



**ResearchInChina**  
www.researchinchina.com

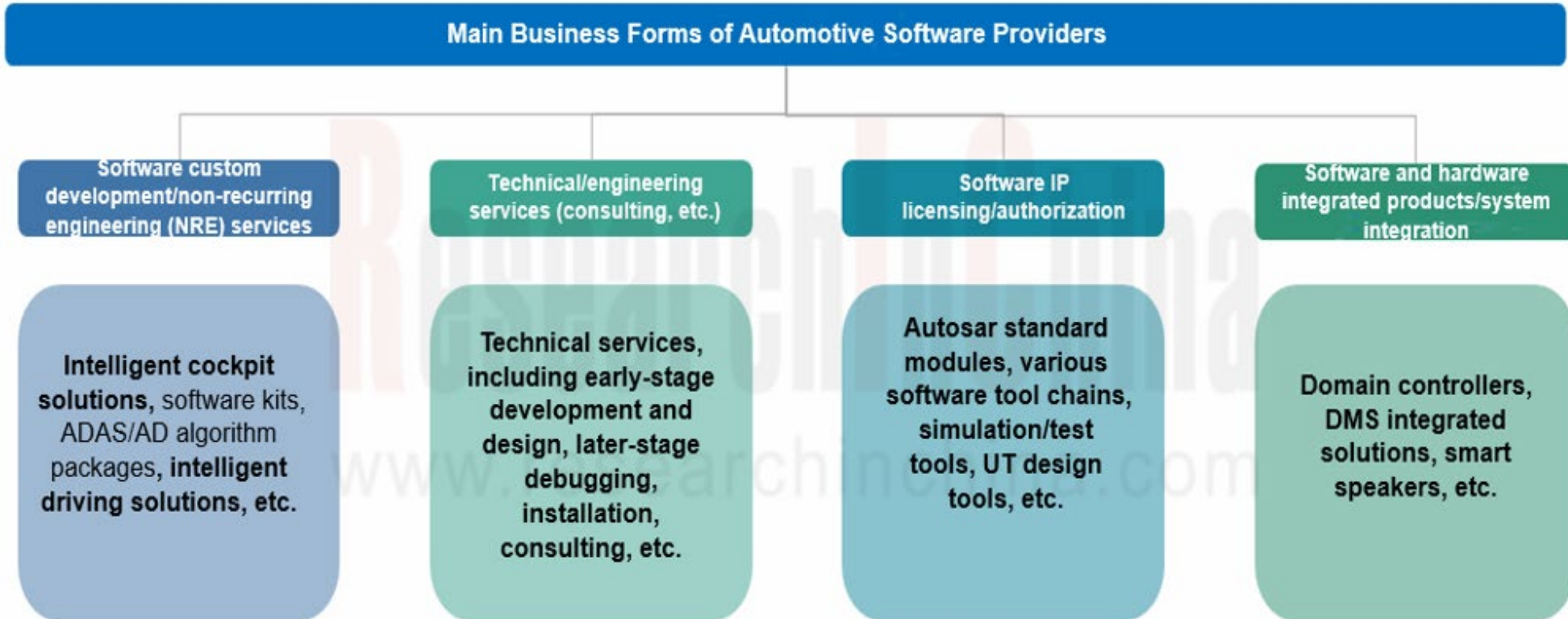
**Automotive Business Models and Suppliers' Layout Research Report, 2023**

Oct. 2023

# Layout and business forms of automotive software providers

From the layout of automotive software products and solutions, it can be seen that intelligent vehicle software business models include IP, solutions and technical services, which are mainly charged in the forms of non-recurring engineering (NRE), software licensing and royalty.

In terms of business forms, software providers are now engaged in custom software development and design, technical services, software licensing/authorization and system integration. Business forms differ slightly in charging modes.



Source: ResearchInChina

# Software Layout Strategy of OEMs

In the megatrend for software-defined vehicles, automotive electronic/electrical architecture has evolved from the distributed to the centralized. Automakers have intention of full-stack self-development and evolution. However, due to multiple factors such as software technology teams, only a few emerging carmakers or well-funded automakers have made it. Most of the rest still make layout by cooperating with suppliers. The model of “independent R&D (independent and controllable) + in-depth cooperation with suppliers” has now become the main way of making software layout for automakers.

