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Embracing the shift to software-defined vehicles: Interview with Elektrobit

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How SDVs are enhancing capabilities through updates, transforming the automotive industry

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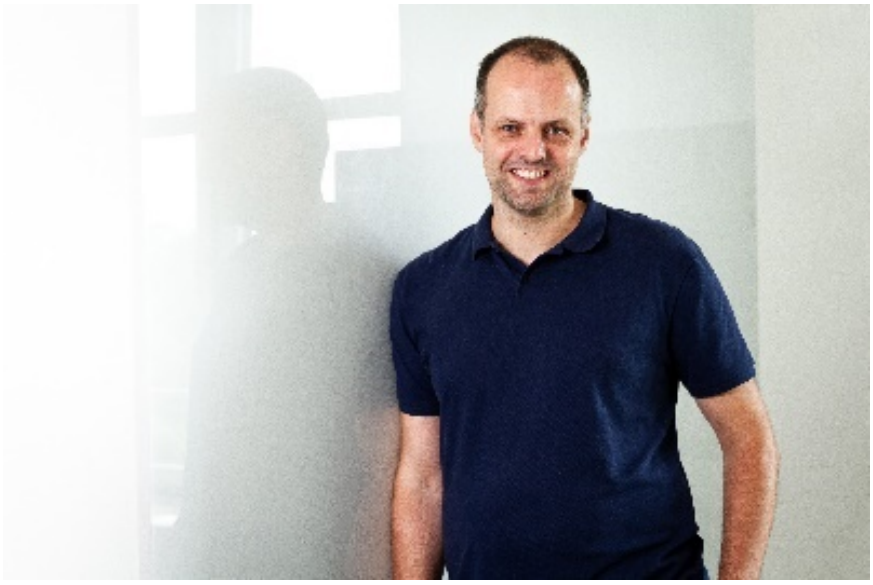
The software-defined vehicle (SDV) is a new buzz phrase in the car industry. It refers to vehicles that can enhance their capabilities through software updates, eliminating the need for physical part replacements. SDVs use software to govern operations, incorporate new features, and facilitate the integration of novel functionalities. This concept marks an advancement in the automotive industry, laying the foundation for autonomous driving and vehicle connectivity technologies.

To learn more, we spoke to Moritz Neukirchner, senior director of strategic product management for SDV, Elektrobit. Elektrobit is a provider of embedded and connected software products and services for the automotive sector. Its software, which operates in more than 600 million vehicles and over 5 billion devices, offers solutions for vehicle infrastructure software, connectivity and security, automated driving and related tools, as well as user experience. Elektrobit is a wholly owned, independently operated subsidiary of Continental.



Key takeaways:

- The growing interest in SDVs is transforming the automotive industry by enabling original equipment manufacturers to generate value beyond traditional vehicle sales. Key impacts include the ability to deliver backward-compatible features and timely software updates over-the-air, improving vehicles post-sale. This shift allows for independent hardware and software lifecycles, necessitating larger, consolidated hardware. New revenue streams are emerging, particularly in three areas: in-vehicle app stores, services around vehicles (like pay-per-use insurance) and fleet management. However, fragmentation poses challenges, similar to the home automation market, necessitating collaboration and standardization among OEMs and service providers.
- OEMs face challenges in developing SDVs, primarily due to the need to rethink traditional design and development approaches. The focus is shifting toward software innovations and accelerating time-to-market, necessitating enhanced collaboration and integration of practices from other industries.

- With regulations like UNECE R155 mandating long-term software maintainability, OEMs must extend their software lifecycle beyond production. Safety development is also more complex, requiring flexible safety concepts for high-performance computing systems rather than just individual components.
- OEMs can effectively embrace software in their development processes by adopting modern build infrastructures and best practices from software-driven industries. Key strategies include implementing hermetic and reproducible builds, as well as containerization, which are becoming standard in automotive projects.

The following is an edited transcript of the conversation.

S&P Global Mobility: How does the growing interest in SDVs impact the automotive industry?

Moritz Neukirchner: The impact is and will continue to be nothing short of revolutionary, enabling OEMs to deliver greater value independent of vehicle sales. New features will be backward compatible with those available when a vehicle was first launched, which is certainly not the case today. Software patches can be delivered in a timely manner via simple OTA updates, minimizing the need for service calls and recalls.

After leaving the dealership, vehicles will improve over time, whether in terms of major new infotainment and connectivity functions, new and improved [advanced driver assistance system] features, better performance or greater real-world range for hybrids and EVs.

Another noteworthy observation is that since OTA forms the backbone of the SDV, the hardware and software lifecycles have become independent of each other. This means that the software is a short-term guest on the hardware of an SDV. Looking at an SDV from the hardware perspective shows an interesting trend: SDVs require bigger and more consolidated hardware.

