

Continuous software releases for tomorrow's mobility demands

Future vehicle generations will be significantly shaped by innovations in software. The impact on the development process is remarkable. BERNHARD D. VALNION describes how AVL is positioning itself in this regard.



Picture: ZF

Exciting times lie ahead for the automotive industry. It must have its foot on the accelerator in at least three areas: Electromobility and urbanization, driver assistance systems and autonomous driving, and the sharing economy colliding with individualization. The previous, predominant clientele, the digital immigrants ('baby boomers'), are gradually being sent into retirement, which is leading to a decline in their purchasing power. As a result, the focus will increasingly turn to digital natives (born in 2000 or later) and their view of sustainable end-to-end mobility.

However, the complexity of the software and the system development process as a whole will also increase significantly. Yes, it's all about thinking in systems. A critical mixture of different propulsion technologies, stricter legal requirements, various market approaches and cost pressure with simultaneous shortening of the time-to-market is emerging, which needs to be mastered. The question is what impact will it have on the vehicle development process when a vehicle becomes a 'software-defined product'?

Cycles of the different speeds

Certainly, hardware will continue to be developed according to the tried-and-tested V-model, while an agile DevOps approach is the measure of all things for software development. The neologism 'DevOps' generally speaking stands for an approach that automates and optimizes the processes between software development and operational IT teams so that software can be built, tested and released faster and more reliably. In a DevOps model, development and operations teams work closely together throughout the software lifecycle. DevOps is now well mastered — so far, so good. But here is the thing: DevOps and the V-process have different 'levels of speed', yet they must be closely interconnected. This results in the following challenges for automotive OEMs:

- Ensuring 'Fast Function Delivery' to the customer
- Implementing a future-proof E/E architecture
- Orchestration of software and hardware development environments.

Generally speaking, the answer to this is composed of the building blocks of agile best practices, continuous integration, automated testing and centralized E/E system architectures. In addition, there is business model innovation in the sense of open innovation or ecosystems. The hierarchical OEM-Tier_n supplier relationships that are still closed off today must give way in order to achieve standardized platforms ('rolling chassis') as a foundation for product differentiation enabled by software, as in the case of smartphones. In this scenario, the role of the automotive OEM is to focus on vehicle functions and user experience while relying on outsourced competence centers for software design (see CARIAD) and strategic operating system and chip partners. As psychoanalysis states, however, one is no longer the 'sole master in one's own house' but part of an innovation organism.

CARIAD is a software subsidiary of the Volkswagen Group. The Group bundles its software development in it, including work on a uniform software platform for all Volkswagen Group passenger car brands, the vw.os operating system and the Volkswagen Automotive Cloud. The new organization is intended to increase the proportion of in-house software in the vehicle from the current ten percent to at least 60 percent.



"If new functions are to be made available in the customer vehicle, the release processes must be rethought."

Wolfgang Puntigam
Global Business Unit Manager IODP, AVL

How must the development process change as a result of these dynamics? The answer can only be accurately given against the backdrop that software will become the key differentiator for automotive OEMs and the hardware powertrain platform will mutate into commodity. In addition, there are the following trends:

- Functional tests will be shifted in virtual environments
- There will be less physical testing required on testbeds
- There will be a shift from a hardware- or product structure-centric focus to software-defined vehicle-centric development

The software functions are distributed across different vehicle layers. Layers are vehicle assistance systems, infotainment or connectivity with the environment. There will be clearly defined interfaces between hardware and software to define Operational Design Domains (ODD). The vehicle 'shell' itself will basically become a component of this.

In the future, automotive OEMs will test the software to be implemented in CI/CD cycles (continuous integration / continuous delivery) against all vehicle variants. This will require virtual, hybrid and physical prototypes which will be combined into so-called 'functional prototypes'. For over-the-air updates, digital twins of their customer vehicles are required to validate the software.

