3.3	Definition of Use Cases (UC) .....	21
4.3.4	Definition of open-source Building Blocks (OS- BB).....	22
4.4	<i>Market Overview &amp; Trends .....</i>	22
4.4.1	McKinsey recommendations to OEMS & Suppliers .....	23
<b>5</b>	<b>Exploitation by Partners .....</b>	<b>23</b>
5.1	<i>Individual Exploitation Plans.....</i>	23
<b>6</b>	<b>Conclusion .....</b>	<b>24</b>
<b>7</b>	<b>References.....</b>	<b>25</b>

## List of figures

Figure 1: Horizon Results Platform .....	13
Figure 2: Booster .....	14
Figure 3: The EU Innovation Radar Platform .....	14
Figure 4: HAL4SDV ecosystem .....	17
Figure 5: Cooperation model within the SDV community for various SDV R&D funded projects and initiatives.....	18
Figure 6: The HAL4SDV matrix structure denotes the basis for multiple projects .....	19
Figure 7: HAL4SDV Transversal Activities content.....	19
Figure 8: HAL4SDV assignment of building blocks to the HAL4SDV basic architectural concept .....	20
Figure 9: HAL4SDV Architecture (extract of D2.1b).....	21
Figure 10: Requirements capture process, and an example of a requirements record.....	21

## List of tables

Table 1: Contributions.....	8
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### Abbreviations

<b>EC</b>	European Commission
<b>EU</b>	European Union
<b>HAL</b>	Hardware Abstraction Layer
<b>HW</b>	Hardware
<b>SDV</b>	Software Defined Vehicle
<b>SotA</b>	State of the Art
<b>SW</b>	Software
<b>TA</b>	Transversal Activity
<b>TRL</b>	Technology Readiness Level
<b>WP</b>	Work Package
<b>C&amp;D&amp;E</b>	Communication, dissemination and exploitation
<b>OEMs</b>	Original Equipment Manufacturers

# 1 Summary

This deliverable, D8.6 Initial project exploitation report, provides an abstract overview of HAL4SDV exploitation activities conducted in the first 18 months of the project.

Important notification:

In the second year of the project, the consortium starts shaping exploitation routes, thus the exploitation deliverable includes a lot of “confidential information”. For this reason, the deliverable should be defined as “sensitive”. However, the HAL4SDV Initial exploitation report was mistakenly marked as “public”. Consequently, the content in D8.6 is limited and doesn't reflect HAL4SDV Exploitation survey results (the survey was implemented in M14-M18). Individual partners' exploitation plans with confidential information will be provided in a “sensitive” extended version of the document within the next project amendment.

## 1.1 Executive Summary

Deliverable D8.6 presents the initial HAL4SDV's Exploitation plan.

The mission of the HAL4SDV project is to advance European solutions in software-defined vehicles and next-generation vehicles. It aims to harmonise efforts across Europe, creating a comprehensive SDV ecosystem while leveraging existing national projects and international R&D activities. By focusing on unifying software interfaces and development methodologies, HAL4SDV will enable software configuration that abstracts from vehicle hardware, paving the way for a "software-defined vehicle" approach for both safety-critical and non-safety-critical applications in future vehicles.

This deliverable defines the HAL4SDV exploitation management processes, rules, and tools to be applied throughout the Project and the initial exploitation plan, including an abstract overview of the partners' exploitation plans. The HAL4SDV exploitation will ensure that Europe benefits from the added value that might result from the HAL4SDV-related work. The competitive advantage shall be with European companies and shall contribute to sustainably strengthening European industry and research organisations in the market.

The framework, consisting of the legal documents – Project Grant Agreement (PGA), Project Consortium Agreement (PCA), and National Grant Agreements (NGAs), forms the basis for using the outcomes of the HAL4SDV project. In case of any conflicts, the rules defined in the legal documents supersede any rules or recommended practices in the deliverable.

The HAL4SDV project's Exploitation plan will serve as a live document that will be systematically updated. As fast as the publicity level of the deliverable will be changed to “Sensitive”, an extended deliverable with partners' individual exploitation plans will be submitted. The final exploitation results will be submitted at the end of the project as deliverable D8.13, “Final project exploitation report” [m36].

## 2 Introduction and Scope

Deliverable D8.6 presents the initial HAL4SDV's Exploitation strategy and plan. This document provides detailed insights into the project's strategic approach to exploiting project outcomes.

### 2.1 Purpose and target groups

The purpose of this document is to detail the strategy and action plan for the effective Exploitation of the HAL4SDV project's outcomes. This involves outlining the methods for engaging target groups - diverse stakeholders, publicising project achievements, and promoting the application of HAL4SDV's research findings, innovations, and best practices in the automotive and SDV sectors. This document lays out the strategy for the exploitation of project outcomes, ensuring the sustainability and impact of HAL4SDV beyond the project's lifespan.

### 2.2 Contribution of Partners

The initial HAL4SDV Exploitation plan is proposed by HAL4SDV partner Teraglobus with respect to the strategic approach of the project coordinator, Andreas Eckel (TCAG), and partners' individual plans to exploit the project-related results. According to the HAL4SDV Grant Agreement requirements, all partners are committed to exploiting the project-related results and will highly support the project's dissemination and exploitation activities.

*Table 1: Contributions*

Chapter	Partner	Contribution
All sections	TERA	Main author, elaboration and completion
4	TAAG	Market Overview & Trends
3.2, 4	TCAG	HAL4SDV exploitation models, Cooperation with other projects

### 2.3 Relation to other activities in the project

HAL4SDV exploitation refers to the action of making use and benefiting from project results. The key obligation for the whole consortium is to ensure the exploitation of results up to four years after the project ends. Each beneficiary must either directly or indirectly exploit its HAL4SDV results by:

- Using them for further research,
- Developing, creating, or marketing products or processes,
- Creating and providing a service, or
- Using them in standardisation activities.

## 3 Description of the Technical Work

### 3.1 Key Concepts and Objectives

Exploitation by the European Commission is described as

*The utilization of results in further research activities other than those covered by the action concerned, or in developing, creating and marketing a product or process, or in creating and providing a service, or in standardization activities.*

Exploitation is essential in recognising exploitable results and their stakeholders. It concretises the value and impact of the R&I activity for societal challenges. Exploitation can be commercial, societal, political, or for improving public knowledge and action. Project partners can exploit results themselves, or facilitate exploitation by others (e.g. by making results available under open licenses).

