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Driving change in software-defined vehicles – Interview with Elektrobit

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Q&A with Elektrobit

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The automotive industry is amid a radical transformation, and software-defined vehicles (SDVs) are at the heart of it. These vehicles are not just cars; they are sophisticated machines powered by cutting-edge software that controls everything from entertainment systems to critical safety functions. This shift is about more than just tech; it is about redefining what a vehicle can do.

One of the most game-changing developments is the rise of over-the-air (OTA) updates. Forget the days of bringing your car into the dealership for a simple software fix. Now, manufacturers can tweak performance and roll out new features remotely, cutting down on annoying recalls and keeping vehicles up to date with the latest innovations. Advanced driver-assistance systems (ADAS) are also stepping into the limelight, with features like lane-keeping assistance and automated parking paving the way for true autonomy. However, as cars become more connected, the risks also escalate. Cybersecurity is no longer nice-to-have tech; it is a must. Automakers are scrambling to fortify their systems against potential hacks that could compromise not just vehicles but lives.

Yet, the road to fully realized SDVs is littered with challenges. The lack of standardized software platforms means that compatibility issues abound, creating headaches for manufacturers and consumers alike. Integrating various software solutions is no small feat, often leading to skyrocketing development costs and frustrating delays in getting new models to market.

Despite these hurdles, the industry is seeing some impressive victories. Tesla has taken the lead, demonstrating the power of OTA updates and advancing autonomous driving. Meanwhile, partnerships between tech companies and traditional automakers are sparking a wave of innovation, resulting in more intuitive and user-friendly technologies.

In summary, the path to SDVs is riddled with complexities, but the potential rewards are immense. Today's advancements are laying a solid foundation for a future where vehicles evolve into intelligent, adaptable machines that revolutionize mobility. However, the question remains: Are OEMs truly equipped to handle the intricacies of full-stack software integration? Ryan Goff, Automotive Technology Director at Elektrobit, offers insights on this topic.

He points out that companies like Tesla and Rivian have adopted a greenfield approach, effectively managing the full stack independently, yet they face distinct challenges compared with legacy OEMs. The latter, constrained by existing structures and requirements, are recalibrating their strategies considering recent financial setbacks. Goff emphasizes that many legacy OEMs are beginning to recognize the importance of collaboration, particularly for non-differentiating components, and are moving away from siloed operations toward more integrated, collaborative frameworks.

As OEMs navigate this transition, they are increasingly leveraging partnerships with tech firms and cloud providers to bolster their SDV strategies. Elektrobit, for instance, is engaging in various cross-industry collaborations to develop cutting-edge solutions tailored to the automotive sector. This cooperative approach not only accelerates innovation but also enables OEMs to concentrate their internal resources on areas that truly differentiate them from competitors.

Ultimately, while fewer OEMs may succeed in owning the entire software stack, those that prioritize collaboration and strategic partnerships will likely find themselves better positioned to thrive in this

rapidly evolving landscape. The shift toward SDVs is not merely a trend; it represents a fundamental change in how the automotive industry will operate, and the time to adapt is now.

The following is an edited transcript of the conversation:

S&P Global Mobility: Do you think OEMs are truly ready to handle the complexity of full-stack software integration, or do you think partnerships and collaborations will continue to be the go-to solution for them?

Ryan Goff: We have seen a mix of approaches, some more productive than others. Companies like Tesla and Rivian have taken true greenfield approaches and effectively manage the full stack largely on their own. However, they have a different set of challenges from legacy OEMs since they were able to start from scratch with the latest technologies and were not bound by legacy requirements. Their abilities to provide long-term support will get more and more challenged as they continue to expand to scale up to the level of the legacy OEMs, which must simultaneously support low- to high-end vehicle models on a global scale.

Some large legacy OEMs have set on a path to tackle everything and own it all; however, we're starting to see some changes in those plans. Provided some of the latest EV-related financial setbacks, these OEMs are now taking steps to recalibrate and figure out a new plan of attack. Legacy OEMs are often tethered by a variety of factors, including but not limited to, current scale, legacy requirements and org charts that do not fit with a modern SDV software stack. Further transformation and more practical or smaller next steps are necessary, but most are planning to still achieve most of their original SDV-enabled goals.

Ultimately, while fewer OEMs may succeed in owning it all, the best approach will be for them to collaborate and leverage partnerships for the "non-differentiating" parts and focus their internal teams on those parts that differentiate them from the rest.

What kind of cross-industry partnerships have you been involved in, like with telecom, energy, or cloud providers?

Elektrobit is engaged in a wide variety of cross-industry partnerships, ranging from industry organizations such as COVESA and Eclipse SDV to close partnerships with AWS for cloud services, Unreal Engine for infotainment systems and Canonical for open-source security and support...to name just a few. With the latter, we have joined forces to develop a cutting-edge automotive operating system (OS): EB corbos Linux and EB corbos Linux for Safety Applications. This OS runs on Ubuntu to create a solution that addresses the specific needs of the automotive sector.

