



Challenges to Open Source Program Offices in the Automotive Industry

Nikita Peters^{ID}, Friedrich-Alexander-Universität Erlangen-Nürnberg

Open source program offices (OSPOs) manage organizational engagement with open source software (OSS) and communities, including compliance, security, and project leadership. As modern vehicles increasingly rely on OSS, automotive OSPOs face unique technical, organizational, and governance challenges.

The Forbes Technology Council states that no company can afford to ignore open source software (OSS), and that every organization tries to become software enabled by utilizing OSS to innovate and create products and services. In this context Porsche

is recognized for its commitment to OSS, highlighting its capacity to “shorten development cycles, reduce costs, foster innovation and talent, and enhance software quality.”¹

OPEN SOURCE IN AUTOMOTIVE

Other automotive companies and manufacturers are pursuing similar strategies by anchoring OSS into their respective software strategies with the help of open source program offices (OSPOs) to support their transformation from traditional car makers to software-driven organizations.²

Although OSPOs have been widely adopted in the technology domain, their integration into multitiered and highly regulated ecosystems such as the automotive industry remains underexplored. These ecosystems try to balance OSS principles with traditional and proprietary development procedures to remain competitive in the rapidly evolving automotive technology sector. In addition, these OSPOs must coordinate cross-functional open source activities among legal, suppliers, engineering, security, product development, and



FROM THE EDITOR

This month's open source column revisits the product vendor side of open source. Organizations of all sorts, but predominantly product vendors, set up open source program offices (OSPOs) to get a handle on the burgeoning use of open source software in their products. This month, Nik Peters takes us inside the automotive industry and his experiences leading Porsche's OSPO. What better way to learn how open source works in practice than looking at outstanding examples like this? As always, happy hacking—Dirk Riehle

procurement, while also managing open source communities, tooling, and aligning strategic initiatives with business goals.

As part of this column article, two semistructured interviews were conducted with key OSPO stakeholders from different original equipment manufacturers (OEMs). One interviewee is a technical architect responsible for the design and implementation of scalable open source solutions, while the other oversees the operational and organizational aspects of the OSPO. Adopting a praxis-oriented approach, the interviews were intended to generate new ideas and explore future research directions.

FROM HARDWARE-CENTRIC ENGINEERING TO SOFTWARE-CENTRIC ARCHITECTURES

It should be emphasized that the automotive industry operates under specific requirements and frameworks, including traditionally long product lifecycles, strict safety rules, and complex

supplier networks. Modern vehicles are no longer hardware-based machines with software now driving most of their features, functions, and updates. This allows systems to be implemented, extended, and ideally updated over-the-air directly through software. Tesla was an early pioneer, setting the example for the industry. This major change put software at the core of automotive transformation, creating the need for innovative approaches to evolve traditional product lifecycle development. Such efforts illustrate a move toward collaboration on open source technologies, open standards, and open architectures across the automotive industry to better cope with challenges in software development, reduce costs, and to remain competitive in a rapidly evolving tech domain.

SOFTWARE-DEFINED VEHICLE

Open source development has been recognized as a major contributor and driver of the future viability of the car, promoting the software-defined vehicle (SDV) initiative and the associated industry standards.³ An SDV can be described as a transformation in which a car's software is independently managed from physical hardware. The main goals are to reduce dependency on vendors, improve compatibility between systems, and build standardized, modular software components that function independent of proprietary hardware. Consequently, open source alliances are emerging between OEMs, suppliers, and tech companies, caused by former setbacks in software development, including rising costs and complexity, "start of production" delays, and the inability to manage software development independently.

For instance, one significant open source cooperation is the signed memorandum, endorsed by the association of the automotive industry

and Eclipse SDV. Leading automotive companies, suppliers, and tech organizations, including Mercedes-Benz, Volkswagen, BMW, Robert Bosch, Continental, and ZF, have committed to collaborate on open source development. This partnership aims to shorten time-to-market, increase efficiency, improve safety, and build a foundation for an open and collaborative ecosystem. It is important to note that this initiative focuses on nondifferentiating components of vehicle software.⁴

Furthermore, the state of Baden-Württemberg in Germany has launched a regionally focused open source alliance that brings together universities and the OSPOs of automotive companies such as Porsche, Mercedes-Benz, and Robert Bosch. This initiative aims to address the opportunities and challenges of OSS collaboration, specifically targeting small and medium-sized enterprises within Baden-Württemberg's automotive sector.⁵

However, these alliances either focus solely on nondifferentiating components, or conflicts over open source licensing and intellectual property rights may arise, requiring further clarification and potentially creating challenges for such collaborations. It remains to be seen how effective these alliances will be in the long run.

