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Role of OEM in Automotive OS platform

Lovely Gaur[1], Rajitha T. B.[2], Srilakshmi Inampudi [3], Kavita Sawant[4]

Lecturer, Electrical Engineering, BVIT, Navi Mumbai, India[1]

HOD, Electrical Engineering, BVIT, Navi Mumbai, India[2]

Lecturer, Electrical Engineering, BVIT, Navi Mumbai, India[3]

Lecturer, Electrical Engineering, BVIT, Navi Mumbai, India[4]

Abstract: In today's dynamic auto industry, original equipment manufacturers (OEMs) are driving innovation and progress. Automotive OS forms the backbone of a car, managing and controlling functions including braking, infotainment, and safety. This means that OEMs must master increasingly complex car elements, such as sensors. Meanwhile, incompatibilities and poor harmonization among software car elements pose significant issues. If left unaddressed, these issues can hinder innovation and impede electric vehicle (EV) adoption, leading to environmental and economic setbacks.

Keywords: OEM, drives, motors, electric vehicles, automotive OS.

I. INTRODUCTION

In the computing world, for example, an Original Equipment Manufacturer is sometimes understood to be a company that assembles products (or systems) out of component parts (or subsystems) manufactured by others. Where this practice consists mainly of bundling and branding, it is in other contexts more helpfully known as Value-Added Reselling; and the OEM more normally identified as the manufacturer of the component parts. Where, though, one company is supplied with component parts by another but still manufactures its own generic, unbranded product – typically to be sold on down the supply chain to a further company more associated with end products – then it more closely approximates to an OEM as most understand it. An Original Equipment Manufacturer is, in short, most commonly defined as any company that manufactures machinery to sell to other companies – either as component parts or for them actually to use within their own manufacturing processes. Drives and drive systems are of fundamental importance to OEMs in a number of fields – in all fields, in fact, where machine operation demands safe and close controllability, dynamic responsiveness and smart energy consumption.

II. THE CURRENT LANDSCAPE OF AUTOMOTIVE OS PLATFORM ELEMENTS

The current landscape of automotive OS platforms is highly fragmented. Typically, OEMs manufacture some components, purchase some from partners, and build some through joint ventures. Once all the elements are ready, OEMs integrate them into a proprietary platform for a car.

Fig. 1 Ecosystem – Proteam Electric: In-wheel/Hub Motors

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Today's leading players include Google's Android Automotive and Apple's CarPlay. As expected, Google's platform integrates with Android phones while CarPlay integrates with iPhones. Meanwhile, Tesla's proprietary operating system provides seamless connectivity for Tesla vehicles, and Blackberry's QNX is steadily increasing its market share. Other prominent players include AGL, Baidu, BMW, Continental, COVESA, Ford, GM, Siemens, Benz, Toyota, Microsoft, and Volkswagen. The automotive OS market reached USD 5.7 billion in 2022, and is projected to increase to USD 19.5 billion in 2032 — an impressive annual growth rate of 13%!

