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The shift to software-defined vehicles: Q&A with DXC Technology

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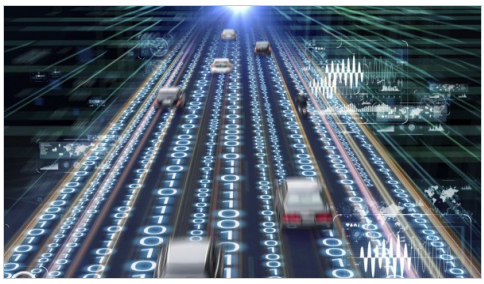
The fifth of six interviews with leading suppliers of SDV solutions.



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Software-defined vehicles (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.

The evolution of SDVs entails separating software and hardware development, like smartphones. OEMs are establishing "walled gardens" for applications. This shift encompasses continuous agile software development, heightened computing requirements for data processing, a modular service-oriented architecture, and fortified security measures against cyberthreats.

The automotive industry is rapidly advancing toward SDVs, with the promise of improved comfort, safety and customization. As collaborations between OEMs and tech companies flourish, SDVs present additional challenges such as cybersecurity risks and design intricacy.

The transition from domain to centralized architecture is also progressing, converting vehicles into mobile data centers. In this transformative journey, standards, collaborations and digital twin technology stand out as critical components, promising a future where software dictates the driving experience.

To delve deeper into this transformation, S&P Global Mobility initiated discussions with leading players in the SDV market, including DXC Technology, Elektrobit, Forvia, Harman, Nvidia and Red Hat. We explore how these companies are navigating the complexities of SDVs. All are at the forefront of driving architectural shifts, enhancing in-vehicle experiences, tackling design challenges and countering cybersecurity risks. Representatives of each company share speak to the evolving landscape of SDVs. Next up is DXC Technology.

DXC Technology is a provider of IT and consulting services. It offers a range of services including analytics, cloud applications, cloud infrastructure, enterprise applications, data security services, IT outsourcing, and workplace and mobility solutions. Beyond the automotive industry, DXC serves various sectors such as insurance, healthcare and life sciences, aerospace and defense, consumer and retail, travel and transportation, hospitality, energy, utilities, oil and gas, technology, media and telecommunications, public sector, banking and capital markets.

We spoke to Matthias Bauhammer, Head of Automotive –Consulting & Data&AI Services EMEA, DXC Technology

Key takeaways:

- **Architectural transformations:** SDVs drive architectural shifts and software complexity, spurring cloud-inspired methodologies and evolving software layers for safety and performance. The hardware shift for SDVs embraces high-speed processors and cloud practices, fostering collaborations for software portability across silicon platforms.
- **Opportunities and challenges**: SDVs enhance in-vehicle experiences, opening data monetization opportunities amid privacy concerns, and fostering industrywide collaboration for innovation. The OTA [over-the-air] updates and data utilization of SDVs are revolutionizing decision-making in the automotive industry, necessitating effective data architectures for accuracy, security and accessibility.
- **SDV design**: SDV design navigates system, security and safety challenges, embracing model-based engineering and automated checks for improved architecture. SDVs address security concerns through standardized protocols and compliance measures, while predictive maintenance and agile methodologies ensure safety and reliability. SDVs prioritize user experience, integrate external infrastructure, and adopt a platform-based approach for scalability and evolving complexities.
- **Addressing the risks**: SDVs mitigate risks with advanced cybersecurity measures, redundant systems and OTA updates, ensuring timely adaptation to emerging threats. SDVs utilize technology collaborations for robust security, continuous monitoring for performance and AI and automation for streamlined productivity.

The following is an edited transcript of the conversation.

S&P Global Mobility: What architectural transformations are SDVs [software-defined vehicles] undergoing, moving from domain architectures to centralized ECUs [electronic control units], and how will this impact vehicle operations?

Matthias Bauhammer**:** The automotive industry's unstoppable drive for SDVs is generating architectural changes, transitioning from domain architectures to centralized ECUs. This transformation necessitates a considerable increase in software code, prompting the adoption of new development methodologies inspired by cloud practices and smart device industries. The software layer is evolving to manage this complexity by incorporating agile methodologies and ensuring compatibility with automotive requirements such as safety and real-time performance.

