

The software-defined vehicle as an outgrowth of megatrends

OPEN STANDARDS AND OPEN SOURCE AS KEY ELEMENTS OF SOFTWARE-DEFINED VEHICLE PLATFORMS

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Digital features are figuring ever more prominently across all lines of business, and this trend shows no signs of slowing. Digital solutions, apps, and the like are already fixtures of consumers' day-to-day lives, and increasing numbers of drivers expect their vehicles to be fully integrated into this smart lifestyle. This requires new connectivity, automation, and personalization functions, more and more of which will be implemented with software. This has consequences for automakers.

While hardware and mechanical features had been the great differentiators for brands, now software is taking on a much more important role. In the future, software will have a tremendous impact on the customer experience and even on vehicles' hardware specifications.

This software-defined vehicle, or SWdV for short, is therefore an outgrowth of megatrends currently sweeping the globe – personalization, automated driving, connectivity, and electrification. It will give rise to new business models and digital services for customers. Above all, though, it is changing the way vehicles are engineered and how automakers are going to create value in the future.

A PARADIGM SHIFT IN AUTOMOTIVE ENGINEERING

Vehicles' increasingly seamless integration into the digital world will eventually require a constant exchange of data with the cloud. This will allow software to be continuously optimized and evolved to the full extent of the hardware's capabilities. Automakers will therefore have to speed up development cycles so they can differentiate their brands by updating and upgrading vehicle functions and the like throughout the lifecycle, even after the SOP.

This paradigm shift is primarily enabled by the separation of hardware and software, as well as by increasing connectivity.

Hardware and software abstraction is already commonplace on most IT platforms, but this practice is just beginning to gain traction in automotive engineering with advent of the software-defined vehicle. In the past, it had been possible to consider individual systems within the vehicle in isolation. Systems integration was already a challenge in and of itself. Engineers had to take dependencies into account and coordinate the

individual systems. But emerging distributed software architectures are now pushing conventional E/E architectures and development methods to limits of their capabilities. Hardware/software abstraction and continuous integration and delivery (CI/CD) methods enable engineers to develop these new central E/E architectures and platform solutions. They can better integrate software functions and accelerate release and innovation cycles with these methods. This reduces system complexity, but it also raises the requirements bar and increases software complexity.

A SMART PLATFORM HELPS TAME COMPLEXITY

ITK Engineering believes that it will take a comprehensive SWdV technology platform with three components to create a cross-domain, centralized architecture and reduce complexity in software development and system integration:

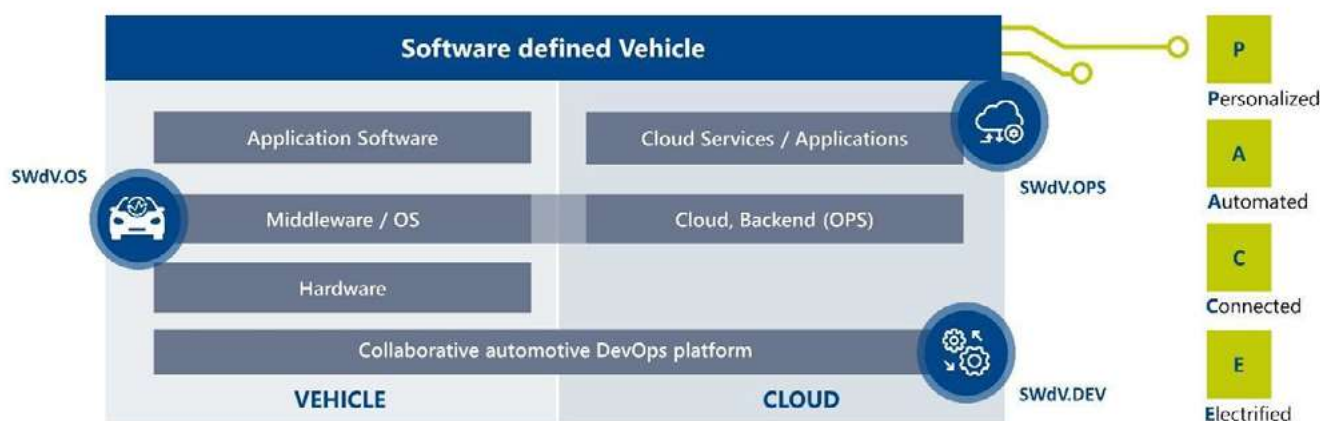


Figure 1
The SWdV technology platform

1. SWDV.OS: An operating system is required on the vehicle side to make it easier to integrate new vehicle functions. This software base layer serves several purposes, one being to enable the abstraction of software functions and, by extension, central data acquisition and software update management in the vehicle.

2. SWDV.OPS: This in-vehicle base layer and the platform in the cloud have to be coordinated. The two elements' functions complement each other to create an over-the-air connection with the vehicle and thereby support efficient and transparent communication among components of the application software. This also enables cloud-based operation of vehicle software and new services.

3. SWDV.DEV: This technology platform will have to include a scalable and collaborative development environment. This environment unifies the two sides, the vehicle and the cloud, to enable end-to-end development of innovative features based on new data-driven development methods and fast integration cycles. A scalable integration platform that accommodates and automatically tests vendors' software is an essential component for increasingly distributed and collaborative software development.

