S&P Global
Mobility

AutoTechInsight Insights
July 2024

The shift to software-defined vehicles: Valeo China interview

04-Jul-2024 11:14 GMT

Matthew Beecham
S&P Global
Supply Chain and Technology, Automotive

Continuing our series of interviews with leading suppliers of SDV solutions, we spoke to Valeo China.

Source: GettyImages/metamorworks

Software-defined vehicles (SDVs) govern operations, integrate new features and facilitate the addition of novel functionalities through software. This advancement in the automotive industry is paving the way for autonomous driving and vehicle connectivity technologies.

SDVs are evolving through the separation of software and hardware development, similar to smartphones. Original equipment manufacturers are creating "walled gardens" for applications, which involve continuous agile software development, increased computing requirements for data processing, a modular service-oriented architecture and enhanced security measures against cyberthreats.

The automotive industry is swiftly moving toward SDVs, promising enhanced comfort, safety and customization. As collaborations between OEMs and tech companies thrive, SDVs pose additional challenges, including cybersecurity risks and complex design.

The shift from domain to centralized architecture is underway, transforming vehicles into mobile data centers. In this transformative journey, standards, collaborations and digital twin technology emerge as crucial elements, heralding a future where software shapes the driving experience.

To gain a deeper understanding of this transformation, S&P Global Mobility engaged in discussions with key players in China. Valeo has had a strong presence in the country since 1994, with many production sites. The company has expanded its business in various areas, including wiper systems, climate control, lighting systems, electrical systems, transmission systems, thermal systems, and powertrain systems. Valeo has also established research and development centers in Wuhan and Shenzhen, focusing on lighting systems and electronics expertise, respectively. It has invested in joint labs and funds to enhance its presence and contribute to the mobility ecosystem in China. We spoke to Jianmin Gu, Valeo China chief technology officer.

Jianmin Gu joined Valeo Group in January 2018, serving as Valeo China chief technology officer. From September 2013 to December 2017, he was research and development director at Volvo Car Asia Pacific and in charge of vehicle engineering, active safety and chassis, cost management, strategy, advanced engineering and concept development related areas. Between 1997 and 2013, he had various leadership positions at Mechanical Dynamics Inc., Ford Motor Co., in the US and Changan Automobile Co. Ltd., managing vehicle attributes, chassis and computer-aided engineering-related research and development. He holds a Ph.D. in mechanical engineering and an MBA, both from the University of Michigan.

Key takeaways:

- SDVs are increasingly adopting centralized ECUs, offering benefits such as optimized resource utilization and simplified architecture. They also transform the in-vehicle experience through customization, enhanced infotainment and improved user interaction.
- However, challenges in cybersecurity and compatibility need to be addressed. Designing SDVs presents challenges in system architecture, security, safety, and failure prevention.
- Large language models have the potential to transform the automotive industry by enabling natural customer interactions, accelerating autonomous driving development, and providing data analysis and insights. They can also be utilized for predictive maintenance and open up opportunities for innovative business models.

The following is an edited transcript of the conversation.

S&P Global Mobility: Could you discuss the architectural transformations that SDVs are undergoing, specifically the shift from domain architectures to centralized ECUs, and the potential impact on vehicle operations?

Jianmin Gu: SDVs are increasingly adopting centralized ECUs over traditional domain-based architectures. Domain architectures traditionally compartmentalize vehicle functions like

powertrain, chassis and infotainment into separate ECUs. This approach results in complex wiring harnesses, increased weight and challenges in software integration, scalability and maintenance.

In comparison, centralized ECUs consolidate these functions into a unified platform. This centralization optimizes resource utilization, reduces redundancy in hardware and software, and simplifies the vehicle's overall architecture. It enables more efficient data sharing and processing among different vehicle systems, enhancing performance and enabling advanced functionalities like AI-driven features and autonomous driving capabilities.

The shift to centralized ECUs also promises significant impacts on vehicle operations. First, it facilitates quicker software updates and upgrades, allowing vehicles to adapt rapidly to new features and improvements. This agility is crucial in enhancing vehicle functionality, performance, and user experience over time. Second, centralized ECUs can improve reliability by reducing the number of physical components and connections, potentially lowering maintenance costs and enhancing overall vehicle uptime.

However, this architectural shift poses challenges such as ensuring robust cybersecurity measures to protect centralized systems from potential threats. Additionally, mitigating risks associated with potential single point failures becomes critical to maintain vehicle safety and operational continuity.