On the hardware side, the shift involves the adoption of faster processors with data center-like performance, operating within the power constraints of vehicles. This move, from distributed ECUs to centralized computing, incorporates technologies such as virtualization, hypervisors, containers

and orchestrators, thereby adapting cloud-centric practices for automotive use. As the industry embraces machine learning and as nontraditional chip manufacturers enter the automotive space, collaboration among traditional chip vendors, new entrants, and automotive OEMs becomes crucial. Initiatives such as SOAFEE [Scalable Open Architecture for **Embedded Edge**] seek to enhance software portability, allowing OEMs to seamlessly transition between different silicon platforms without extensive code rebuilding.

How are SDVs changing the landscape of in-vehicle experiences, and what opportunities and challenges do these changes present for customization, infotainment and user interaction?

SDVs are reshaping the in-vehicle experience by learning from user behavior, providing personalized services and enhancing customer experiences. This shift opens opportunities for data monetization, creating new revenue streams as businesses tap into user insights and preferences. However, the challenge lies in navigating privacy concerns and complying with regional regulations to ensure responsible data usage. The collaborative ecosystem required for SDVs involves extensive cooperation across the automotive industry, including OEMs, suppliers and software companies; it also incorporates a mix of proprietary, commercial and open-source software, fostering innovation and enabling diverse features. The industry must navigate the challenges of distinguishing unique and nonunique features, ensuring interoperability and addressing standardization issues.

Additionally, SDVs enable OTA updates, transforming the relationship between car buyers and OEMs; while this opens avenues for delivering new features and business models remotely, it introduces challenges related to cybersecurity and system reliability. Leveraging data from SDVs offers the potential to revolutionize decision-making processes in the automotive industry, shortening development cycles through informed choices. However, establishing effective data architectures is crucial to maximize these benefits. It supports machine learning, autonomous driving and research and development while ensuring data accuracy, security and accessibility.

What are the challenges in SDV design, including system architecture, security, safety and the prevention of failures, and how are these challenges being addressed?

Designing SDVs involves navigating challenges in system architecture, security, safety and failure prevention. The separation of software from hardware, coupled with the need for regular updates, calls for changes in the architecture, reliability and safety of in-vehicle systems. Embracing model-based systems engineering, shifting away from text-based requirements documents, and utilizing models for safety analysis and automated checks help enhance system architecture.

Security concerns, particularly with OTA updates and external infrastructure integration, can be addressed through standardized communication protocols for secure OTA updates. Compliance with regulatory standards remains paramount to establishing a robust security framework. SDVs prioritize safety through predictive maintenance tools, diagnostic systems and a focus on agile methodologies, thereby ensuring reliability and effective failure prevention.

Moreover, SDVs are designed for seamless integration with external infrastructure, prioritizing user experience through ergonomic design and extensive testing. Scalability and flexibility are inherent in SDV designs, so adopting a platform-based approach to accommodate the evolving complexities of target systems is key.

Among all the non-technical challenges faced in developing an SDV, is the biggest one silos?

Yes, silos within organizations are a significant challenge in developing SDVs. These silos can result in suboptimal decisions, such as choosing smaller controllers or memory components to cut production costs, potentially impeding over-the-air updates due to insufficient resources. To address this challenge, leaders should empower end-to-end architects more and foster collaboration across different teams and subsystems. This collaboration should extend to suppliers to ensure a more holistic and effective approach to developing SDVs.

How do you see the automotive industry addressing the increased risks associated with safety-related software crashes and remote cyber threats in SDVs?

The automotive industry is actively countering the heightened risks associated with safety-related software crashes and remote cyberthreats in SDVs. This involves deploying advanced cybersecurity measures like encryption, firewalls and intrusion detection systems, along with integrating redundant systems into critical vehicle functions such as braking and steering. OTA updates play a crucial role in swiftly deploying software patches and security updates, ensuring timely adaptation to emerging threats without requiring physical interventions.

Collaborative efforts with technology firms and cybersecurity experts are focused on building robust security architectures specifically tailored for SDVs, enhancing the industry's ability to anticipate and respond to evolving cyberthreats. A continuous monitoring approach is adopted to regularly assess vehicle performance and security, reducing the likelihood of safety-related software crashes. Additionally, efforts to streamline and enhance productivity involve reducing system complexity by minimizing the number of ECUs and car configurations, while embracing technologies like AI, software factory, automation and virtualization.

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