CHALLENGES TO OSPOs IN AUTOMOTIVE

Drawing on two interviews, eight core functions were identified that capture the primary challenges of the respective OSPOs.

Organizational structure

The automotive experts offered valuable insights into real problems and emphasized that there is a need to define clear organizational structures for OSPOs, as unclear responsibilities can result in insufficient OSS frameworks

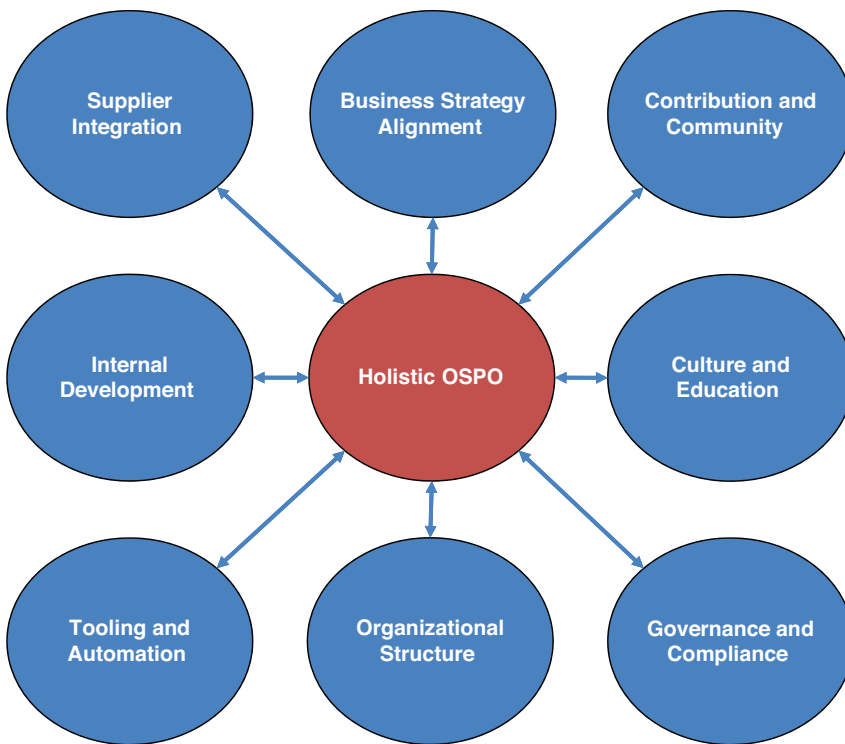


FIGURE 1. Challenges of a holistic OSPO in automotive.

within organizations, for example, well-defined OSPO roles such as software analyst, product owners, developers, and architects are needed, and these roles must continuously adapt to the organization's evolving needs over time. Managing virtual and multilevel OSPO structures requires strong coordination throughout interdisciplinary teams, including OSS coordinators, ambassadors, and dedicated legal support, who often operate outside the OSPO domain. Compliance setups involving multiple roles aimed to ensure thorough reviews may add complexity, resulting in inefficiencies and delays in the review process. For instance, task delegation, where developers generate the initial software bill of materials (SBOM) that must pass through multiple stages, including technical review and curation by OSPOs, followed by legal assessments can result in delays due to the need for multiple rounds of alignment and the associated efforts. In the automotive industry, inner source program offices

are often managed as part of OSPOs; however, this integration may cause misalignment and create conflicts within OSPO responsibilities.

Business strategy alignment

Ambiguously defined strategies and the difficulty of moving from compliance-focused toward a comprehensive, centers of excellence OSPO are lengthy processes but is essential to support innovation and strategic OSS adoption across companies. Automotive organizations struggle to embed comprehensive open source strategies, often lacking cross-domain board-level support and a neutral organizational positioning to ensure strategic alignment throughout enterprise IT and vehicle development divisions, which is essential to leverage open source as a strategic driver for transformation. OSPOs need to maintain their role as both a strategic authority and a consulting entity, while promoting cross departmental support and driving ongoing OSS strategies.

Governance and compliance

Practitioners also highlighted the complication of establishing and maintaining internal directives, governance frameworks, escalation processes, service level agreements, and compliance processes for managing OSS usage. The existence of a directive alone does not lead to adherence or compliance and demands time to build trustworthiness. OSPOs also face challenges of balancing compliance obligations, which involves providing mandatory compliance training and guiding departments through governance processes to ensure all software releases meet compliance requirements before deployment.

Supplier integration

Ensuring compliance with supplier-developed software remains challenging and time intensive, as verification is often limited to contractual agreements and declaration-based workflows rather than technical validation via SBOM checks. Addressing certification for suppliers requires more comprehensive approaches, given that automotive companies do not demand them. Supplier integration with parallel legal systems and workflows which are managed separately by the legal department introduce complexity and potential process fragmentation.