COMPLEX SOFTWARE INTEGRATION DEMANDS EFFICIENT COLLABORATION

The SWdV technology platform addresses general challenges faced by OEMs. Although not a differentiator from the customer's perspective, it is essential and also necessary for creating differentiating vehicle functions. ITK Engineering believes cooperation and partnerships are vital this end. A scalable platform based on open standards and open source could enable players to join forces and reach as many users as possible.

As OEMs adopt and evolve the SWdV technology platform, the collaboration will also have to be stepped up at the ECU level. The reason for this is that more and more software vendors are contributing to the functionality and demanding ever faster feedback on delivered software. This is compounding the complexity of software integration. Today's conventional approach of manually integrating and validating software is therefore no longer viable – it cannot cope with all the complexity. This will lead to a transformation of the software integration process. After all, state-of-the-art software integration is all about maximizing speed and flexibility while minimizing the validation effort.

This new software integration process will have to be efficient, which is why creating neutral ground between all stakeholders makes so much sense.

More open communication with a neutral partner mediating as a coordinator will inevitably promote collaboration. A detached and independent integration environment could serve to create this neutral ground. As it stands, manual software integration is a drawn-out procedure that takes place at long intervals. To meet the main requirements, it will have to be transformed – in all its details – into a collaborative and continuous software integration and validation process.

The result of a co-integration environment could look like this (Fig.2):

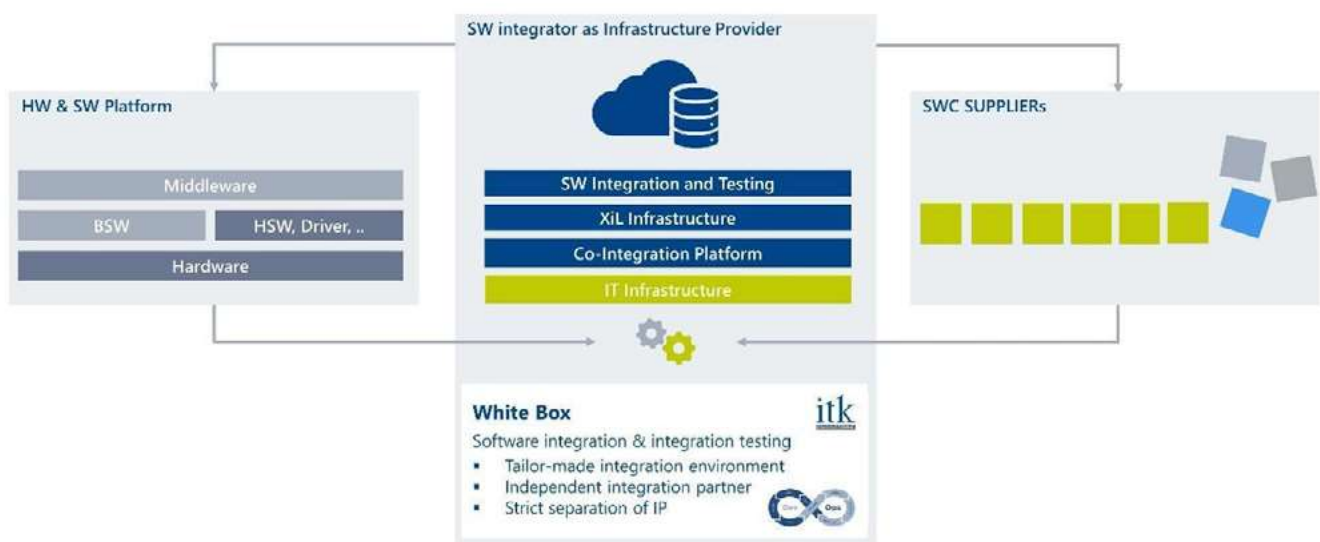


Figure 2

The co-integration environment

The SWdV technology platform is a key to the software-defined vehicle. It will take intensive collaboration within the framework of alliances and partnerships for this platform to succeed.

As an independent partner, ITK Engineering is rising to the emerging challenges of software-defined vehicle development and state-of-the-art software co-integration by offering tailored environments for collaborative software integration and validation. As an integration partner, the technology company can set up a collaborative co-integration environment to provide a neutral and independent basis and achieve the required scalability and high level of automation. This environment is the third pillar of the SWdV technology platform (SWdV.DEV) described in this article.

AUTOSAR AS A BUILDING BLOCK OF THE SOFTWARE-DEFINED VEHICLE

AUTOSAR has long appreciated the advantages of collaboration and for 20 years has been working on AUTOSAR standards, which have been adopted by many OEMs, suppliers, and tool vendors. The established standard focuses on specific requirements at the vehicular level. The SWdV technology platform is going to extend beyond the boundaries of the standard, but the consortium will remain an important component.

Combining established elements such as AUTOSAR with open source software can drive and accelerate innovations on the SWdV technology platform as well as reduce time to market.

Keeping pace with times, the AUTOSAR Alliance is pursuing its Opening Strategy and intends to declare part of the specifications as an open standard. Opening protocols at the network level is a crucial step to support efforts to develop compatible applications beyond AUTOSAR. This simplified access will further extend the reach. On top of that, the new Vehicle API standard is to create fresh opportunities for in-vehicle interaction with AUTOSAR for the world outside AUTOSAR.

This is a major stride towards connecting AUTOSAR with other elements of the software-defined vehicle. AUTOSAR is thus setting the stage for software-defined vehicle activities on a global scale. ITK Engineering believes this is the right thing to do and will therefore continue to support AUTOSAR as a Premium Partner.