The achievement of the HAL4SDV consortium, which covers a wide and complementary set of expertise along the automotive supply chain and applied sciences (manufacturers, Tier-1 & Tier-2, semiconductor manufacturers, engineering solutions, and research/academia), providing the appropriate work environment in terms of expertise, lab infrastructure and access to the appropriate real data sets (also from previous projects). Further, the international composition of the consortium will provide vast knowledge and expertise of the European and global markets, with its specific certification and standardisation procedures (while the project outcome will not necessarily be limited to these markets).

### 3.2 HAL4SDV exploitation strategy

The HAL4SDV consortium recognises the following main exploitation models for the project results:

- **The commercial exploitation model**, which implies the paid provision of the project results to the end-users, complying with an IPR scheme that will be defined in the HAL4SDV exploitation plan.
- **Research exploitation model**, which implies the re-utilisation of the research know-how acquired in future research activities, and
- **The technological exploitation model**, which implies the re-utilisation of the technological know-how acquired for the development of innovative products and the provision of advanced services built on top of them.
- **The cross-project use model**, which will allow sharing OSS building blocks with different projects without the complex contractual obligations to be negotiated, like license models or non-disclosure agreements to be put in place among a large group of cooperating Partners in the potential projects working together and sharing results.

HAL4SDV exploitation plan involves a four-step strategy, including identifying potentially valuable and exploitable results, explaining the types of results and potential users, discussing how the use of HAL4SDV results could be carried out, and seeking expert advice on the most appropriate routes for the expected results on how to deploy them. The plan also includes an

exploitation management process, which involves consultation activities between partners and key external stakeholders to develop a comprehensive exploitation plan.

### 3.2.1 The commercial exploitation model

The commercial exploitation model complies with the industrial HAL4SDV Partners. Despite the fact that the HAL4SDV project is a “Research and Innovation” (RIA) project with a final Technology Readiness Level (TRL) of four to five, the Partners are committed to continuing developments until higher TRLs up to the final product level as far as possible. In this context, the industrial Partners intend to not only inform potential customers inside the project about upcoming product developments resulting from the initial work in HAL4SDV, but also externally. This includes both, presenting the work in conferences, trade shows and exhibitions, which is also sometimes called a “dissemination activity”, but we consider that such activities conducted by industrial Partners, which are tied to the need to focus on profits, can also be called an “Exploitation Activity”. It is understood that such presentations are not made for the pure sake of spreading R&D results, as it may be the focus of academia Partners, but aiming at potential customer cooperation and/or an opportunity to later sales.

On the other hand, the industrial partners will directly address the desired final results at higher TRL up to TRL 9 to potential customers using their customer base. The aim is to commit “lead customers” to later start at a better launch event, already relying on first sales and/or even receiving risk-sharing financial or in-kind contributions on the way to the final product.

### 3.2.2 Research exploitation model

In contrast to the industrial Partners, the exploitation model for academic Partners is rather different. Academic Partners, in general, do not focus on providing products or marketable services, but are looking for diploma and PhD students or even post-docs by increasing the attractiveness of their organisations. In particular, universities will aim at installing new promising lectures and classes, building on the R&D work and their first results. The SDV topics enjoy a high reputation in the public domain and thus are considered attractive for this group of people. Being able to offer connections to industry and providing academic content in these lectures or classes related to the newest developments and technological trends, therefore, is a major differentiator in the field. The R&D work also offers a lot of “follow-on” developments in the future that further raise the institution's attractiveness.

It is also of utmost importance for research institutes to be at the cutting edge of technology and provide a large network to major industrial payers in the industry.

### 3.2.3 The technological exploitation model

HAL4SDV widely uses Open Source Software (OSS) development approach, which is currently experiencing a “hype” in the automotive software domain. At first glance, this looks like relinquishing profits since the direct sales of an OSS building block are not that easily possible. However, direct cooperation in SDV middleware and abstraction and potentially a joint architectural approach to ease integration and reusability of building blocks, is highly important to reduce the risk and cost of development. Alike the joint approach for common use of vehicle chassis, the approach followed in the SDV “movement” in Europe will offer multiple opportunities to develop add-on software modules which will be proprietary and

thus can be offered to the market. It will also enable a broad API and interface for almost any kind of functionality and application that can then be integrated in a much more efficient and cost-effective way. New business models are expected to have multiple new functions provided by all kinds of industrial partners, enlarging the value of a receiving vehicle in the end.

### 3.2.4 Cross-project use model

Concerning the cross-project use model, HAL4SDV is probably the first project enabling such a way of collaboration beyond the scope of an individual R&D project. It overcomes the traditional obstacle or burden of restricted access to R&D results from different projects. Due to the specific situation of the SDV community, it has become possible to insert OSS building blocks from one R&D project to another R&D project by Partners working in both or multiple SDV-related R&D projects. Thus, they know about the requirements. Labelling will document the origin, enhancing the results of a specific project by results from another, forming a larger entity and making sure that R&D results will be used in a broader community.

A related, more detailed description of this approach is provided in §4.

## 3.3 Consortium's exploitation workshops

The exploitation activities within the project comprise internal and external exploitation workshops to ensure that all partners share the same understanding of the importance of this activity. The aim of the workshops is to get the entire consortium involved in preparing comprehensive plans for commercial and academic exploitation of results and to reach collective agreements on the following topics:

- Characterization of the exploitable results and identification of new results as the project progresses;
- Validation of the business opportunities for these results, which depend on their replication potential;
- Continuous update of the consortium about the competition (existing or emerging alternative solutions);
- Identification and assessment of the risks and barriers to be overcome to enable the exploitation of the results and design of a mitigation plan;
- During the final exploitation workshop: verification and validation of the exploitation plan, in particular, the management of IP and the business models for each of the retained results;
- Analysis of the impact of project results on traditional business models of system integrators and the potential of new business models in this area.

The exploitation workshops will be organized on an annual basis and whenever possible, just before/after consortium meetings.

## 3.4 Plan for reporting on exploitable results

According to the HAL4SDV Grant Agreement, Beneficiaries which have received funding under the grant must, up to four years after the end of the action, use their best efforts to exploit

their results directly or to have them exploited indirectly by another entity, in particular through transfer or licensing [1].

If, despite a beneficiary's best efforts, the results are not exploited within one year after the end of the action, the beneficiaries must use the Horizon Results Platform to find interested parties to exploit the results. If results are incorporated in a standard, the beneficiaries must (unless otherwise agreed with the granting authority or unless it is impossible) ask the standardisation body to include the funding statement in (information related to) the standard.