How do you think adopting an SDV strategy will change your company's operating model

and core business? What kind of organizational changes have you noticed or do you expect to see within OEMs to support this shift toward SDVs?

At Elektrobit, our products and services fully scale the SDV software stack. We have stayed ahead of the SDV curve by offering our solutions as individual or combined parts of the broader SDV stack, and we work with our customers to understand their needs on various levels, providing systems consulting expertise to help make their visions a reality. As OEMs and tier 1 suppliers recognize the real value they gain from a truly software-defined future, the opportunities also increase.

A modernized SDV platform promises significant gains in overall software development efficiency, which will result in further gains in ease of maintainability and scalability. The reuse of hardware and software will propel additional cost savings. Opening an SDV platform up to third parties will also enable new business opportunities.

As a fundamental part of this SDV transition, OEMs must align their organizations with the foundational needs of an SDV platform to fully leverage its benefits. This typically involves shifting from a siloed organization structure to one that promotes collaboration and centralized decision-making.

In the development structure of a traditional vehicle, there are typically siloed departments for each vehicle system (e.g., powertrain, chassis, infotainment), little collaboration or communication between departments and significant tool fragmentation, with a decentralized and slow decision-making process. The ideal structure for organizations developing SDV platform architecture is set up quite differently. It requires a centralized software development team responsible for developing the SDV platform, a collaborative approach to software development across vehicle systems, and decision-making and prioritization based on the needs of the entire platform, rather than individual systems.

Transformations like this are actively taking shape within automotive OEMs to better serve their SDV needs.

How do you think the slowdown in electric vehicles and the uncertainty around tariffs are impacting OEMs' plans to roll out SDVs? Do you see any differences in how this plays out in the US, Europe and China?

The shift in EV incentives and tariffs has caused difficulties for many automotive OEMs. However, this is less about the SDV and more about financial issues like investment returns.

While EVs offer a chance to rethink how OEMs achieve their SDV goals on a broader level, the current financial pressures are leading them to reconsider and seek quicker returns on their investments. For legacy OEMs, this means they are looking for ways to extend their existing platform components through their own unique and more incremental SDV approaches.

Here is what this might look like:

- Treating the software development process as a product.
- Reducing tool fragmentation to make management easier.
- Making it simpler to sustain development efforts.
- Leveraging fewer in-house capabilities and seeking more collaborative solutions and partnerships, especially for the non-differentiating parts of the software stack.
- Re-evaluating their ability to scale from low- to high-end vehicle models through abstraction

of the software and hardware stack.

In other words, they are seeking to get a quicker return on investment, provide customer value, collaborate more and make their platform more fluid and adaptable, all without a complete overhaul. With this refocusing, OEMs can realize many of the same end goals that their original SDV vision entailed but with near-term results. This is largely a global challenge since we are seeing it across the board.

How do you see the collaboration between German automakers evolving in the context of open-source software development? What specific benefits and challenges have you observed in these partnerships?

As referenced earlier, OEMs are re-evaluating their return on investment. They are becoming more open to reducing in-house sourcing and expanding external collaboration and partnerships, especially for the non-differentiating parts of their platforms. One example of this is the recent announcement from the Eclipse SDV working group for S-Core (Safe Open Vehicle Core).

S-Core is an open-source software framework for developing electronic control units (ECUs) . It was developed by a consortium of German OEMs and suppliers, including Audi Electronics Venture GmbH (AE Ventures), BMW Group, Daimler AG, Continental Automotive, Robert Bosch GmbH, Elektrobit and ZF Friedrichshafen AG.

Collaborative efforts like S-Core and other open-source initiatives are expected to deliver a wide range of positive impacts across the automotive industry. These include

- **Cost savings**: By using a common software framework, OEMs and suppliers can reduce development costs by avoiding duplication of effort and sharing resources.
- **Faster time to market**: With less time spent on developing custom software solutions for each ECU, companies can bring new vehicles to market faster.
- **Improved quality**: By leveraging the expertise of multiple companies in the development process, the resulting software is likely to be of higher quality than if developed by a single entity.
- **Increased innovation**: The open nature of S-Core allows for external contributors to participate and contribute to its development, leading to increased innovation in the automotive industry.
- **Greater flexibility**: With a standardized software platform, OEMs can more easily integrate new technologies into their vehicles, such as autonomous driving systems and advanced connectivity features.

