S&P Global
Mobility

科大讯飞 iFLYTEK

Featured Interview with IFLYTEK

The Shift to Software-Defined Vehicles

May 2024

Background

S&P Global Mobility

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

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, such as smartphones. Original equipment manufacturers 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 cyber threats.

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 Iflytek. Iflytek is an intelligent voice and artificial intelligence company in the Asia-Pacific region. They specialize in providing intelligent solutions for the automotive industry, including intelligent cockpits, sound effects, driving systems and services for automotive companies. As of March 2024, their automotive intelligent products and technologies have been embedded in millions of vehicles, with billions of online interactions and millions of active users. To learn more about this business and SDVs, we spoke to Lei Qin Hui, Iflytek Intelligent Auto Chief Technology Officer.

Key Takeaways

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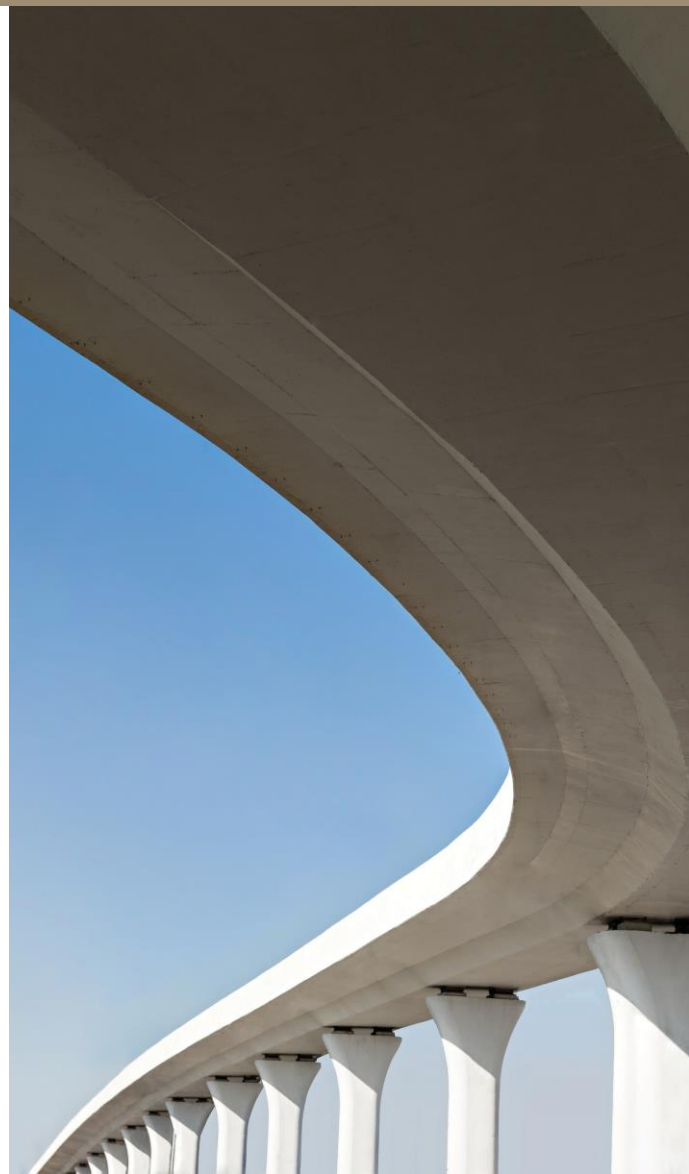
- Distributed and centralized architectures have pros and cons, with distributed architectures offering lower component maintenance costs and centralized architectures providing flexibility and the ability to integrate new functions.
- Communication speeds have increased from Kbit/s to Gbps due to high-resolution cameras, with high-speed communication required in the entertainment domain and real-time data communication and low latency needed for vehicle communication and automated driving.
- SDVs are built on vehicle hardware, with the cockpit domain transformed by mobile internet advancements, enabling intelligent features and turning the vehicle into a versatile space.
- Software development in the automotive industry follows standards, such as Automotive ASPICE and IATF 16949, with different software demands for each domain and complex software architecture in the central computer.
- Law enforcement and traceability are crucial for the safety and security of connected cars, with software protection for the network and gateway playing a key role in preventing unauthorized access and malicious attacks.
- In traditional partnerships, co-creation and co-development are necessary due to uncertain software specifications, and effective software development requires partnerships, frameworks and integration of different software modules. Natural Language Understanding (NLU) and Large Language Models (LLMs) improve user experience, while automated driving involves training algorithms and LLMs facilitate vehicle design and generate visuals. Manufacturing planning optimizes production processes, and LLMs are used in sales and marketing. Vehicle manuals provide maintenance guidance, and human salespeople establish emotional connections with clients.