Overall, the move toward centralized ECUs in SDVs represents a transformative shift that leads to streamline operations, enhance vehicle capabilities, and pave the way for more sophisticated and autonomous driving technologies in the future.

Valeo has developed a strong track record in the last two years of winning the confidence of several customers with new orders, which include:

- BMW, domain controller for their new architecture for Neue Klasse platform
- Renault on their SDV architecture
- Entry domain controller in China with Geely
- A central computing unit for an unnamed major global OEM

We are interested in how SDVs are reshaping the in-vehicle experience. Could you elaborate on the opportunities and challenges this presents for customization, infotainment and user interaction?

SDVs are fundamentally transforming the in-vehicle experience by offering extensive opportunities for customization, enhancing infotainment capabilities and revolutionizing user interaction.

- Customization: SDVs allow for personalized settings that adjust everything from driving modes and climate control to ambient lighting based on user preferences stored in the vehicle's system. This level of customization enhances comfort and convenience, providing a tailored driving experience for each occupant.
- Infotainment: SDVs integrate advanced infotainment systems that offer a diverse range of entertainment options such as streaming services, podcasts and personalized media libraries. These systems often include seamless connectivity with smartphones and other devices, enabling passengers to stay connected and entertained throughout their journey.
- User Interaction: SDVs feature sophisticated human-machine interfaces that improve user interaction through intuitive touchscreens, augmented reality displays like AR HUD, and voice commands. These interfaces simplify the control of vehicle functions, navigation, and communication systems, enhancing convenience and reducing driver distraction.

Despite these benefits, SDVs face challenges in maintaining cybersecurity to protect sensitive user data and ensure the integrity of vehicle systems. The complexity of integrating multiple software components and ensuring compatibility across different devices and platforms can also pose difficulties. Furthermore, balancing the enhancement of user experience with ensuring driver safety remains critical to mitigate distractions and maintain focus on the road.

What challenges have you encountered in SDV design, including system architecture, security, safety and failure prevention? How are these challenges being tackled?

Designing SDVs presents multifaceted challenges across system architecture, security, safety and failure prevention.

- System architecture: Integrating diverse software components and ensuring their seamless interaction while maintaining performance and scalability is challenging. SDVs are tackling this by adopting modular architectures with centralized ECUs, facilitating easier software updates and enhancing overall system efficiency.
- Security: SDVs face significant cybersecurity risks due to their connectivity and reliance on software. Addressing these risks involves implementing robust encryption, authentication mechanisms and secure over-the-air (OTA) updates. Continuous monitoring and threat detection systems are employed to mitigate vulnerabilities and respond swiftly to potential breaches.
- Safety: Ensuring the safety of SDVs involves rigorous testing and validation of software algorithms and hardware components. Challenges include developing fail-safe mechanisms, integrating redundant systems, and refining sensor fusion technologies for accurate perception. Advanced simulation tools and real-world testing scenarios are utilized to assess and improve system reliability under diverse conditions.
- Failure prevention: Preventing failures in SDVs requires proactive maintenance strategies and predictive analytics to anticipate and mitigate potential issues. Challenges include developing predictive maintenance algorithms, implementing diagnostics for early fault detection and ensuring robust backup systems. Manufacturers are leveraging data analytics and machine learning to optimize maintenance schedules and enhance overall vehicle reliability.

In conclusion, addressing these challenges in SDV design involves leveraging advanced technologies, rigorous testing protocols, and collaborative efforts across the automotive industry. Continuous innovation and adherence to stringent standards are essential to overcome these challenges and ensure the safe and reliable deployment of SDVs in the future.

How do you perceive the automotive industry's response to the increased risks of safety-related software crashes and remote cyber threats in SDVs?

The automotive industry is responding vigorously to the heightened risks of safety-related software crashes and remote cyber threats in SDVs.

- Safety-related software crashes: Manufacturers are intensifying efforts in software verification and validation. This includes extensive simulation testing to cover a wide array of scenarios and conditions, ensuring software reliability in diverse environments. Real world testing complements simulations to validate performance under actual driving conditions. Additionally, redundant systems and fail-safe mechanisms are being integrated to mitigate the impact of software failures on critical vehicle functions. Collaboration with regulatory bodies helps establish robust safety standards and guidelines, ensuring adherence to rigorous safety protocols throughout the development lifecycle. The UN R156 regulation, for example, gives a

means to ensure the maintenance for SDVs.