Where the call conditions impose additional exploitation obligations (including obligations linked to the restriction of participation or control due to strategic assets, interests, autonomy or security reasons), the beneficiaries must comply with them — up to four years after the end of the action.

Where the call conditions impose additional exploitation obligations in case of a public emergency, the beneficiaries must (if requested by the granting authority) grant for a limited period of time specified in the request, non-exclusive licences — under fair and reasonable conditions — to their results to legal entities that need the results to address the public emergency and commit to rapidly and broadly exploit the resulting products and services at fair and reasonable conditions. This provision applies up to four years after the end of the action.

The HAL4SDV partner TeraGlobus (TERA) is supporting this task with the development of exploitation questionnaires, information webinars/meetings, and other supporting material to ensure that partners are aware of the exploitation activities importance and will report their results in an appropriate manner. As the first report D7.6. "Initial project exploitation report" was planned for Month 18, joint exploitation iterations were started in Month 14. The consortium was informed on how to report exploitable results without prejudice to the confidentiality of their companies' product and market information.

The second exploitation iteration and questionnaire update are planned for months 30-34 to guide each partner's exploitation strategy, ensure that project results are effectively used and deliver maximum impact. Collected input will be used to prepare the final HAL4SDV exploitation plan.

### 3.5 Intellectual Property Rights

During the project runtime and beyond, the consortium partners will appear on the market in order to evaluate means of commercially exploiting the full potential of the research output. Exploitation measures also include intellectual property rights (IPR).

HAL4SDV addresses highly competitive markets. Consequently, Intellectual Property Rights management of the developments made, and the technical goals achieved will be one of the central challenges. Thus, it is of utmost importance to establish a strong IPR management and policies to also defend IPR against project internal/external competitors. It is also seen as important that, in the first instance, Europe benefits from the added value that might result from the HAL4SDV work. The competitive advantage shall be with European companies and shall contribute to sustainably strengthen European Automotive industry and research organizations on the market. Thus, the central "dogma" in HAL4SDV will require keeping the

IPR of the HAL4SDV inventions and developments/research results with the Partners/Beneficiaries that have conducted such work.

For the success of the HAL4SDV project, it is essential that all project partners agree on explicit rules concerning IP ownership, access rights to any Background and Foreground IP for the execution of the project and the protection of IPRs and confidential information before the project starts (IPR details are included in the PCA).

### 3.6 Routes to Exploitation

The European Commission offers various free-of-charge services to support dissemination and exploitation activities:

- [Open Research Europe platform](#): An open-access publishing platform for scientific papers for Horizon 2020 and Horizon Europe beneficiaries, including an open peer review and article.
- [Horizon Results platform](#): A platform for showcasing your research results, finding collaboration opportunities and getting inspired by the results of others. Publishing results is part of the project execution for which all partners are responsible.

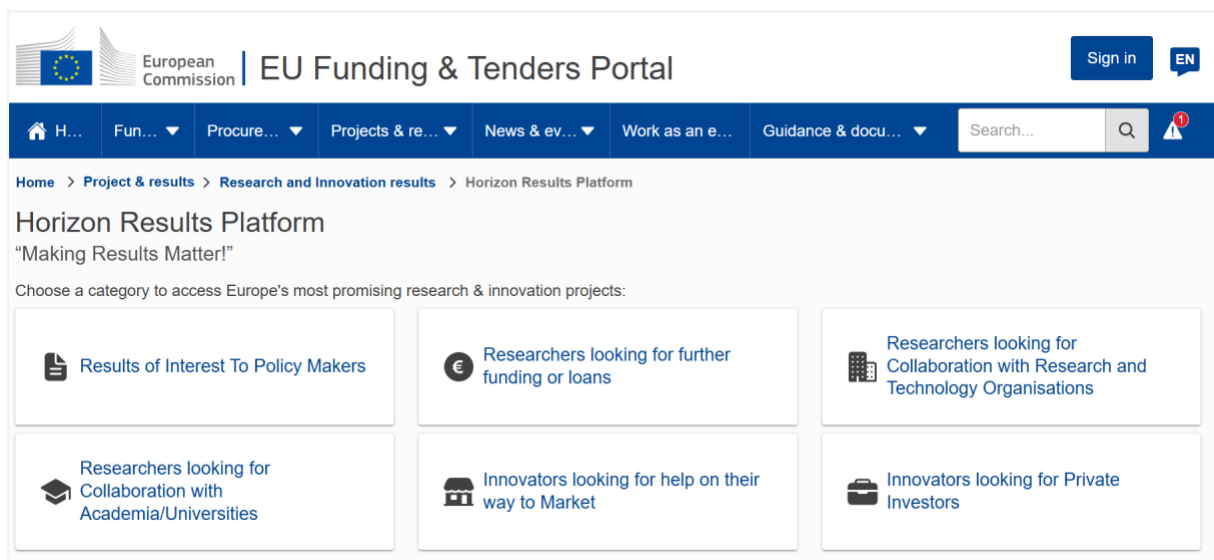


Figure 1: Horizon Results Platform

- [Booster](#): In order to help beneficiaries get a step further and better implement their dissemination & exploitation actions, the European Commission offers free consulting services through the Booster running between 2024 – 2028 which are continuing the services of the previously called Horizon Results Booster (2020 – 2024).