While there are many benefits to open-sourced collaborative solutions like S-Core, there are also challenges. These include:

- **Intellectual property (IP) concerns**: Sharing proprietary technology with competitors can raise concerns about the protection of IP and trade secrets. This can make it difficult for companies to decide what parts of their software stack they are willing to contribute to an open-source project.
- **Compatibility issues**: Ensuring that the contributed code is compatible with other parts of the software stack can be a challenge, especially when multiple parties with differing development practices and priorities are involved.
- **Quality control**: With open-source contributions coming from multiple sources, maintaining quality standards and ensuring the security of the software can be difficult. This could lead to

issues such as vulnerabilities or bugs in the final product.

- **Dependence on other parties**: Relying on external contributors for critical components of a software stack can create dependencies that may impact the company's ability to react quickly to changing market conditions or customer needs.
- **Differing business models**: Some OEMs may have different business models than others, which could lead to conflicts in how they approach development and collaboration. For example, some companies might prioritize rapid development over quality assurance, while others might focus more on thorough testing and validation before releasing new features.

While the benefits of open-sourced collaborative solutions like S-Core are significant, OEMs must carefully consider and address these challenges to successfully leverage this technology for their own advantage and contribute positively to the broader automotive industry.

With software suppliers entering the automotive safety market, how do you believe open-source solutions can meet or enhance existing automotive safety standards? What measures do you think are necessary to ensure compliance and reliability?

Historically, safety-critical automotive software has been developed using closed-source platforms. However, as OEMs seek to reduce costs and embrace collaboration, the convergence of open-source software and functional safety is becoming increasingly viable.

Proprietary OSes have long been the preferred choice for supporting ADAS-related safety applications. However, as ADAS requirements grow more complex and OEMs aim to avoid redundant development, alternatives like Elektrobit's Linux for Safety Applications are gaining traction. This solution combines the strengths of Linux — such as a robust developer community, toolset and POSIX compliance — with a design that isolates the safety application from the broader OS, streamlining certification and maintenance. Elektrobit's approach builds on lessons from earlier Linux-based safety efforts, significantly reducing the life cycle management burden, and offers long-term support (up to 15 years).

For ISO 26262 compliance, open-source safety initiatives require strong governance, comprehensive documentation and third-party certification, the latter of which typically comes from bodies like Germany's TÜV (Technischer Überwachungsverein, or Technical Inspection Association). While this entails a greater upfront investment than traditional open-source projects, shared ownership among stakeholders helps distribute costs and reduce individual burden.

Minimizing complexity is key to long-term reliability. Elektrobit's solution reduces dependencies, allowing safety applications to be recertified only when necessary, rather than with every OS update. This separation also supports ongoing security updates — critical under regulations like UNECE WP.29 R155 and R156 — without compromising safety. Automated testing will be essential to ensure consistent safety performance throughout the software update life cycle.

The growing adoption of open-source platforms in automotive safety marks a pivotal shift in the industry, demonstrating that these solutions can meet rigorous safety standards once thought exclusive to proprietary systems. They accelerate software-defined vehicle development through cloud-native workflows and OTA updates, while reducing costs and shortening development cycles. With support for modern toolchains, open source offers a secure, efficient and future-ready foundation for next-generation automotive systems.

In your experience, how does the adoption of open-source frameworks influence the pace of innovation in automotive software development? Can you share any examples

where open-source collaboration has accelerated project timelines?

While progress may begin slowly, open-source projects such as the Android Automotive OS (AAOS) provide a path toward convergence and increased speed. Today, much of the market has aligned on leveraging AAOS's open-sourced software for standard IVI (in-vehicle infotainment) offerings. This is largely due to the evolved maturity that the system brings, along with a robust developer community.

By leveraging the AAOS app framework — which separates applications from the underlying OS and services — OEMs can deliver feature updates more rapidly, enhancing customer value. Further, suppliers like Elektrobit can build on the AAOS foundation with solutions such as Virtual IVI Development and Theming Engine, reducing reliance on hardware availability and enabling earlier development within the product development life cycle. The centralization around these established frameworks and capabilities greatly accelerate progress toward SDV objectives. As each OEMs' SDV platform continues to evolve, added capabilities will be delivered and maintained more efficiently across a wider range of vehicle platforms, as demonstrated in theory and effectiveness by AAOS. This is the "appification" of the SDV, making it easier to manage the software stack over the long life of these vehicles while continuing to add value.

Looking ahead, what trends do you anticipate in the realm of open-source collaboration within the automotive industry? How do you foresee these trends impacting the competitive landscape and the development of new technologies?

We see the adoption of open-source collaboration increasing over time as companies are looking for ways to become more efficient and cost-conscientious on non-differentiating parts of the platform. These areas of focus are enabling OEMs and suppliers to align on some of the essential and common core capabilities of a software defined platform, while freeing up resources to focus more in the areas where unique value or differentiation can be provided. The competitive landscape will thrive because OEMs are expanding their ability to focus what really matters: Customer experience, differentiation and value.

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