Call 2024-1 Topic ☐ Service Oriented Framework for the Software defined vehicle of the future (IA)

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<th>Specific conditions</th>
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<td><strong>Indicative budget</strong></td>
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<td><strong>Type of Action</strong></td>
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<td><strong>Technology Readiness Level</strong></td>
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The automotive industry is going through major rapid transformations making vehicles’ hardware and software increasingly important: mobility is rapidly evolving in a digital dimension, as natural evolution of vehicles’ propulsion, of their environmental impact, of their passive safety features, of their inclusion in wider digital ecosystems and of the new services/functionalities they offer. The automotive industry is a high-growth market for the entire semiconductor-based electronic hardware and for the edge-to-cloud software stack. The exponentially increasing complexity of the technology stack is leading to a necessary transformation, away from many highly specialized single-task control units, towards a networked mix of fewer Embedded Control Units (ECU), domain controllers, gateways and high-performance computers (HPCs), performing several tasks, complemented by digital twins and augmented by specialized artificial intelligence processing units, as trustworthy artificial intelligence is necessary for most of the new software functions in the vehicle of the future.

In this context, the automotive industry is increasingly following the Software Defined Vehicle paradigm, which is composed of the following main elements:

- **SDV Hardware Layer**: new low power, highly secure, high-performance system, based on a flexible and open integration of IP cores. The SDV hardware layer is implemented with interconnected electronic components such as mid-to-high performance processors, microcontrollers, and peripheral IP cores. These electronic components are increasingly realised in Systems-on-Chip (SoC) to support the transition towards more hierarchical and centralised electronic architecture of future vehicles and their intelligent capabilities.

- **SDV Operating System Layer**: often called Car OS, it plays a key role in the SDV, as the intermediary layer abstracting hardware, facilitating integration, and decoupling hardware from software through a specific SDV Hardware Abstraction Layer (HAL). The HW Abstraction Layer Interface (HALI) connects the SDV Hardware Layer with the SDV Middleware Layer.

- **SDV Middleware Layer**: the Car OS is further extended by a Service Oriented Framework (SOF), a middleware with an open and modular service oriented architecture, which abstracts the low-level technical details of the entire technology stack up to the vehicle OS. The SOF is the second level of decoupling between
hardware and software and is intended to expose the hardware functionalities directly as services, in an OS independent, standard & interoperable, safe, secure and efficient way. The Service Oriented Framework Interface (SOFI) connects the SDV Middleware Layer with the SDV Application Layer.

- **SDV Application Layer**: this layer consists of modular building blocks and APIs which offer the functionality visible to the end-users as infotainment, ADAS functions, AD functionality, Over-the-air updates during the operational phase of the vehicle, diagnostics, function-on-demands, cloud services as traffic guidance, HD mapp updates etc.

These elements constitute the main components of an open and modular European SDV platform for the vehicle of the future. In this platform, the possibility to access the hardware resources and functionalities in a simple, protected, and efficient way, thanks to a stack of software layers, standardised interfaces and compute layers, will facilitate the design, development, certification and maintenance of the final automotive applications. The layers themselves are composed of modular building blocks to allow easy adaptation to existing hardware and software components during the transitional phase from the existing to the new, centralized architecture of future vehicles. The ecosystem of SDV building blocks must be supported by a holistic engineering framework assisting the SDV across the entire lifecycle, enabling a mass market adoption and attracting the required industry investments. This holistic engineering framework has to differentiate from the ones adopted for the SDV hardware development, which requires increasing complex and expensive production processes, equipment and facilities, while it has to embrace an iterative, agile and flexible model capable to manage the continuous evolution of both the software and the hardware of the SDV, which does not conclude with the delivery of the vehicle but extends to its entire lifecycle.

This focus topic is part of the SDV Focus Area. Selected actions will be implemented as ‘linked actions’, i.e. they are linked with other actions selected under ‘SDV’ topics in past calls, this call and future calls. In this context, for example, collaboration with the CSA on “Coordination of the European Software-defined vehicle platform” (if selected in 2023) is of particular importance. The notion of “linked actions” may as well be extended to other EU-supported actions, e.g. HW-related actions under the Chips JU or actions under the CCAM and 2ZERO partnerships. A collaboration agreement with other selected projects and future projects should be established, that sets out requirements for IP sharing, a common governance model, and conformity with specifications set by suitable industry bodies. Respective options under Article 3 and Article 7 of the Model Grant Agreement will be used to this end.

**Expected Outcomes**

Proposal results are expected to contribute to:

- **Open, modular and extensible architectures and modular building block implementations for a Service Oriented Framework (SOF) for the vehicle of the**
future, hiding and abstracting the low-level hardware and software details of the technology stack up to the operating system (OS) to the extend possible, preparing for an OS independent, interoperable, modular solution, including a middleware layer and standardised interfaces, for the new high-level on-board and off-board functionalities on which the final competitive applications of future vehicles will be built. This includes platform integration with a focus on open standardised APIs to allow the development of cross-domain applications and services.

- **Integration with higher-level cloud based software applications to decouple the lower two SDV layers from specific applications connected to cloud platforms**, simplifying the development of brand and vehicle independent edge to cloud applications and the integration with the cloud.