Internal development

OSS evaluations are usually aligned with product release cycles, requiring mandatory approval before release. Subsequent reviews can be conducted at a maximum frequency of once per year. This approach may lead to bottlenecks and risks, as delayed reviews hold up releases, while infrequent reassessments cause compliance violations. Compliance scanning practices vary among organizations, some engineering teams conduct scans on their own, whereas others use a central service provided by OSPOs. This is likely to result in a hybrid and fragmented approach across the organization. For instance, decentralized and project-based execution of compliance

tools often increase the complexity of meeting the company's governance standards. The absence of shared systems and associated workflows to track internal OSS utilization across projects limits OSS reuse and collaboration among teams.

Culture and education

Organizations shifting from traditional car manufacturers to technology-driven enterprises face major challenges. Current efforts include role-specific mandatory training for technical personnel and optional education for other staff; however, building a culture of immediate feedback and integrating best practices and web-based certifications into everyday development work demands targeted training initiatives to ensure continuous engagement in compliance and contribution efforts. In practice, implementation often reveals that additional guidance, education, and support are needed more than initially anticipated, making change management a core enabler to overcome resistance and drive cultural transformation.

Automation and tooling

Transitioning from manual to fully automated processes and tools takes considerable time to mature, including license and vulnerability validation through SBOMs and the creation of central platforms to oversee compliance efforts for both supplier and in-house-developed software. OSPOs also struggle to harmonize various open source, commercial, and custom-built hybrid tools by creating comprehensive tooling landscapes required to manage license compliance, vulnerabilities, contributions, project management, and legal workflows in automated pipelines, as no integrated system currently exists. Relying on commercial tools with curated databases poses challenges that lead to vendor lock-in since open source alternatives are limited and attempts to build a centralized in-house curation database is still difficult.

Contribution and community engagement

Motivations for shorter time to market, increasing tech visibility, attracting talent, sharing best practices through cross-organizational collaboration, and giving back to the community are recognized, but translating these into active community participation is not straightforward. Well-defined internal contribution processes and ongoing engagement are essential to leverage the benefits of open source alliances and setting examples for other organizations. Another challenge is that companies transitioning to a technology mindset often lack company-wide acceptance due to limited leadership support and low employee buy-in, which can hinder open source contributions and community engagement. In addition, OSPOs heavily rely on commercial tools, which restrict their ability to lead by example by contributing to open source communities and may result in supplier dependency.

The automotive industry is undergoing a transformation triggered by the rise of SDVs, positioning OSS at the core of technological innovation. While open source offers opportunities to create open collaboration models, reduce development costs, and accelerate time-to-market, it also introduces challenges such as the design of clear organizational responsibilities, technical validation of supplier SBOMs, active participation in open source communities, a cultural shift toward a technology-oriented mindset, and strategic open source alignment with overarching business objectives.

In the next series of articles, the identified challenges will be examined, and practical solutions will be proposed. ■

REFERENCES

1. M. Desai, "Why every company should be open source aligned," *Forbes*, Oct. 25, 2023. Accessed:

May 11, 2026. [Online]. Available: <https://www.forbes.com/councils/forbestechcouncil/2023/10/25/why-every-company-should-be-open-source-aligned/>

2. "Mercedes-Benz embraces open source to drive its digital ecosystem." Mercedes-Benz Group. Accessed: May 11, 2026. [Online]. Available: <https://group.mercedes-benz.com/company/production/production-network/open-source-software.html>
3. "Concept paper on an open European software-defined vehicle platform," Eur. Commission, Brussels, Belgium, Feb. 2023. Accessed: May 11, 2026. [Online]. Available: <https://digital-strategy.ec.europa.eu/en/library/concept-paper-open-european-software-defined-vehicle-platform>
4. "Automobilindustrie unterzeichnet Memorandum of Understanding." VDA - Verband der Automobilindustrie. Accessed: May 11, 2026. [Online]. Available: https://www.vda.de/en/press/press-releases/2026/260107_Automotive-innovation-through-open-collaboration--Momentum-builds-around-open-source-software-as-a-key-driver-of-efficiency-and-success
5. "Open-Source-Software für die Automobilwirtschaft." Baden-Württemberg Ministry of Economic Affairs. Accessed: May 11, 2026. [Online]. Available: <https://www.baden-wuerttemberg.de/de/service/presse/pressemitteilung/pid/open-source-software-fuer-die-automobilwirtschaft>

NIKITA (NIK) PETERS is pursuing his Ph.D. as an external candidate with the Chair of Open Source Software at Friedrich-Alexander-Universität Erlangen-Nürnberg, 91054 Erlangen, Germany. Contact him at nik.peters@fau.de.