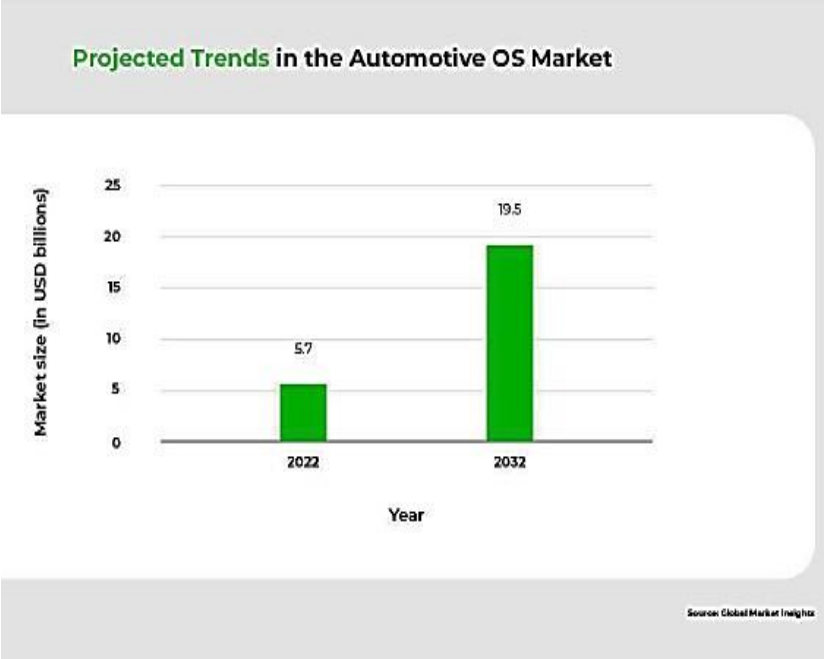

Fig. 2 Projected Trends in the Automotive OS Market

However, capitalizing on this high growth rate will not be easy for OEMs, given the rapid technological advancements, user demands, and lack of standard protocols across software platforms. In particular, the ever-growing number of software components and the need to communicate between in-car and cloud-based platforms further complicate software development. A promising solution to scale and overcome these impediments is to focus on harmonizing the different elements for cohesive functionality and greater synergy

III. THE NEED TO HARMONIZE PLATFORM ELEMENTS

The existing fragmentation among automotive software platforms and standards poses a challenge for all EV stakeholders, particularly OEMs. Traditional gasoline-powered vehicles were primarily hardware-driven, but current and future vehicles are increasingly replacing hardware with software to control and manage various functions. As a result of this shift, OEMs have been investing more resources to adapt their applications and services to work on different OS platforms.

As vehicle models proliferate and software functions become more complex, however, these investments lose scalability. A better option is to prioritize integrating and harmonizing disparate software elements. By adopting such a strategy, OEMs can:

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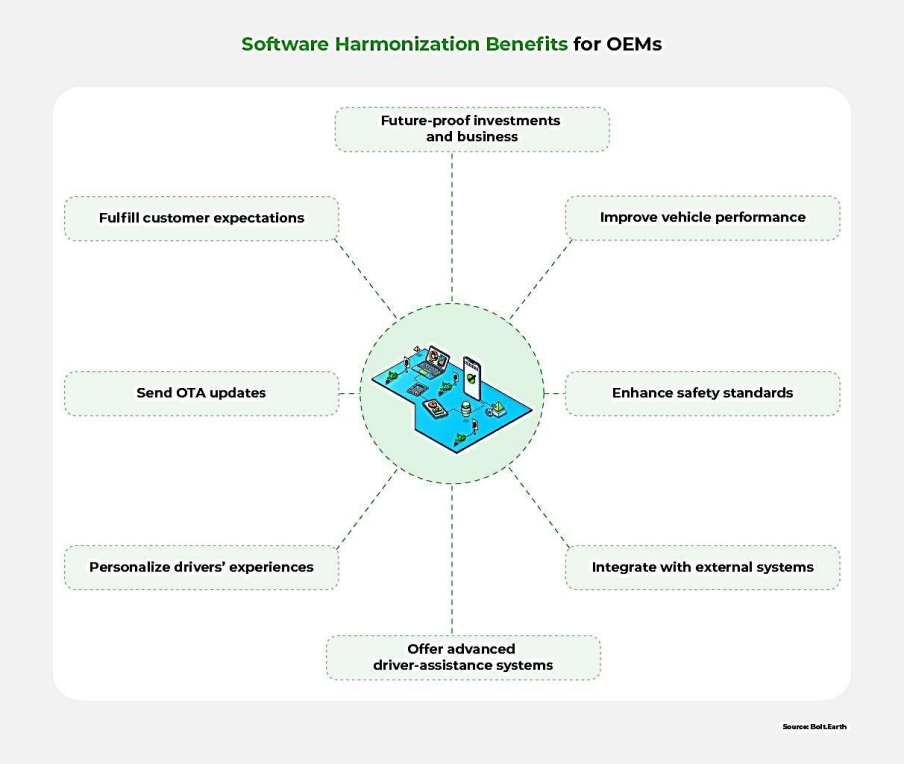

Fig. 3 Software harmonization benefits for OEMs

To realize these benefits, it is crucial for OEMs to adapt their strategies and priorities toward harmonization.