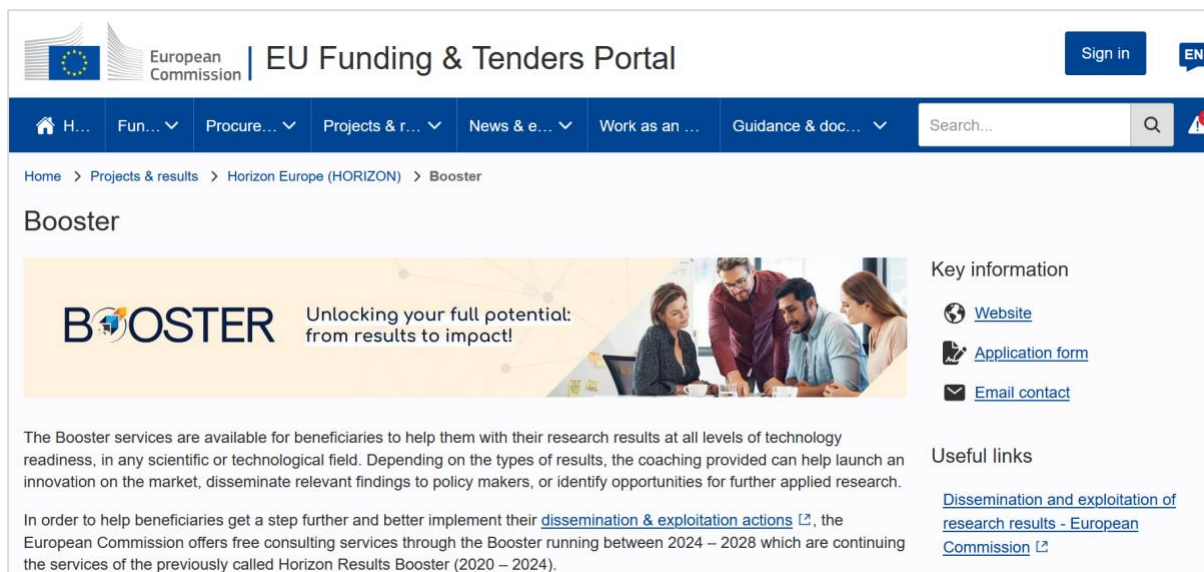


Figure 2: Booster

- The EU Innovation Radar platform:** Innovation Radar is now reinforced with the new Innovation Radar Bridge project, launched in Brussels on 16 April 2024. Innovation Radar Bridge will focus on strengthening connections between EU-funded innovators, European investors, and policymakers in member states (especially funding programmes managed by EU Member States that target innovators). It will do this throughout targeted events, deep-dive thematic reports, and mobilising greater use of Innovation Radar intelligence. The ultimate goal? Ensuring greater market and societal uptake of ground-breaking EU-funded innovations.

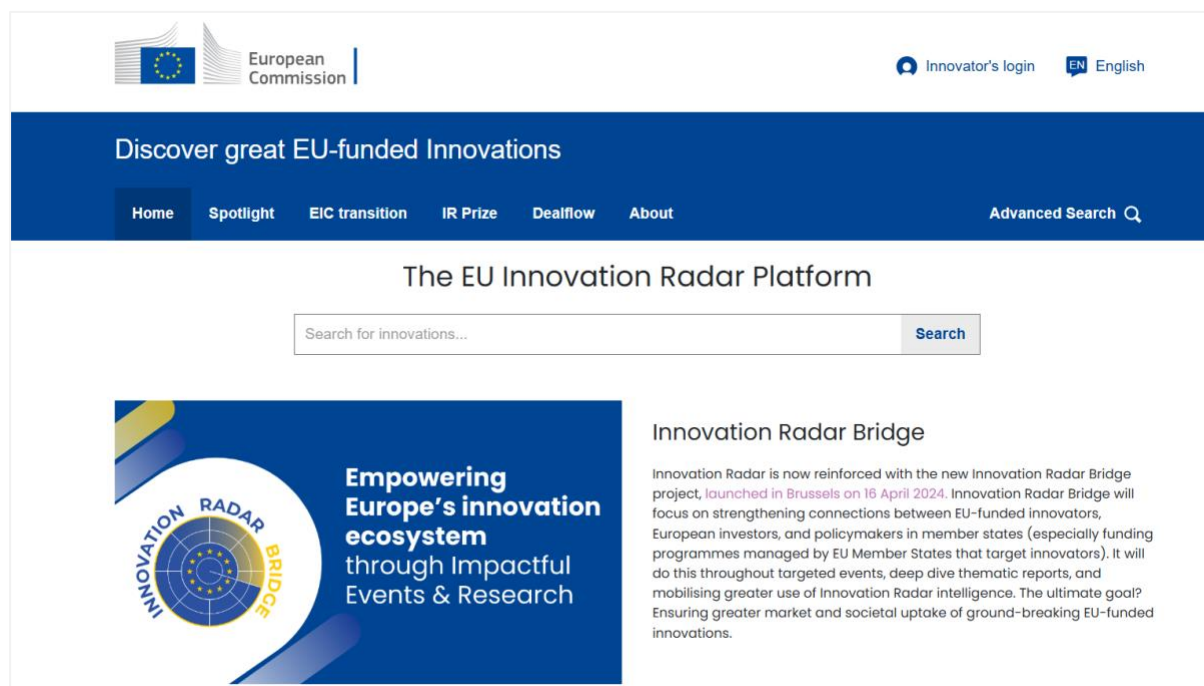


Figure 3: The EU Innovation Radar Platform

## 4 Cooperation with other projects – the most effective exploitation

Generally, EC-funded projects commit to cooperating with other projects running in parallel. This causes a number of problems, which are not easy to solve and do not look obvious at first glance. In case sensitive information or developments shall be shared, legal and/or contractual and often also IP or economic obstacles come up very quickly. In addition, different technical requirements or development rules are another challenge to master upfront. Thus, very often the so-called “cooperation” is more fiction than reality.

Concerning legal and contractual obstacles, at first, different non-disclosure agreements (NDA) build up a hurdle which is very seldom taken. To overcome such a hurdle, a common NDA would have to be negotiated with the partners of the projects involved, which, in general, is a significant effort and takes a lot of time. Alike, different Project Consortium Agreement (PCA) contracts are even more complex to handle. Topics like liability clauses, trade treaty clauses or export control terms, IP issues, etc., require lengthy negotiations prior to an agreement being found, and all partners of the projects concerned have signed such legal and contractual documents, and the targeted cooperation work could start. Often, the research and development work is completed prior to such agreements being found and signed.

Concerning technical challenges, the major question is how to agree on a harmonization of in general different design development and development rules or different standards to be respected. Even if technicians do not see any problems exchanging information and building upon each other’s work, desired cooperation frequently results in barriers that cannot be surpassed with reasonable and justifiable efforts.

Often also specific rules to be respected and originated by the funding authorities and instruments may establish a blocking point difficult to lift. A hard requirement states that double funding or double development of similar or close to identical developments must be avoided, nobody wants to “re-invent the wheel”.

Last not least, Intellectual Property Rights (IPR) denote a problem, at least if the developments are not open source. Even in the case of open-source many questions like those explained above require a mutually agreed solution frequently needing contractual documents to be negotiated and signed ending up in a “show-stopper” or blocking situation.