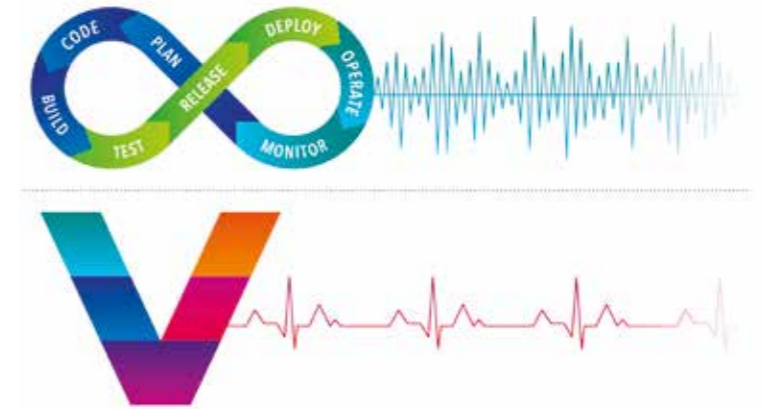
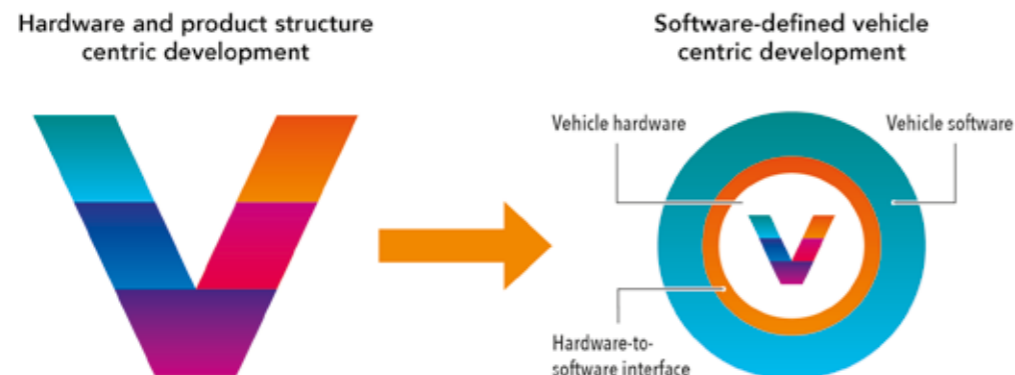


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Gianluca Vitale
Global Business Segment Manager
Smart Calibration and Virtual Testing, AVL

Software in and around the vehicle becomes the key differentiating factor. The focus of the system development process must be transformed

Source: AVL 2021



DevOps and V-model are run at different speeds

Source: AVL 2021

The left hand must know what the right hand is doing

DevOps for software development in the vehicle means: After a release, the software is deployed in the vehicle in order to test it together with the hardware.

The DevOps process enables significantly faster release cycles of new or improved functions to the customer and must therefore be able to run independently of the V-process, which focuses on optimization and reuse. This requires clearly defined interfaces between agile software and conservative hardware development. The increased pace of software release will result in a paradigm shift in system development: Especially when it comes to validation, the two development environments 'pure simulation' and 'in-use phase' (such as the so-called shadow mode) will become massively more important.

The shadow mode is an important building block for the validation of highly automated driving functions. Shadowing is generally considered to be the analysis of functions implemented in the car that simulate, but do not execute, driving actions/decisions. The behavior of software (component) functions is monitored, and relevant data is stored and transmitted to a backend when anomalies occur. Ultimately, the vehicle in the field provides important data for further development. After all, big data applications only make sense with real operating data. What happens on the testbed is already stored in models. Big data has little potential on the testbed.

AVL is at your side

There is no question that the megatrends will permanently change the automotive industry. But there is also no question that the future must already have arrived for those companies that want to actively shape it. At AVL, for example, they are thinking hard about what a process-supporting software solution could look like to accompany the transformation in the long term. AVL is not only a software vendor, but also a sparring partner when it comes to modern mobility. The 3 000 software developers employed by AVL speak for its enormous competence in vehicle development.

