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Improving continuous development efficiency along the full project lifecycle – the CODE4EV framework for Software Defined Vehicles

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The automotive industry is subject to major transformation initiated by societal and economical pull (reducing emissions, zero fatalities, competitiveness) and accelerated by technology push (electrification, connected and automated mobility). Following this trend, the Software-Defined Vehicle (SDV) targets the integration of software (SW) development methodologies for vehicle development as well as the value delivery shift toward customers along the entire lifecycle. It promises to create benefits for the car manufacturers in terms of faster time to market, easier update – as well as for the car users (private persons, fleet operators) in terms of personalized user experience and upgradability. At the same time, SDV requires a much more integrated and continuous development framework to enable different experts to efficiently develop and validate concurrently the different parts of the vehicles, to gather information about field operation, and to support update in the field. Building upon the development framework introduced in the CODE4EV project[1], target of this paper is to demonstrate its impact for the development of three automotive use cases related to data-driven optimisation of electric vehicle, health monitoring and predictive maintenance, and smart motion control.

The CODE4EV project aims to accelerate the development of electric software-defined vehicles by establishing a collaborative development framework. This framework supports the design, production and operational phases of electric vehicles (EVs) by demonstrating its application through selected Use Cases relevant to emerging and future SDV architectures. The project key objectives include the elaboration of digital design tools and a trustworthy development methodology for electric SDVs, improving the efficiency and reliability of SDV architecture, component sharing, and accelerating validation processes. The project is relying on 3 complementary use cases, with the target to demonstrate the implementation of the collaborative development framework, such as data-driven EV optimisation (use case 1), health monitoring and predictive maintenance (use case 2), and smart motion control (use case 3). These use cases aim to demonstrate improvements in energy consumption, component life extension and overall vehicle performance. CODE4EV plans to develop virtual, hybrid and full-scale demonstrators of electric SDVs for different vehicle categories, focusing on efficient verification procedures and the evaluation of the scalability of the CODE4EV approach. These efforts aim to ensure compatibility and efficiency for a range of vehicle types, including heavy-duty electric trucks and L-class EVs, thereby making an important contribution to the promotion of zero-emission mobility solutions.

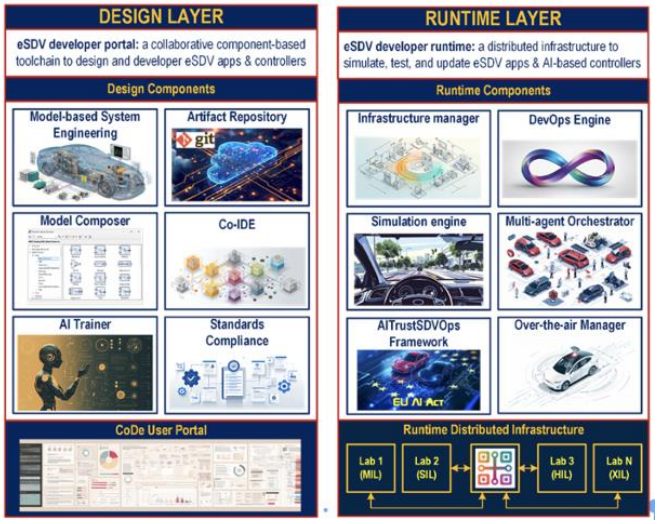

Figure 1: The CoDe framework

The transition toward software-defined vehicle implies a shift toward consistent software and data management for the full vehicle and along the full product lifecycle. New solutions are required to accelerate design space exploration, support early (virtual or hybrid) integration and validation, and reduce time-to-market. This paper provided an overview of three relevant use cases, and explained how the CODE4EV framework could improve development consistency, respectively supported the efficient collaboration between different teams, relying on geographically distributed testbench facilities.

[1] www.code4ev.eu