- Remote cyberthreats: Cybersecurity has become a top priority in SDV design and deployment. Automakers are implementing robust cybersecurity measures such as secure communication protocols, encryption of data transmissions, and intrusion detection systems to safeguard against remote threats. Secure OTA update mechanisms are crucial for promptly addressing vulnerabilities post-deployment. Collaboration with cybersecurity experts and investment in threat intelligence capabilities enable proactive defence strategies against evolving cyberthreats.

In summary, the automotive industry's response to safety-related software crashes and cyberthreats in SDVs is characterized by rigorous testing, integration of redundant safety features, adherence to stringent safety standards, and robust cybersecurity measures. These efforts aim to ensure the reliability, safety and security of SDVs as they continue to advance in technology and adoption. Continued collaboration and innovation will be essential to stay ahead of emerging risks and maintain consumer confidence in SDVs.

Could you provide some insight into the division of software development between the OEM and suppliers?

In the automotive industry, software development for vehicles is often divided between OEMs and their suppliers collaboratively. OEMs typically focus on core vehicle functionalities, overall system integration, and the high-level software architecture. They define the vehicle's performance requirements, safety standards and user experience expectations.

Suppliers, on the other hand, specialize in developing specific software components and subsystems that meet the OEM's specifications. These components can include advanced driver assistance systems, infotainment systems, connectivity solutions and vehicle control systems. Suppliers bring expertise in niche areas such as sensor technologies, embedded software development, and application-specific algorithms.

The collaboration between OEMs and suppliers is crucial for leveraging specialized knowledge and accelerating innovation while maintaining quality and reliability standards. OEMs oversee the integration of various software components into a unified vehicle system, ensuring seamless operation and adherence to regulatory requirements. Suppliers contribute by delivering tailored solutions that enhance vehicle performance, safety, and user experience, aligning closely with the OEM's vision and market demands.

This division of software development allows OEMs to focus on their core competencies while benefiting from the specialized capabilities and innovations brought by suppliers, ultimately driving advancements in automotive technology and enhancing the competitiveness of vehicles in the market.

Valeo is an important partner of global automobile manufacturers. In China, our customers cover both traditional OEMs and new force auto manufacturers. We use our professional advantages to help OEMs strengthen their competitiveness in both domestic and overseas markets. For example, the Valeo Intelligent Security Solution VSS360 system is a brand new one-stop ADAS, which uses the latest Mobileye computer vision technology for front-facing cameras and has the advantages of easy integration, high cost-effectiveness and scalability. OEMs can optimize costs and efficiency by eliminating a separate ECU. At the end of 2023, the smart # 3 model equipped with this system obtained the E-NCAP 5-Star Safety Certification (2023 new regulations).

How do you see large language models transforming the automotive industry and its business models? What potential applications could we anticipate in the automotive sector?

Large language models are poised to revolutionize the automotive industry and its business models in several potentially impactful ways.

- Customer interaction and support: LLMs enable more natural and intuitive interactions through voice assistants and chatbots. They can provide personalized customer support, assist with vehicle troubleshooting, and handle inquiries about features, services and maintenance schedules. This enhances customer satisfaction and streamlines service operations.
- Autonomous driving development: LLMs contribute to autonomous driving advancements by processing vast amounts of data from sensors and simulations. They help in refining algorithms for perception, decision-making, and planning, accelerating the development and deployment of autonomous vehicles.
- Data analysis and insights: Automotive companies can utilize LLMs for analyzing market trends, consumer preferences and sentiment analysis from social media and customer feedback. This data-driven approach informs product development, marketing strategies and enhances understanding of real customer needs.
- Predictive maintenance: LLMs analyze vehicle sensor data to predict maintenance issues before they occur. This proactive maintenance approach minimizes downtime, reduces repair costs and optimizes fleet management operations.
- Innovative business models: Integration of LLMs opens opportunities for new business models such as subscription-based vehicle services, personalized vehicle configurations based on consumer preferences gathered through natural language interactions and enhanced in-vehicle advertising and commerce experiences.

CONTACTS

The Americas
+1 877 863 1306

Europe, Middle East & Africa
+44 20 7176 1234

Asia-Pacific
+852 2533 3565

www.spglobal.com/mobility