IV. THE ROLE OF OEMS IN PLATFORM ELEMENTS

Given OEMs' pivotal role in building software systems, they have the unique opportunity to turn the existing harmonization challenges into beneficial opportunities. Here are various elements that OEMs can enhance to propel growth in the automotive OS domain while focusing on scalability and security.

- **Designing and Integrating Platform Elements**

Design is the first step in software development, and, by prioritizing harmonization, OEMs can ensure that they create designs based on hardware and software components that work cohesively. From infotainment systems and connectivity modules to sensors and control units, OEMs can design a system that enables smooth connectivity and integration.

- **Ensuring Compatibility and Interoperability**

In the world of software-defined vehicles such as EVs, cars are seen as devices. Just as computers and smartphones need compatible apps, cars need systems that can communicate and collaborate. Standards like AUTOSAR attempt to ensure this interoperability, but each electronic control unit (ECU) is still built individually. OEMs must strive to use common protocols that ensure compatibility with other software apps and interoperability with diverse hardware components.

- **Collaborating with Software and Technology Partners**

Collaboration with software and technology partners enables OEMs to leverage external expertise with minimal upfront research costs. With this approach, OEMs can enhance their software capabilities, accelerate innovation, and keep pace with rapidly evolving technologies. Sharing knowledge and experience among different stakeholders of software-defined vehicles can lead to creating a universally-compatible OS with cutting-edge features, robust security, and a superior user experience.

- **Conducting Testing and Validation**

Rigorous testing and validation of platform elements within the automotive OS give OEMs the opportunity to verify functionality, performance, and safety standards, and to identify and address any potential issues or vulnerabilities before vehicles reach consumers. By adhering to stringent testing protocols, OEMs can ensure that the platform elements, which include electronic control units, sensors, IoT units, and mobile apps, meet the highest quality standards and deliver a reliable and secure user experience.

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- **Providing Ongoing Support and Updates**

Providing ongoing support and software updates, along with addressing customer feedback and preferences, are important processes which OEMs must plan in advance. In particular, cyber security best practices must be geared for EVSE devices, communications with EVs, and upstream devices like cloud, third-party apps, and software of grid operators. By continuously monitoring and addressing likely security threats, OEMs can release timely bug fixes, security patches, and feature enhancements to adapt to evolving user needs and ensure the long-term performance and functionality of the OS.

- **Collaborating with Industry Stakeholders**

OEMs must work with industry stakeholders, including regulatory bodies and standards organizations, to shape industry standards, protocols, and guidelines for interoperability and compatibility among diverse vehicles and systems. These efforts can empower OEMs to drive the overall advancement of the automotive OS landscape and ensure a cohesive and standardized approach to platform integration.

V. OEMS' PLATFORM INTEGRATION CHALLENGES

All emerging technologies create complexities, and software-defined cars are no exception. Advances in automotive software are not only enhancing next-gen cars' capabilities, but also creating numerous integration challenges for OEMs.

- **Diverse Hardware Configurations across Vehicles**

Each vehicle model and brand may have unique combinations of processors, memory capacities, connectivity modules, and sensor configurations. These variations among car models make it difficult for OEMs to design software that works seamlessly across diverse hardware configurations. More importantly, such incompatibilities can lead to safety and security issues. As a result, OEMs must continue to invest resources in developing software that can adapt to varying computing capabilities while efficiently utilizing available hardware resources.

- **Compatibility Issues with Third-Party Applications**

Third-party applications, like navigation systems or infotainment platforms, are often developed by different software providers, each with their own interfaces, data formats, and compatibility requirements. To integrate them, OEMs must perform compatibility testing for smooth interactions between the OS and third-party software. Even with extensive testing, however, compatibility issues can still arise when OS updates or changes impact the functioning of third-party applications. A possible solution is for OEMs to collaborate closely with software partners to maintain compatibility and address any issues.

- **Compatibility Issues with Legacy Systems**

OEMs face challenges when integrating new platform elements with legacy systems in older vehicles. Legacy systems may have different communication protocols, software architectures, and hardware limitations. Ensuring backward compatibility with legacy systems can be complex and may impose limitations on system updates and advancements. OEMs need to carefully balance the need for backward compatibility with the desire to introduce new features and technologies, as it may be necessary to maintain support for legacy systems while gradually phasing them out in favour of more advanced platform elements.