- **Holistic engineering framework supporting the entire SDV DEVOPS lifecycle (design, development, integration, maintenance and update process)**, including design, development, test and validation, and deployment toolsets, to support the evolution of open-source based modular SDV architecture scenarios and solutions of OEMs and TIERs. The engineering framework must support an agile engineering process, which does not conclude with the delivery of vehicles to customers, but continues with analyses of the status and behavior of the vehicles, identification of new unknown safety-critical situations and over-the-air software updates to address the identified safety risks.

- **Showcasing and evaluation** of enhancements in terms of engineering costs, time-to-market, quality, inclusion of hardware and software legacy technology and solutions, resource optimization, service interoperability, availability, modularity, diversity, data/knowledge management.

**Scope**

Proposals need to particularly address the following aspects:

- Open and modular Service Oriented Architectures intended to expose the vehicle's features and functionalities in the form of standard modular services, simplifying the development and certification of in-vehicle and edge-cloud applications, simplifying the access to vehicle data, functions and resources, making vehicle upgradability easier, simplifying the adoption of existing and new regulations, and adding agility and speed to automotive engineering.

- Layer-based solutions introducing a new higher level of abstraction which allows the SOF (and the vehicle services) and middleware to be independent from the SDV hardware (and operating system) layer. The concept of hardware abstraction layers (HAL) and related APIs, which facilitates the integration and the decoupling of vehicle hardware from software, represents the foundation on which these solutions should be based.

- Modular platforms based on the concept of standardised, interoperable and non-differentiating “building blocks”, based on open source components as far as appropriate, enabling in-vehicle and cloud-based applications and ensuring the integration and support of existing frameworks such as ECPLISE SDV, AUTOSAR
Adaptive, COVESA, SOAFEE, digital.auto, etc. Modularity is fundamental to promote the evolution of a European platform for the vehicle of the future.

- Support the evolution towards domain- or vehicle-centralised E/E architectures, consolidating vehicle functions at domain-level (e.g., powertrain, autonomous driving, cockpit, body) with dedicated domain controllers, and simplifying the evolution toward zone- and vehicle-centralisation, with central control unit(s) running functions or services in different domains.
- Ensure the coverage of safety and security, including secure access to on-board resources, features and services, and data provision, exploiting for example an increased use of virtualisation, software building blocks isolation, and standardised interfaces.
- Adoption of standardised data formats and improved interoperability. Optimisation of data usage, respecting European privacy regulations in data collection, storage, analysis and sharing.
- Development of reference implementations of a Service Oriented Framework (SOF) for the vehicle of the future in different scenarios of OEMs and TIER1s. Reference implementations complement the SOF architecture open specifications and allow the concrete evaluation of the SDV platform with demonstrators.
- Highly-automated engineering methods and toolsets, supporting the devops continuous approach and virtual engineering, and including design, development, test, validation solutions to improve the efficiency, productivity, quality, … of the engineering process and keep it in the temporal contraints of the time to market of ADAS, AD, infotainment, sensing and control systems.
- Mechanisms to capture and manage, from the software level, non-functional characteristics of possible underlying hardware implementations with particular focus on real-time operation, low power dissipation, handling of (precise) computational exceptions and interrupts.

The consortium should be coordinated by a leading European industrial actor of the automotive industry (OEM or tier 1), or by a neutral organisation well established in the sector. The consortium must include:

- a large and representative number of European OEMs of motorised vehicles (passenger cars, trucks, buses, motor cycles) with headquarters in several Member States;
- a large and representative number of European tier-1 automotive suppliers and technology companies, including semiconductor companies and software engineering experts;
- innovative SMEs across the value chain;
- universities and research and technology organisations bringing the newest advances in relevant digital and other technologies and/or acting act as neutral mediators.

Proposals are encouraged:
• To allocate tasks to cohesion activities with the projects selected under the call HORIZON-KDT-JU-2023-3-CSA Topic 3 on Coordination of the European software-defined vehicle platform on and the call HORIZON-KDT-JU-2023-2-RIA Topic 2 on Hardware abstraction layer for a European Vehicle Operating System.

• To allocate tasks to cohesion activities with the [call 2024 automotive HW?].

• To allocate tasks to cohesion activities with the [related CCAM and 2ZERO projects].

• To allocate tasks to cohesion activities with the [related national SDV projects]

Specific conditions
All the specific conditions (admissibility, eligibility, evaluation criteria, scoring and threshold, etc) are the same as for Topic 1 of this call except:

Reimbursement rate for establishing the EU contribution
Reimbursement rates as percentages of the eligible cost according to HE.

<table>
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<tr>
<th>Type of beneficiary</th>
<th>EU Contribution as % of the Eligible Cost according to HE (*)</th>
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<tr>
<td>Large enterprise (for profit organization but not an SME)</td>
<td>25 %</td>
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<tr>
<td>SME (for profit SME)</td>
<td>35 %</td>
</tr>
<tr>
<td>University/Other (not for profit)</td>
<td>35 %</td>
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(*) beneficiaries may ask for a lower contribution

Capping:

The EU contribution per project is capped at 20M€ and the maximum contribution per partner in a project is limited to 40% of the total EU funding for the project.

The maximum number of participants is 70.