Software represents entirely new revenue streams and will open up new market opportunities. Specifically, there will be five markets around SDVs. Two that exist today, and three new ones. The two that have long been in use are the in-vehicle software market and software tools market. The three emerging ones are the ecosystem of in-vehicle app stores, the eco-system of products and services around the vehicle and the eco-system of vehicle fleets.

In-vehicle app stores will sell new or upgraded functionality to customers outside of the vehicle sale. OEMs will attempt to replicate the success of smartphone app stores for vehicles. So far, this type of activity has been mainly limited to infotainment systems. As an example, software upgrades will not be used to install a trendy social media app into a vehicle, but instead will be used to provide additional capabilities beyond what is provided by a smartphone. In any case, this trend introduces a business-to-consumer market for software, which will likely be operated by OEMs.

The second emerging market is related to products and services around a vehicle, such as connecting data or vehicle functions to outside services. Current prominent examples are pay-per-use insurance, delivery-to-trunk services, or connecting a vehicle to home energy management to control charging, and plenty of other opportunities exist as well. These will require OEMs to shift to not only target end customers beyond the initial vehicle sale, but also partners from other industries to build an ecosystem of services around the APIs of a vehicle.

Fragmentation of the automotive industry will become a major hurdle, similar to the current state of the home automation market. This market is a two-sided business, connecting service providers on one end to consumers on the other, using the vehicle as the platform. Ecosystem size is essential to

success, and we're seeing the first open-source initiatives and standards forming to overcome the fragmentation.

The third new market is centered around managing vehicle fleets and monetizing fleet data. This market is hugely attractive in the commercial sector as it may have a significant financial impact on rental car companies and delivery services, among other players. Typical examples include predictive maintenance, fleet routing or collecting road condition data. Again, to address this market, OEMs need to transform their business to target different customers with new business models. The market is a business-to-business relationship; however, OEMs will not necessarily be the dominant party.

While the two established markets for in-vehicle software and software tools are undergoing tremendous change, the three emerging markets offer new opportunities for OEMs to unlock the full potential of the software-defined vehicle.

What are the major challenges faced by automotive OEMs in developing SDVs?

OEMs are rethinking their traditional approaches to vehicle design and development. With SDVs, it's all about software innovations and accelerating time to market for these innovations. This means accelerating development practices, accelerating collaboration among partners, accelerating by enabling re-use from other industries, etc.

Traditionally the automotive OEMs have formulated their software infrastructure targeting a specific start of production. With security regulations such as UNECE R155 in place (which mandates long-term maintainability of software) and OEMs' motivation to monetize on connected services, they now need to think about their software lifecycle way beyond the end of production.

From a safety perspective, it was easier to develop safety concepts within the scope of smaller ECUs. With high-performance computers that also enable parallelism at the hardware and software level, it is not sufficient to develop safety concepts considering only the individual components of the HPCs. The safety concepts should allow flexibility yet they should also provide a hierarchical recovery mechanism starting from smallest recovery handling to the most drastic recovery mechanism.

What features and capabilities of SDVs are driving the interest in them?

The promise of a vehicle that can improve over time and offers the occupants an evolving choice of new options is one of the most appealing elements of the SDV. One aspect of this improvement is that the regular updates will allow the consumers to enjoy the latest features. The other aspect is that the second-hand market becomes more appealing. The buyers are not completely blocked by the decisions made during the configuration of the vehicle by the first user. A feature that might not have been attractive to a driver who first configured the car can be subscribed to by the second-hand buyer.

The other attractive domain for the car buyers is the increasing focus of an SDV on customer centricity. The combination of driver comfort features being encapsulated in a profile help the drivers to quickly set-up their preferences in a different car of the same manufacturer e.g. seat and mirror adjustment. The other way round is also true i.e., multiple users of the same car can quickly setup their preferences thanks to the user profiles.

What specific advancements has Elektrobit made in open source for the automotive industry, particularly about safety-critical systems in SDVs?

Elektrobit achieved a world-first with an open-source-based automotive operating system – EB corbos Linux for Safety Applications – that has received a positive assessment for certification to the industry's highly demanding functional safety standards: ISO 26262 ASIL B and IEC 61508 SIL 2.

This product enables OEMs and suppliers to use open-source in key safety-related applications including ADAS, powertrain and autonomous vehicles. EB corbos Linux for Safety Applications is a major breakthrough for the industry, enabling OEMs to reduce development times, enhance robustness and bring new models to market in as little as half the time – with commensurate reductions in development costs.