### 4.1 The specific Industrial situation and setting

Concerning the Software Defined Vehicle (SDV) community and the related projects, a very special situation and setting is in place. Major, special features can be interpreted as “Nuggets” fostering a particular situation for the communalities in the European SDV R&D approach:

- Nugget 1: Exclusivity: SDV-related projects address the “automotive industrial domain” only
- Nugget 2: Open-Source Approach: Common approach to deploy open-source contributions throughout the community – everybody can benefit from the results
- Nugget 3: Common Basis: Community is already working together in several SDV-related open-source funded projects, mainly in nationally funded projects

- **Nugget 4: Overarching Project:** HAL4SDV is the internationally working link between the different national and privately organised R&D projects
- **Nugget 5: Distributed Contribution:** Partners of the large-scale EC funded projects can insert open-source software building blocks into nationally funded projects they are also active in
- **Nugget 6: Overarching Governance:** The Common Support Activity (CSA) within the Chips-JU Program FEDERATE

### **Nugget 1: Exclusivity**

A large number of European players in different countries work in the field of SDV development and software. In many cases, the developments are done under the umbrella of “open-source” development and research. The community consists of three groups (a) Original Equipment Manufacturers (OEM), (b) Tiers/Suppliers and (c) the Academia, namely the Universities/Research Organisations. They all cooperate in different contracts for ages and are used for cooperation in research agreements and commercial contracts.

### **Nugget 2: Open-Source Approach**

Many obstacles to cooperation, in particular in the area of legal and contractual matters, were removed by focusing on open-source software building blocks. The aim is to establish a kind of common technical approach, saving the cost of development, and making use of results deployed by multiple players in the field. Various business models around the open-source world support follow-on commercialisation and deployment in products for generating profit. The approach can be seen as the next logical level of common use compared to the former step of sharing chassis designs among different brands.

### **Nugget 3: Common Basis**

While in most of the large-scale funded projects like those funded under the Strategic Research and Innovation Agenda (SRIA) by European Chips-JU, the consortia are composed of different industrial domains cooperating in dedicated groups, the projects targeting SDV related results stem from one industrial domain: the automotive domain. This provides a common basis that was rarely the case in other projects of similar scale.

### **Nugget 4: Overarching Project**

Since the majority of funded projects around SDV R&D work were nationally funded projects, an overarching project approach was “overdue”. By launching the SDV research and development initiative with dedicated “focus topics” in the Chips-JU funding program, the community now uses the instrument to deploy the activities on a larger scale.

### **Nugget 5: Distributed Contribution**

The new generations of SDV-funded projects in Chips-JU, 2Zero and CCAM programs can submit the results of the EC-funded projects to insert them into the open-source repositories of the national projects, enlarging their results. This enables harmonised contributions well fitting to the already developed building blocks and architectures, avoiding double developments and thus also double funding at the advent of broader opportunities to use the R&D results also in later series production programs.

**Nugget 6: Overarching Governance**

FEDERATE conducts an overarching governance and initiates a higher-level approach to bring forward the “Software Defined Vehicle of the Future” (SDVoF) initiative. It launches the needed cross-partner discussions to boost the building of an ecosystem. The project acts as an information platform fruitfully merging ideas and concepts to be further deployed in the surrounding funded R&D projects.

**4.2 A new movement: the cooperation between different funded projects**

The practice now proves a fully functional ecosystem (see Figure 4), which is already operational and in place in its initial deployment stage. On the example of HAL4SDV, which is the first of these overarching projects in a row of further projects in the programs of Chips-JU, 2Zero and CCAM, Partners are developing their open-source software building blocks in the frame of the HAL4SDV obligations. It turns out that the same Partners are also active in other initiatives and R&D projects like Eclipse S-Core, SOAFEE, COVESA, digital.auto, Shift2SDV and many others (see Figure 5). This provides a unique chance for such Partner working in HAL4SDV to develop the HAL4SDV obligations according to the rules of one or more projects running in parallel. HAL4SDV therefore does not implement its own open-source repository, but the Partners insert their HAL4SDV into different other projects. These contributions are labelled to HAL4SDV and thus the origin of HAL4SDV-funded developments and open-source building software blocks are specially earmarked and become traceable as HAL4SDV-funded R&D work.

This approach is unique in the domain of funded projects and denotes a new, effective way of cooperation. Thus, cooperation between different funding instruments is lifted to a new level of efficiency.



