S&P Global
Mobility

AutoTechInsight Insights
March 2024

The shift to software-defined vehicles: Foryou General Electronics interview

19-Mar-2024 10:45 GMT

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

Software-defined vehicles are transforming the automotive industry, enhancing comfort, safety and customization while posing cybersecurity challenges.

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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 involves continuous agile software development, increased computing requirements for data processing, a modular service-oriented architecture and enhanced security measures against cyber threats.

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 the SDV in the Greater China market. First up is FGE. Huizhou Foryou General Electronics Co., Ltd, is a subsidiary of Foryou Corporation. This Greater China-based company supplier's key business focus on Intelligent, products and services cover three areas smart cockpit, intelligent driving, and Connected Vehicle System, including in-vehicle infotainment, cockpit domain controller, digital cluster, display, climate control system, e-mirrors, acoustic system, connected vehicle services, around view monitoring, automatic parking and other Advanced Driving Assistance Systems. In recent years, the company has continued to improve software and hardware technology innovation around the development trends of domain integration and central computer platform. The company's products have been sold to more than 80 countries and regions around the world.

We spoke to Zhang Hai Jun, marketing director, Huizhou Foryou General Electronics Co., Ltd.

Key takeaways:

- **Intelligent vehicle revolution:** In Greater China, the popularity of intelligent vehicles is growing, driven by changes in electrical/electronic (E/E) architecture and SDVs. The market is shifting toward centralized computing. Foryou has developed a system focusing on the cockpit domain and advanced driver assistance system (ADAS) domain electronic control units (ECUs) to stay competitive. Data, especially from ADAS and connected cars, is vital for software improvements and enhancing user experience. However, the shift toward hardware centralization presents challenges for tier 1 suppliers, such as maintaining product quality and managing increased maintenance costs.
- **Opportunities and challenges:** In Greater China, the intelligent car market is evolving with software driving the intelligence of hardware-based systems. This results in continuous user experience improvements but also increases complexity, challenging tier 1 suppliers.

Hardware consolidation enables data collection for various scenarios, enhancing navigation and passenger entertainment. However, managing these scenarios, especially with increasing car, home device, and smartphone interconnectivity, is complex. The industry must identify and focus on the most relevant scenarios, ensuring high-quality user experience amid the challenges of continuous software updates and complex infotainment features.

- **Further challenges:** Tier 1 suppliers in the vehicle industry are grappling with challenges, such as increased software complexity, a talent shortage in embedded systems design and cybersecurity concerns due to the rise of connected cars and cloud technology. They are learning to define clear roles in SDV development, decouple hardware and software development timelines, meet stringent cybersecurity requirements and implement online detection for remote diagnostics. These challenges highlight the need for continuous adaptation in the face of evolving technology and market demand.
- **Addressing risks:** The evolution of intelligent vehicles blurs the boundary between the interior and exterior, due to the integration of vehicle computers, cloud technology and virtualization. This integration can lead to software bugs. For tier 1 suppliers, quick response to these threats and prioritizing consumer safety is vital, requiring lifetime software management and collaboration with OEMs. Ensuring passenger and driver safety is paramount, necessitating functional safety requirements and continuous learning and improvement to manage increased risks in this evolving field.
- **Division of development:** The division of work between OEMs and tier 1 suppliers in the intelligent vehicle industry varies based on each automaker's resources and competencies. Some OEMs choose to develop all software in-house, some focus on key software, while others purchase components directly from tier 1 suppliers. Clear communication of requirements from OEMs to tier 1 suppliers is crucial for timely and quality software delivery. The strategy each automaker adopts depends on their individual focus and capacity, with different layers of partnership established as needed.

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?

Mr. Zhang Hai Jun: In Greater China, Intelligent vehicles are gaining popularity, driven by revolutionary changes in E/E architecture and SDVs. The market trend is shifting from domain to centralized computing. In this competitive landscape, we have developed a system focusing on cockpit domain and ADAS domain ECUs. These are key areas of competitiveness. Intelligent vehicles require higher bandwidth and a powerful yet affordable centralized computer, leading to a trend toward increasing software complexity in the industry.

Data is crucial in the new business model. For instance, data from ADAS and connected cars, collected from the vehicle to the cloud, provides valuable insights for software improvements. Analyzing consumer data in the cockpit domain is important, as it allows automakers and suppliers to understand user behavior, enhancing functionality and user experience.

From a tier 1 supplier's perspective, product quality is becoming increasingly important due to the shift toward hardware centralization, requiring higher standards for stability and quality. Consequently, maintenance costs for components have increased. The ADAS system uses data for algorithm improvements, while the cockpit domain requires frequent updates for function and user experience. The key challenge lies in maintaining product quality and hardware stability to avoid quality issues, even as maintenance costs increase.