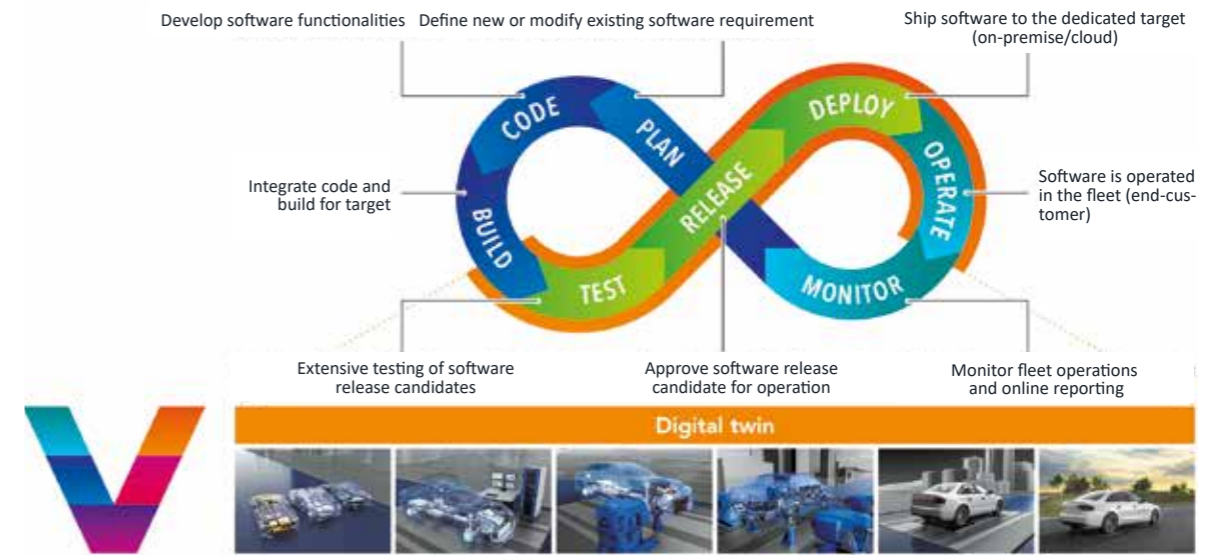
We talk to AVL experts Wolfgang Puntigam, Global Business Unit Manager IODP; Gianluca Vitale, Global Business Segment Manager Smart Calibration and Virtual Testing; and Josef Zehetner, Chief Engineer System Architecture. “For the legacy organization at the customer site, this means a big change. New ways of thinking are required and new toolchains have to be implemented — that’s exactly what we do!” says Gianluca Vitale emphatically. But Wolfgang Puntigam points out: “You must not mix up the topics: Electrification, autonomous driving and software development — even if everything is now happening at the same time, as if in a melting pot, focusing more on the end customer does not mean saying goodbye to the genesis of the vehicle, as we know it from daily development practice.” Until now, functions were frozen when the vehicle rolled off the assembly line. This will no longer be the case in the future — yet: a high demand on the hardware will remain.

The tasks already in place will continue to exist. Wolfgang Puntigam: “If new functions are to be made available in the customer vehicle, the question arises as to what the release process for this will look like in the future. After all, someone has to be held liable if something goes wrong.” Gianluca Vitale agrees, saying, “After all, it’s not just about security, but also about precarious safety issues, because a car like this is much more than a smartphone. A new software version has to be introduced in a very quick, agile and absolutely reliable way — in the virtual world as well as in the real world. And this is exactly where we support our customers.” Josef Zehetner explains why AVL can deliver added value here: “AVL is very good at testing and validation on the testbed. But for cost reasons, we have to move more and more in the direction of virtual validation. This is where we have invested a lot in the past. Overall, we understand the process of validation, whether it is done in the virtual world or hybrid. We have acquired extensive skills in how to reuse the existing know-how in the organizations and data. The aspect of traceability in terms of documentation is very important. Only in this way can a test be repeated without doubt.” Josef Zehetner adds that it is important to record exactly what the input variables for the test were and where problems occurred.



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*Josef Zehetner
Chief Engineer System Architecture, AVL*



After the release of a software version, it is implemented in the vehicle to be tested together with the hardware

Source: AVL 2021

Automotive OEM put to the test

All three experts agree that a methodically sound stock-taking of the customer is necessary first before the path to the future can be taken. Every OEM has a different place where it wants to be picked up. But, the development department is first and foremost made up of engineers, of professionals. What do the huge changes that are now emerging mean for career opportunities and the job profile of the engineer? Wolfgang Puntigam sees it as follows: “Development will become much more multidisciplinary than it is today. The required systemic thinking will offer excellent career opportunities for engineering professionals. On the other hand, the question naturally arises as to whether the automotive environment will continue to be attractive enough for the ‘young-wild software potentials’. Because we absolutely need them.” And, as we all know, the best pedagogy is based on role models. AVL is happy to take on this role by demonstrating interdisciplinarity in its most holistic form. (bv)

For more information on the comprehensive validation of vehicle functions, see

www.avl.com