Figure 4: HAL4SDV ecosystem

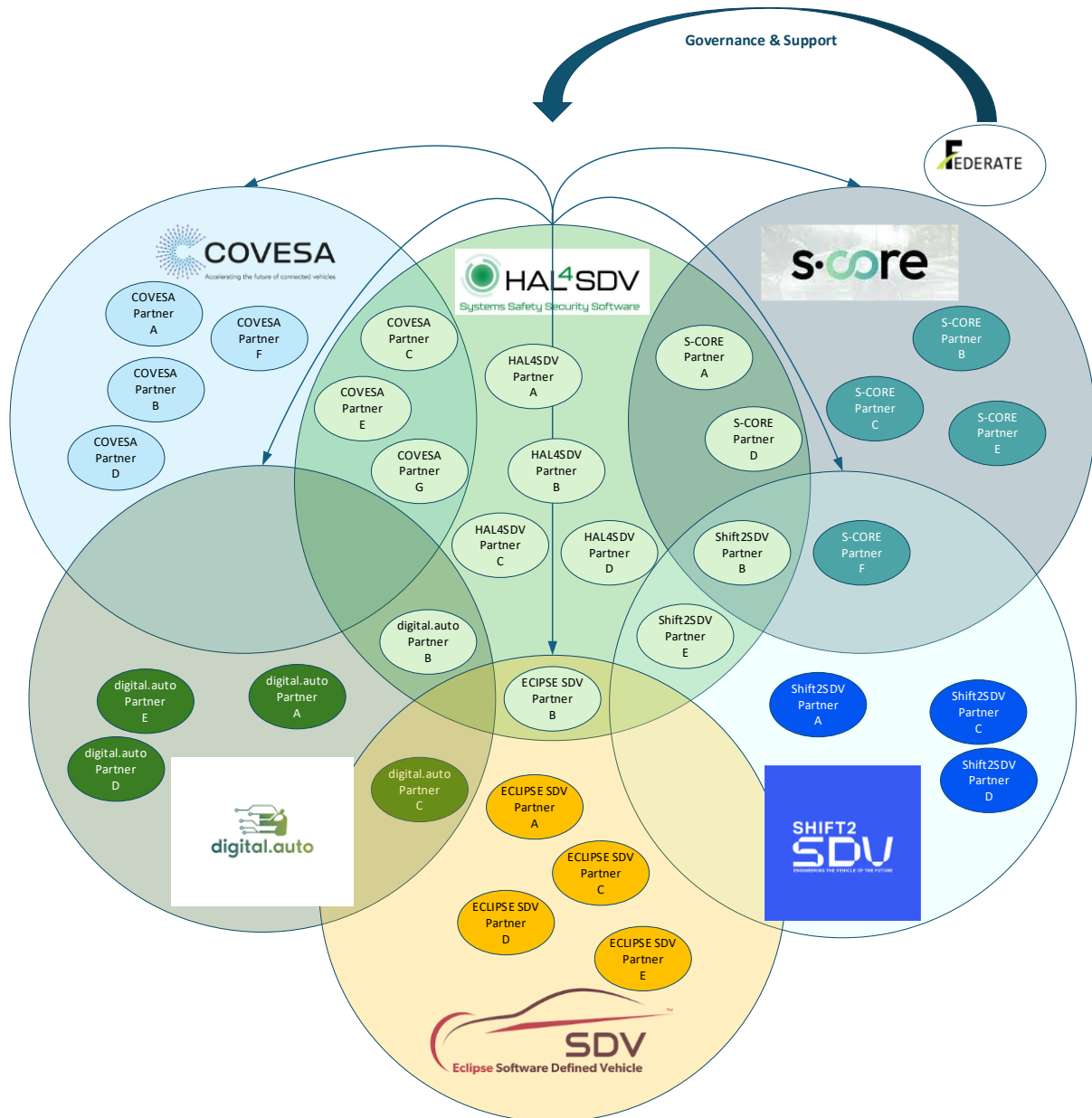


Figure 5: Cooperation model within the SDV community for various SDV R&D funded projects and initiatives

### 4.3 HAL4SDV current technical contributions for such exploitation approach

HAL4SDV has set up a project structure that denotes the basis not only for the conduct of producing the HAL4SDV results in their fulfilment of obligations, but also for later projects to come, like Shift2SDV. This consists of a matrix organisation with work packages overarching transversal activities, which follow a specific development stream like abstraction, interfaces, mixed criticality, security tools, etc. (see Figure 6).

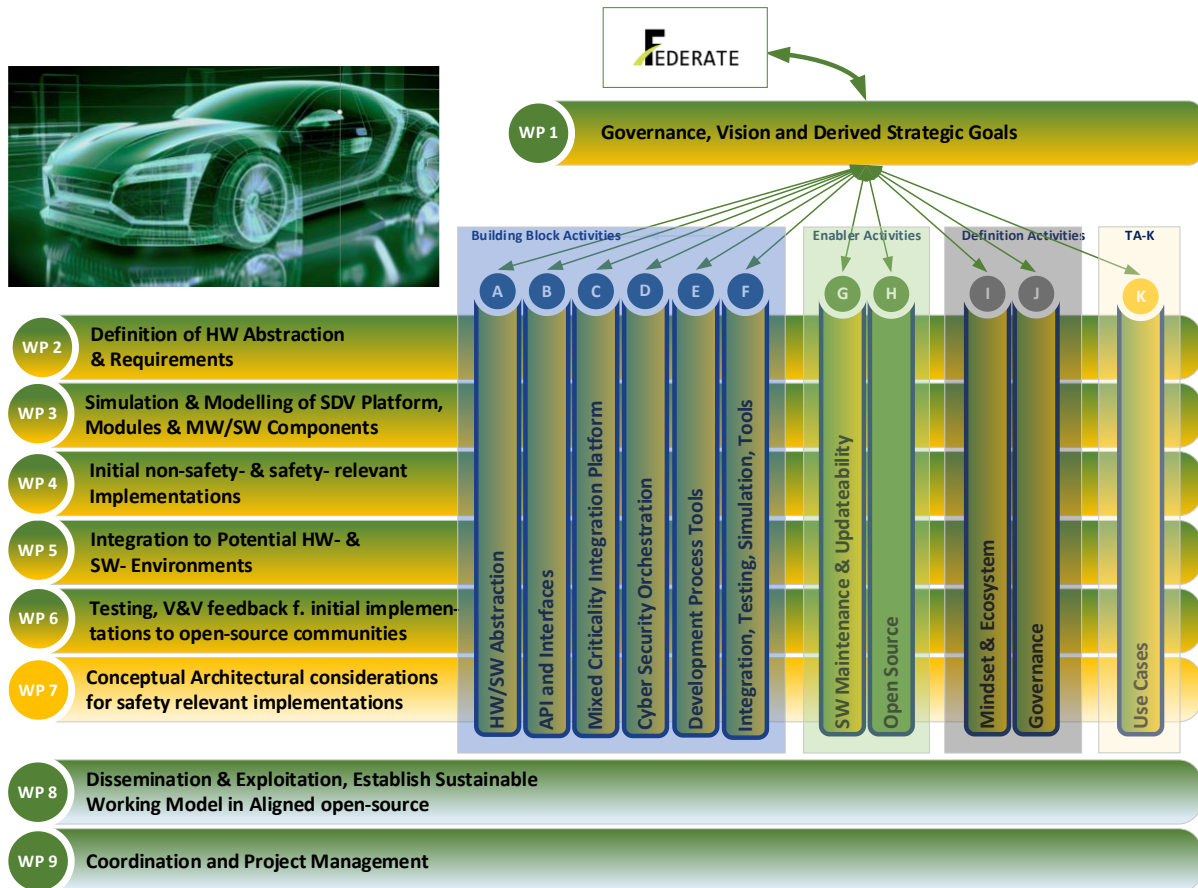


Figure 6: The HAL4SDV matrix structure denotes the basis for multiple projects

The definition of content is based on the topics and building blocks assigned to the transversal activities (see Figure 77).

Building Block Activities					
<b>A HW/SW Abstraction</b> 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>B API and Interfaces</b> B01 DSS - Vehicle Signal Specification B02 Efficiently Integrating SDV B03 Mapping for Internationalization B04 Plug & Charge according to ISO Standards available as Open Implementations	<b>C Mixed-Criticality Integration Platform</b> 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	<b>D Cyber Security Orchestration</b> D01 Security Threat Analysis D02 On-board Security Service Gateway SW D03 Cloud Connectivity: Security Service Integration to On-board Integration SW Environment	<b>E Development Process Tools</b> 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	<b>F Integration, Testing &amp; Simulation</b> 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
<b>Enabler Activities</b> <b>G Software Maintenance &amp; Updateability</b> G01 Isolation of Applications G02 Sustainable Maintenance <b>H Open Source</b> H01 OSS Blueprints for Compliance with EU Regulations (e.g.: cyber security)		<b>Definition Activities</b> <b>I Mindset &amp; Ecosystem</b> I01 Define and Show "Automotive Grade" <b>J Governance</b> J01 Process Mapping: CRA Compliance with OSS J02 Supply Chains Open-Source Governance Model			

Figure 7: HAL4SDV Transversal Activities content

Resulting from this definition, the assignment of building blocks to an architectural basic approach was made (see Figure 88).