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?

In Greater China, the intelligent car market operates on the principle that while hardware forms the foundation, it is the software that drives intelligence. This leads to continuous improvements in user interaction experience through multiple software iterations. However, this presents challenges for tier 1 suppliers as hardware consolidation and increasing software complexity demand a high level of user experience in the cockpit domain. For instance, the infotainment system now requires a more personalized design, matching standards from the consumer electronics industry.

As hardware becomes consolidated, it enables the collection of information based on different scenarios. Information, such as navigation can be displayed on the digital cluster. Passengers can enjoy entertainment and share navigation points of interest from their side to the driver's side. They can also select different content for rear entertainment, especially for children.

The car industry is creating various scenarios. For example, if a driver monitoring system detects fatigue, the vehicle can adjust the climate control system to make the driver feel more alert. If the system detects smoking in the car, it can automatically open the windows to let in fresh air. With increasing connections between the car, home devices and smartphones, these scenarios are becoming more complex. This complexity poses a challenge to identify the most frequently used scenarios and eliminate unnecessary ones from the car's design.

To summarize, while the growth and improvement of intelligent vehicles present opportunities, they also pose challenges. These include the need for continuous software updates, complex infotainment features and the management of various vehicle scenarios. Suppliers must adapt to these changes, ensuring a high-quality user experience while identifying and focusing on the most relevant scenarios.

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

Tier 1 suppliers in the vehicle industry face three main challenges. First, software complexity has significantly increased. A project that required 10 to 20 people three to five years ago now requires up to 80 people due to the heavier workload, highlighting the growing complexity in software development.

Second, there is a shortage of software talent in the industry, particularly in the area of embedded systems design. This scarcity of skilled professionals presents a significant hurdle.

Third, the advent of connected cars and cloud technology has raised cybersecurity concerns. Protecting vehicle and personal information from potential cyberattacks on the cloud or various ECUs is a critical challenge.

In addition to these, we face four specific challenges. The first is defining clear roles in the development of SDVs. OEMs are taking charge of the application layers, while Tier 1 suppliers handle the middle and low layer software development. Lessons are being learned from other industries like consumer electronics and internet companies.

The second challenge is the decoupling of hardware and software. While hardware development takes one to two years, software iterations, akin to smartphone operating system (OS) releases, allow for the development and release of functionalities over time.

The third challenge is meeting cybersecurity requirements. Tier 1 suppliers can implement Hardware Security Modules (HSM) and build firewalls to protect vehicles and ECUs from cyberattacks, aligning with ISO 21434 certification.

The fourth challenge is online detection. If a defect is discovered, ECUs can log the issue for check, and an online platform can be used for remote diagnostics. This involves collecting faults, recording them in a log, uploading them online and analyzing the defects remotely.

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

In the realm of intelligent vehicles, the boundary between the interior and exterior of the vehicle is becoming less distinct due to the integration of vehicle computers, cloud technology, and virtualization. This integration, especially with third-party software modules, can lead to software bugs that need to be addressed.

For tier 1 suppliers, responding quickly to these threats and prioritizing consumer safety is crucial. This requires a strategy for lifetime software management and a commitment to working closely with OEMs to resolve issues promptly.

Protecting the safety of passengers and drivers is a top priority, necessitating the implementation of functional safety requirements. As part of this process, continuous learning and improvement are essential to respond to the increased risks and challenges in this evolving field.

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

The division of work between OEMs and tier 1 suppliers depends on the resources and competencies of different automakers. While some have leadership in research and development, others follow three general collaboration models.

The first model involves OEMs choosing to develop all software in-house. The second model sees OEMs selecting key software modules for in-house development. The third model involves purchasing components directly from tier 1 suppliers. For example, mainland Chinese OEMs, such as Geely, Great Wall and Changan have set up companies to develop software with key partners.

From the tier 1 perspective, it is advantageous for OEMs to provide clear requirements, enabling suppliers to deliver quality software on time. Some current collaborations involve OEMs developing application software and part of the middleware, while tier 1 suppliers build the rest of the middleware and basic software layers. This ensures timely delivery and quality assurance.

In summary, the strategy depends on the individual automaker. Some prefer in-house development, some focus on key software development and others purchase components from tier 1 suppliers. It is akin to a chef preparing dishes—they do not need to grow the vegetables themselves. The key advantage for development with tier 1 suppliers is that OEMs can share requirements and receive quality and timely delivery, with different layers of partnership depending on the focus of the OEM.

CONTACTS

The Americas
+1 877 863 1306

Europe, Middle East & Africa
+44 20 7176 1234

Asia-Pacific
+852 2533 3565

www.spglobal.com/mobility