Question 1

S&P Global Mobility

S&P Global Mobility:

Could you discuss the architectural transformations that SDVs are undergoing, specifically the shift from domain architectures to centralized electronic control units (ECUs), and the potential impact on vehicle operations?

iFLYTEK:

“Both distributed and centralized architectures have their pros and cons. Distributed architectures offer lower component maintenance costs but have higher overall vehicle costs and complex hardware management. Centralized architectures provide flexibility and the ability to integrate new functions but come with software complexity and higher maintenance costs for key components like the central computer.

The distributed architecture offers the advantage of combining multiple ECUs together, which extends its capabilities and results in lower maintenance fees. However, it also leads to higher total vehicle costs and complexity in terms of hardware and vehicle configuration.

With the rise of intelligent vehicles, there is a growing demand from our customers for entertainment and highly automated driving. As a result, the architecture is shifting toward domain-based and centralized architecture, where the software can control the vehicle sensors. This approach allows for flexibility in adding new functions to new vehicles, reduces the cost of hardware procurement, but increases software complexity and maintenance fees for the components.

Communication speeds have increased from Kbit/s to Gbps due to the use of high-resolution cameras. The entertainment domain requires high-speed communication, while vehicle communication and automated driving require real-time data communication and low latency. This complexity is further amplified by the high communication speed and low latency requirements of automakers' sliding functions.

Question 1

S&P Global Mobility

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Could you discuss the architectural transformations that SDVs are undergoing, specifically the shift from domain architectures to centralized electronic control units (ECUs), and the potential impact on vehicle operations?

iFLYTEK:

As mechanical vehicles transition to electric and intelligent vehicles, we are witnessing a shift toward domain-based architecture, such as the vehicle control domain, cockpit domain controller and advanced driver assistance system (ADAS) domain controller. However, in the next one or two years, we can expect to see the emergence of central compute as a mega trend in the industry.

Both distributed and centralized architectures have their pros and cons. Distributed architectures offer lower component maintenance costs but have higher overall vehicle costs and complex hardware management. On the other hand, centralized architectures provide flexibility and the ability to integrate new functions but come with software complexity and higher maintenance costs for key components like the central computer. The distributed architecture offers the advantage of combining multiple ECUs, extending its capabilities and resulting in lower maintenance fees. However, it also leads to higher total vehicle costs and complexity in terms of hardware and vehicle configuration."

Question 2

S&P Global Mobility

S&P Global Mobility:

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?

iFLYTEK:

“The first point emphasizes the importance of a solid foundation for SDVs. Currently, we have high-performance hardware in vehicles, which provides a strong base for SDVs.

The second point focuses on the intelligence and customer increasing demand of new features, particularly in the Greater Chinese market where there is a mobile internet industry. In the vehicle domain, this represents cockpit domain intelligence. As highly automated driving becomes more prevalent, the cockpit and rest of the cabin will transform into a multifunctional space resembling an office, meeting room, or smart home. It will no longer be solely a transportation space but also a place where you can work, be entertained, or relax. Therefore, the increasing demands of customers are a key driver for the development of new software features.

In relation to the other points, software-defined vehicles are essential for achieving highly automated driving. This requires a car with a wide range of features and software complexity. Additionally, there is a need for numerous software-defined vehicle chassis options. This is because software can be used to modify the performance of the vehicle chassis, opening up a multitude of possibilities for software customization in vehicles. Another important aspect is the ability to update the software regularly over time, even without software-defined vehicles.”

Question 3

S&P Global Mobility

S&P Global Mobility:

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

iFLYTEK:

“Software development in the automotive industry faces challenges due to the sheer volume of code involved. To overcome these challenges, robust software development practices are essential. Different domains within the automotive industry have varying software requirements. For instance, infotainment software focuses on user-friendly interfaces, while software for highly automated driving prioritizes safety standards.