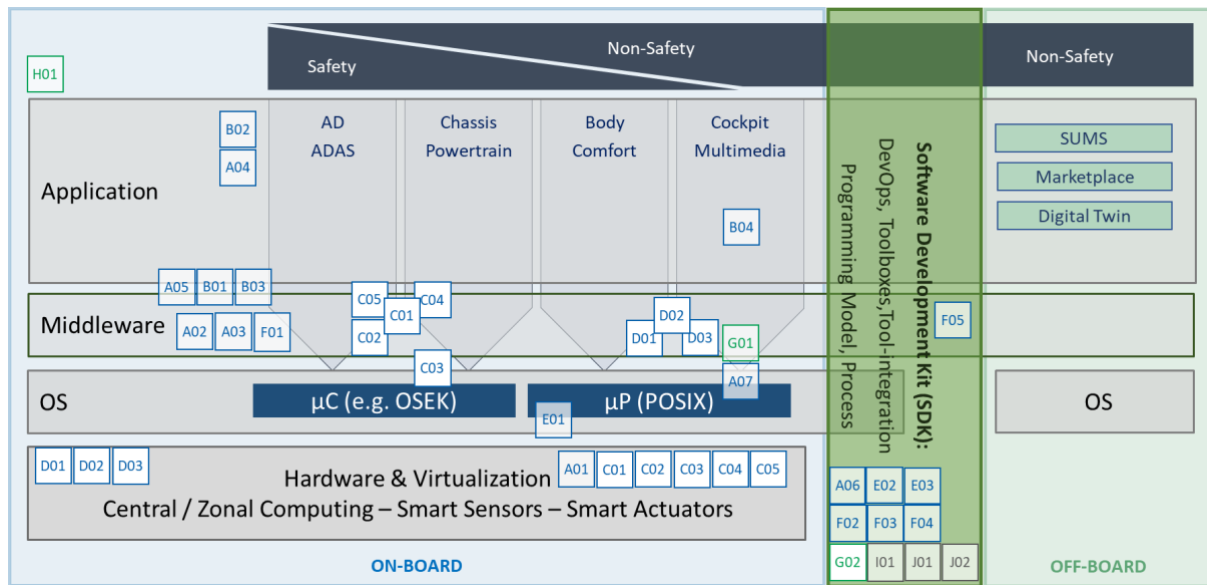


Figure 8: HAL4SDV assignment of building blocks to the HAL4SDV basic architectural concept

### 4.3.1 Common software architecture

One of the most critical challenges was to define an architecture that fulfils the requirements of real-world applications, such as chassis control or ADAS functions support for SDV on the one hand, and be compatible with other approaches in the SDV domain. HAL4SDV committed to a set of Use Cases (UC) for demonstration of applicability of the R&D work and developed open-source software building blocks conducted. These Use Cases denote various applications requiring a special software architectural approach. Thus, HAL4SDV endeavoured to define these UC architectures and developed an overarching architecture useable for all of the considered UC applications. In addition, HAL4SDV researched other architectural concepts used in the SDV domain like the suggestion of the European Commission DG CNECT run activity of the SDV Sherpa Group and projects like Eclipse S-Core and fused the needs to form a harmonized approach (see Figure 99).

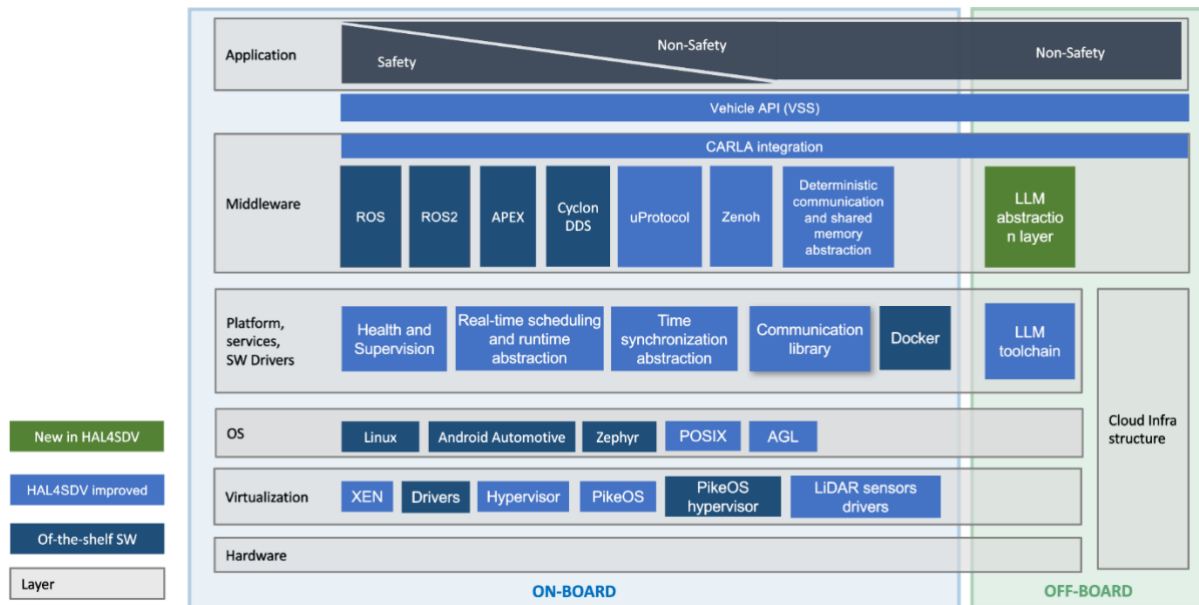
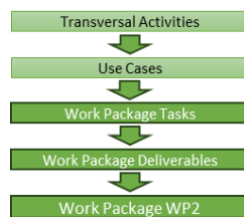


Figure 9: HAL4SDV Architecture (extract of D2.1b)

### 4.3.2 Large collection of requirements

The requirements capture process starting at each Transversal Activity and the Use Cases followed the task description of the project denoted in the WP 2 commitments and lead to the WP 2 dedicated requirements deliverable documents (see Figure 1010).