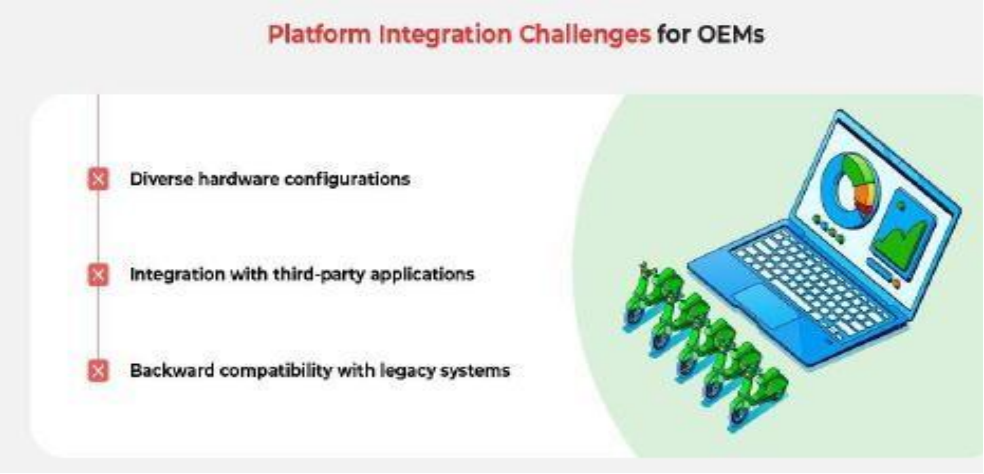

Fig. 3 Platform Integration Challenges for OEMs

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Addressing the above challenges is difficult, but not impossible. With the right strategy and concerted effort, OEMs can overcome them.

VI. THE IMPACT OF HARMONIZED PLATFORM ELEMENTS WITHIN AUTOMOTIVE OS

By driving the harmonization of platform elements, OEMs can shape the future of the entire auto industry as a whole. For example, their efforts can promote:

- **Faster Development and Deployment of New Features**

Platform harmonization permits OEMs to streamline the development and deployment of new software features and updates. A harmonized platform provides a standardized framework for software development, thereby reducing the complexity and time required to develop new features across different vehicle models and brands. This enables OEMs to accelerate innovation, improve their time-to-market, and more efficiently deliver advanced features and functionalities to customers.

- **Enhanced Safety and Security**

Harmonized platform elements lead to improved safety and security of vehicle systems and data. Standardized security protocols and robust software architectures enable OEMs to establish a strong foundation for cyber security. Additionally, harmonized platforms enable faster deployment of security patches and updates that can enhance the overall security posture of vehicles. Through such efforts, OEMs can build trust with customers and prioritize their well-being.

- **Facilitation of Connected and Autonomous Vehicle Technologies**

In a harmonized platform, sensors, connectivity modules, and control units work together to provide a superior user experience. Furthermore, such harmonization enables the automotive OS to efficiently process, analyze, and share data for real-time traffic updates and predictive maintenance. These features enhance the usability of vehicles and can lead to their wider adoption.All of the above benefits create a unified ecosystem that empowers society to enjoy the positive environmental and economic effects of software-defined vehicles.

- **Fostering a Unified Approach Towards EV Software**

The harmonization of platform elements holds the potential to create an automotive landscape that improves users' driving experience by providing them with cutting-edge technology. Moreover, harmonized platform elements enhance vehicle systems' and data's safety and security. Though many challenges exist in harmonizing diverse car elements, OEMs can overcome them with the right strategy and active collaboration with other stakeholders to implement standardized security protocols and robust software architectures.

VII. CONCLUSION

With seamless communication and interoperability among different vehicle systems and external networks, OEMs can unleash the full potential of these technologies. This can enable the creation of advanced features, improve efficiency, and foster a more interconnected and intelligent automotive software ecosystem, as well as economically benefiting OEMs by bolstering car sales and providing a competitive advantage. As the industry evolves, OEMs will remain at the forefront, strengthening a unified approach toward EV software to realize a connected, autonomous, and electrified future.

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