The central computer in vehicles exhibits complex software architecture. To protect data, safety and artificial intelligence (AI) in cars adhere to ISO 21434 standards. Algorithms and data are stored within the vehicle's mechanisms. Automated driving necessitates backup systems, low latency and multiple software layers. Control software ensures driving safety, stable design and robustness.

Extensive testing is conducted to verify and ensure the reliability of the software. Standards, such as Automotive ASPICE and IATF 16949, are followed in software development in the automotive industry to ensure quality and compliance with industry standards. These practices and standards play a crucial role in the development of software for the automotive industry, enabling the creation of safe, reliable and efficient systems. ”

Question 4

S&P Global Mobility

S&P Global Mobility:

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

iFLYTEK:

“Law enforcement and traceability are critical for ensuring the safety and security of connected cars. While no network can guarantee complete safety, those who attempt to attack a connected car will face consequences. To protect the vehicle network, it is essential to have software protection for the network and gateway. These components play a crucial role in preventing unauthorized access and malicious attacks. Timely response is vital for addressing software issues and fixing bugs. Regular updates and patches are necessary to maintain software security and reliability.

Although there are laws in place to provide coverage for cars under attack, it is important to note that no network can provide 100% safety and protection for the car. Similar to the banking system, which can also be vulnerable to attacks over time, software can be utilized to check the system and identify attackers, enabling them to be held accountable for their actions.

The second point emphasizes the importance of a vehicle network gateway, which serves as the entrance to the vehicle communication network. This unit is crucial in ensuring the security and protection of the vehicle network from potential attacks. Establishing requirements and protocols to safeguard the dedicated software of the vehicle is necessary to protect it from unauthorized access or breaches. The gateway acts as a barrier, preventing unauthorized access to the vehicle's internal systems and data, thereby enhancing the overall security of the connected car.

The third point highlights the significance of a quick response when software detects a problem or potential attack. Immediate software updates are crucial to address the issue and ensure the security and functionality of the system. Rapid response and effective bug fixing minimize the impact of potential attacks and maintain the safety and reliability of the connected car. Regular software updates and patches are necessary to address vulnerabilities and enhance the overall security posture of the vehicle network..”

Question 5

S&P Global Mobility

S&P Global Mobility:

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

iFLYTEK:

“In traditional partnerships, the OEM defines specifications while the supplier develops and delivers the software. However, due to uncertain software specifications, co-creation and co-development are now necessary. Different software layers are involved, including standard capabilities like Iflytek AI, voice recognition, navigation, and music. Automakers can dominate by co-creating SDKs for various vehicle scenarios. Effective software development requires a software architecture similar to the E/E Architecture and powertrain, along with partnerships and frameworks to integrate different software modules. Without these, software development can be challenging.

Specifically, let us first address the partnership model. In the traditional model, known as the turnkey approach, the product is purchased from a supplier who then delivers it to the automakers. However, with software-defined vehicles, the requirements for software features have become more uncertain. This uncertainty necessitates a shift towards co-creation and co-development between automakers and software providers.

Question 5

S&P Global Mobility

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

iFLYTEK :

The second point highlights the different layers involved in software development. For instance, Iflytek utilizes AI technology for voice recognition and text-to-speech functionalities, among others. There are also standardized capabilities, such as navigation and music applications. Additionally, there are upper layers that focus on user experience. To achieve optimal results, there needs to be a co-creation process between software providers and automakers. This allows automakers to define the dominant software development and choose an integrator to integrate and develop the system. Partnerships play a crucial role in this process, as they involve not only delivering software applications to automakers but also co-creating software development to create user-friendly applications tailored to different vehicle scenarios.

The final point addresses the software framework, which is similar to the powertrain architecture‘s e-architecture. In software-defined vehicles, automakers have their own software architecture. This allows them to choose different software providers to offer various software modules that align with the same software architecture. This is crucial because it prevents the software management process from becoming overly complex. By following this framework, automakers can effectively manage and integrate different software components from multiple providers within their software architecture.”

Question 6

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S&P Global Mobility:

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?

iFLYTEK:

“User experience in cars is enhanced through NLU, transitioning from rule-based systems to LLMs that integrate extensive information. LLMs act as personal assistants, answering queries and controlling functions.