Identifier		Characteristics								Traceability				Lifecycle				
Unique ID	Title	Description	Leading TA	TA Topic	Author	Category	Safety related	Priority	Reviewer	Verification method	Covered Objectives	Covered by "Use Case"	Rationale / Motivated by	Refines	Date of creation	Version	Status	Status Comment
H_TA-A_0084	Function development independent of hardware	The framework based on Vehicle API must support function development independent of vehicle type [...]	TA-A	A05, A01	ZF Mandli Dheeraj Kumar Yadav	Architecture	Safety relevant	High		Test	Objective 1, Objective 2, [...]	UC1 - Powertrain	Technological advancements and modernization [...]			1.0.0	Ready for review	Possible duplicate: H_TA-A_0011

Figure 10: Requirements capture process, and an example of a requirements record

Following these principles, 561 requirements were captured and compared against each other to remove double entries and merge similar approaches into one record of requirements, building a large-scale collection of requirements.

### 4.3.3 Definition of Use Cases (UC)

During year one HAL4SDV also progressed significantly in defining the content and forming the project teams cooperating in the research and developments committed and the set-up

of the dedicated applications for the Use Cases. They form the back-bone for the evaluation and proof of concepts and developments within HAL4SDV.

### 4.3.4 Definition of open-source Building Blocks (OS- BB)

Alike HAL4SDV launched a large-scale activity to define the software building blocks across the Transversal Activities and topics defined in the architectural approach based on the requirements captured. So far, more than 50 building blocks have been identified and will contribute to the abstraction of hardware, functions, middleware and tools for the SDV.

## 4.4 Market Overview & Trends

With all the problems that became visible during the current year, which challenge the European automotive industry with reduced turnover, reduced profit and lots of layoffs, it is obvious that activities must happen to preserve the “former European wealth guarantee”, a former cornerstone of the European economy. There is massive competition from the Chinese OEMs exporting high numbers of low-cost, subsidised vehicles to the European market. In addition, these are currently of recognised quality and also offer over-the-air (OtA) updateability in most cases. On the other hand, European cars are no longer the status symbol in China, and sales figures are decreasing.

It is now in our hands in Europe to at least react on such threats and challenges. “What does it take to regain competitiveness?” a McKinsey study asks<sup>1</sup>.

For that reason, we focus more on this question and how HAL4SDV and the SDV ecosystem can improve the situation rather than complaining about problems in the market.

The major topics are to reply to the five disruptions that are hitting the markets at the moment in a successful manner (see McKinsey study in footnote 1 in the following).

- a) Strong increase in the significance of Geoeconomics
- b) Power train and its uncertainties
- c) Strong increase in demand for infotainment
- d) Software and ADAS
- e) Chinese growth challenge

This implies that European car manufacturers and the supply industry need to respond quickly and in a unified manner. SDV technologies will be a decisive key know-how to benefit from resulting new business models like vehicle fleets instead of individual sales, longer mileage versus loss of ROI in the basic mechanical and E/E parts of a vehicle for the benefit of quickly changing software modules and new functions implemented OtA and many more.

HAL4SDV provides a first European approach to research and develop architectures, software building blocks, and first configuration and design tool kits to form a basis for a large set of requirements provided. Cooperation alongside multiple other R&D projects in Europe and a

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<sup>1</sup> <https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/european-automotive-industry-what-it-takes-to-regain-competitiveness>

sound cooperation among the leading players in the field provide an ecosystem that is ready to take the challenge.

### 4.4.1 McKinsey recommendations to OEMS & Suppliers

The following recommendations were defined in the Report by McKinsey (see footnote 1):

Addressing OEMs:

- a) Embed customer centricity into the core of the business.
- b) Establish robust regional operating models.
- c) Develop a competitive strategy for lithium iron phosphate batteries.

Addressing Suppliers:

- a) Work on lowering their “break-even point” (our interpretation: lower cost, use SDV methods)
- b) Mitigate volume volatility (our interpretation: be able to react to changes fast and efficiently at high flexibility in cost structure and product offerings using a lean operating model)
- c) Optimise the ratios of fixed and variable costs
- d) Increase of efficiency by reducing the complexity of architecture/specification, implementing efficiency-enhancing technologies like generative AI, etc.

## 5 Exploitation by Partners

### 5.1 Individual Exploitation Plans

All HAL4SDV partners had a strong interest in participating in this project, as they foresee strong potential for the exploitation of the project results and the creation of sustainable collaboration at the TAs level. TAs clusters work on common research topics according to the application area of the industry in which the TA partners are working. This leads to a combined result for each specific industry with its particular background. Also, partners are working on their exploitable results, demonstrating the most significant outputs and benefits partners are gaining from participation in the project.

To clarify exploitation pathways at the individual partner's level, an exploitation survey was implemented in Months 14-18. Partners provided detailed information about their exploitable results, including current and future exploitation actions, application possibilities, expected commercial/scientific value and impact, and generated IPR. Due to the confidentiality of this information, the content is not provided in this public deliverable. The HAL4SDV partners' initial exploitation plans will be provided in the deliverable D8.6 extended version, marked as “sensitive”.

Strategies for how the exploitation path is defined by the different Partner „types“ (industrial, research organisations, universities) are provided in §3.2.

## 6 Conclusion

To implement the exploitation strategy, HAL4SDV uses a four-step operating strategy that is based on dialogue, reflection, and consensus on what products and/or services can represent a legacy of the project. HAL4SDV consortium partners are working to highlight and exploit the most promising technologies that arise as a result of the HAL4SDV research and development. Conversations regarding exploitation were started in the second reporting period, and new systems, products, and services will be introduced to the market during the next several years.

The HAL4SDV Consortium has the knowledge, communication, and technology value to develop and implement a plan that ensures proper and wide dissemination, exploitation, and communication of the project and its results. Currently, partners have defined about multiple exploitable results, as explained by the results in architecture, requirements and building blocks defined. Therefore, consortium partners are actively assisting in exploiting and disseminating the results in the future to maximize the HAL4SDV impact on Europe's economic growth and social welfare.

This Report summarised the market overview, individual and shared exploitable result information, and the consortium's approach to exploitation steps. It will serve as a live document, which will be updated. The HAL4SDV partners' initial exploitation plans will be provided in the deliverable D8.6 extended version, marked as "sensitive" after the amendment. The final exploitation results will be submitted at the end of the third reporting period as a deliverable D8.13. "Final projects exploitation report".

## 7 References

1. HAL4SDV Grant Agreement, p.39-41
2. MCKinsey&Company, European automotive industry: What it takes to regain competitiveness. Link: <https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/european-automotive-industry-what-it-takes-to-regain-competitiveness>