Given the unprecedented challenges driven by electrification, greater competition from the raft of new EV brands entering the market, and the drive towards software defined vehicles, the fundamental advantages offered by open-source will enable OEMs to stay ahead and deliver the innovations that their customers want and expect.

How does Elektrobit address the challenge of long lifecycles and reliable support for SDVs?

Elektrobit has developed a solution called the Software Lifecycle Platform, which targets setting up maintainable build infrastructures in order to comply with UNECE R155 and ensures that the software can easily be maintained up to 10 years after end of production. Essentially a "time machine for your projects." It is a holistic build infrastructure concept that encompasses having everything-as-code, harmonizing the build environment for the developers across the project/company and archiving the legacy toolchain for long-term reproducibility of software releases.

Relative to EB corbos Linux for Safety Applications, we offer an up to 15-year maintenance package that ensures safe, secure and updateable software for the complete life cycle of the vehicle. This is even more important now that regulation UNECE R155 for software updates and software update management systems has come into effect for all new vehicles as of July. According to UNECE R155, OEMs must ensure that cybersecurity practices and measures are adequately applied on any vehicle software across the development process and entire vehicle life cycle. EB corbos Linux provides peace of mind as UNECE R155 compliance is centrally ensured for the distribution, including aspects like delivery of a software bill of materials.

Which companies have you partnered with on this project, and what are their contributions?

A strength of Linux is the open-source ecosystem. This ecosystem encompasses not only the Linux distribution but also silicon support for the application space and tools space. One of our core eco-system partners is Canonical. EB corbos Linux is built on Canonical's Ubuntu — one of the most highly trusted Linux distributions and used in many security critical environments. Also, Arm is a trusted partner to enable EB corbos Linux for safety applications on automotive hardware. This is, of course, not an exhaustive list of partnerships. In fact, we have launched an open partner program with the Product Compatibility Program to enable all interested parties to establish compatibility with this new solution.

Why is embracing an open-source philosophy important for the development of SDVs?

Collaboration has been slow in the past as the industry's process was largely based on change requests, requirements specifications and deep supply chains. When a problem was detected or a new idea was to be introduced, this information needed to propagate through multiple stages and

gates — even for minimal source code changes. When we want to have quick iteration cycles, collaborating on source-code level is the only way.

Moreover, the complexity and amount of software that goes into an SDV is enormous. Sourcing all of this software from different proprietary suppliers would become extremely expensive and unmanageable. On the other hand, an OEM developing everything themselves is also not feasible. Open-source provides the logical alternative. It enables OEMs to determine which software they should take from open-source communities, which to buy and which to develop themselves.

How does Elektrobit ensure the security and reliability of its open-source solutions for SDVs?

EB's open-source Linux offerings offer long-term support, which includes regular updates, security patches and maintenance. This ensures that the software remains secure and reliable throughout its lifecycle.

Elektrobit collaborates with the open-source community and other industry partners to stay updated with the latest advancements in security and reliability, ensuring that it incorporates best practices and cutting-edge technologies.

To ensure reliability, the EB corbos Linux for Safety Applications solution is developed in compliance with ISO 26262, a crucial functional safety standard for automotive systems. This guarantees that the software meets rigorous safety requirements throughout its development lifecycle.

With our unique solution architecture, we are able to include security patches of the Linux community into the safety solution, without requiring re-certification — an endeavor that would be hopeless with the change frequency of roughly 500 security patches per year that we see in the Linux kernel. As a result, we can combine the typically conflicting goals of stability out of the safety domain and the short update cycles required for keeping large scale software solutions secure.

How are you addressing the challenges of managing multivendor software ecosystems in the context of SDVs?

Elektrobit has realized that vendor lock-ins are a thing of the past, resulting in unsatisfied customers and limiting business opportunities. This has led us to a process whereby we intentionally think about the software ecosystem from our customers' perspective. Our products are increasingly compliant to other pieces of software offered by different software vendors in a typical SDV.

Even from an organizational perspective, Elektrobit treats SDV as a separate topic. This helps us connect with different partners and collaborate in providing joint SDV solutions.

How can OEMs embrace software in the development process and understand the impact of software on the production schedule?

OEMs realize that to achieve their dream of continuous deployment of software in the field, they need to make use of modern and efficient build infrastructures. The car companies are adopting the best practices of developing and maintaining software from the other software-driven industries. The newer technologies around hermetic/reproducible builds and containerization are something that OEMs are starting to adopt as standard for their projects.

To meet the production deadlines, OEMs need to start with integration and testing efforts as soon as possible and then automate them using CI/CD tools. Reduction of software variants and decoupling

software versions from particular vehicle architectures is essential to manage the software complexity that will only grow with increasing change frequencies.

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