Automated driving involves training algorithms with data to handle corner cases and enhance driving performance. LLMs facilitate vehicle 3D design and generate visuals, while manufacturing planning optimizes production processes and resources.

LLMs are also utilized in sales and marketing for product introductions and demonstrations. Vehicles and robots are employed for advertising and explaining functionalities. Vehicle manuals provide maintenance guidance, while human salespeople establish emotional connections with clients.

These various applications of LLMs contribute to an improved user experience in cars, providing assistance, enhancing driving performance, aiding in design and manufacturing, and supporting sales and marketing efforts. The combination of technology and human interaction creates a holistic experience for car users. ”

Moderator

Matthew Beecham

**AutoTechInsight Research Manager,
Supply Chain & Technology,
S&P Global Mobility**

Matthew Beecham is a research manager for
S&P Global Mobility's AutoTechInsight platform.

Matthew brings almost three decades of industry knowledge and an extensive network to his role. His expertise spans ATI domains, providing shop floor insights and conducting high-level interviews.

He has worked for GlobalData plc, Just Auto, HORIBA MIRA, Economist Intelligence Unit (EIU), McKinsey, AT Kearney, and Supplier Business, a predecessor of ATI.

Matthew's academic credentials include a PhD in Automotive Technology Transfer from Cranfield University.

Fanni Li

**Principal Research Analyst,
Automotive Supply Chain & Technology,
S&P Global Mobility**

Fanni is Principal Research Analyst focused on Connected Car and related technology at S&P Global Mobility. Her responsibilities include China market research and analysis of digital cockpit and connected car, as well as global market analysis of over the air updates, connected services and vehicle software paid updates.

Fanni has more than 10 years working experience in automotive industry with engineering background. Prior to joining S&P Global, she worked for global OEM engineering centre in China for several years focusing on project management and product development of infotainment domain products.

Fanni holds a Master of Engineering in Mechatronic System from University of Technology of Compiegne in France, along with an MBA from University of Canberra.

Partner

S&P Global Mobility

Lei Qin Hui

Chief Technology Officer and Deputy General Manager

iFLYTEK Automotive Business Unit

Mr. Lei responsible for research and development of core products of intelligent vehicles.

He has led and participated in a number of significant R&D projects, including development of industry's first embedded spoken language learning product, algorithm engine development for voiceprint, language, wake-up, AEC, NR, face recognition, platform identification, and advertising detection, as well as the development of noise cancellation modules and development kit for smart vehicles.

In 2018, he participated in the revision of the national standard for Information Technology - Intelligent Voice Interaction System - Part 5: In-Vehicle Terminal, which was published and implemented by the State Administration for Market Regulation in 2019.

He has obtained 5 provincial and ministerial level scientific and technological achievements appraisals in the category of in-vehicle voice. He is an expert in technology and products in the fields of kernel and algorithm engine, automotive intelligent network connection, and autonomous driving. He was awarded the May 1st Labor Medal by Hefei Municipal Government in 2015.

Under his leadership, in October 2021, iFLYTEK was recognized for its outstanding contributions to the scientific and technological advancements in China's automotive industry and was awarded the third prize for the research on automotive multimedia network architecture and the development of international standards by the China Automotive Engineering Society.

Corporate Profile

S&P Global Mobility

S&P Global Mobility

S&P Global Mobility enables customers to anticipate change and make decisions with conviction.

We help them to optimize their businesses, reach the right consumers, and shape the future of mobility. Leveraging technology and data science, we provide unique insights, forecasts and advisory services spanning every major market and the entire automotive value chain—from product planning to marketing, sales and the aftermarket.

With a legacy dating back to the 1920s when R. L. Polk published the first vehicle registration reports, our solutions are used by nearly every OEM, more than 95% of tier one suppliers, media agencies, governments, insurance companies, and financial stakeholders to provide actionable insights that enable better decisions and better results.

iFLYTEK Automotive Business Unit

iFLYTEK is a well-known intelligent voice and artificial intelligence listed company in the Asia-Pacific region.

As a global leader in the field of speech recognition and synthesis, the company has built the China's National Key Laboratory of Cognitive Intelligence and the National Engineering Research Center of Speech and Language Information Processing. The company has been chosen as one of the first four open innovation platforms for artificial intelligence in China, makes it known as the core backbone enterprise in the field of artificial intelligence in China.

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