In the trend for software and hardware decoupling, customers are no longer satisfied with purchasing sensors, software and hardware products provided by suppliers, but tend to choose software or hardware solutions that are compatible with products from competitors.

To follow this trend, providers work to make layout. For example, in August 2023 Bosch introduced video-perception software as a standalone product, which can be used on diverse SoCs (systems on chips). This gives automakers maximum flexibility. The image data captured by several sensors, such as the new Bosch camera heads, are processed by Bosch software and made available for advanced driver assistance functions relating to driving and parking.

Bosch's software and hardware separation solution can provide customers with diversified solutions in various fields, including separate hardware, software or software and hardware integrated system. It also supports customers to build application layers on this basis and offers a variety of combination solutions.

Software Layout Strategy of OEMs

OEM	Automotive Software Layout Mode
<b>Tesla</b>	<ul style="list-style-type: none"> <li>Software self-development + SoC self-development</li> <li>HW system full-stack self-development</li> </ul>
<b>NIO</b>	<ul style="list-style-type: none"> <li>Software system full-stack self-development</li> <li>NIO OS + Pilot system self-development</li> </ul>
<b>Xpeng</b>	<ul style="list-style-type: none"> <li>Software system self-development</li> <li>Xmart OS + Xpilot system self-development</li> </ul>
<b>Neta</b>	<ul style="list-style-type: none"> <li>“Self-development and self-production + open cooperation” dual mode</li> </ul>
<b>Mercedes-Benz</b>	<ul style="list-style-type: none"> <li>Independent R&amp;D + cooperation</li> <li>In MB.OS’ case, Mercedes-Benz is responsible for software architecture and integration for the system, and its partners take on development of some software modules and application software.</li> </ul>
<b>Volkswagen</b>	<ul style="list-style-type: none"> <li>Independent R&amp;D + cooperation</li> <li>Led by CARIAD, a wholly-owned subsidiary</li> </ul>
<b>Ford</b>	<ul style="list-style-type: none"> <li>Partner supply mode</li> <li>In-depth cooperation with Google Auto (overseas) on cockpit system</li> <li>In terms of autonomous driving, set up an intelligent driving subsidiary to integrate solutions of suppliers</li> </ul>
<b>Great Wall Motor</b>	<ul style="list-style-type: none"> <li>Coffee Intelligence System</li> <li>Great Wall Motor established subsidiaries for independent R&amp;D layout. In terms of cockpit system, it founded Bean Tech, Beijing Metawall Intelligent Technology, and Jiayu Tech.</li> <li>Regarding intelligent driving system, it established a subsidiary named Haomo.AI</li> </ul>
<b>Geely</b>	<ul style="list-style-type: none"> <li>Establishment of subsidiaries or joint ventures</li> <li>Establishment of cockpit system subsidiaries such as ECARX and Meizu</li> <li>Lotus and Momenta jointly established an intelligent robot company called Lotus Robotics Co., Ltd.</li> </ul>
<b>BYD</b>	<ul style="list-style-type: none"> <li>Self-development of BYD OS and Dilink system</li> <li>For driving assistance, it adopts a multi-supplier supply mode and established a joint venture, Dipai Zhixing, with Momenta</li> </ul>
<b>Changan</b>	<ul style="list-style-type: none"> <li>Establishment of Changan Automobile Software Co., Ltd.</li> <li>Establishment of Phoenix Auto Intelligence with Tencent</li> <li>Multi-supplier model for intelligent driving; establishment of Changxian Technology with Horizon Robotics</li> </ul>
<b>SAIC</b>	<ul style="list-style-type: none"> <li>Establishment of an innovation research institute</li> <li>Establishment of a software subsidiary called Z-One</li> <li>In terms of cockpit system, SAIC and Alibaba set up a joint venture named Banma Zhixing</li> </ul>
<b>AITO</b>	<ul style="list-style-type: none"> <li>Adoption of complete solutions of Huawei Smart Selection</li> </ul>

Source: ResearchInChina



## In the trend of EEA, OEMs speed up vehicle OS layout, the solutions of software suppliers become more systematic, and multi-party cooperation accelerates mass production

In the context of cross-domain fusion, the intelligent vehicle industry requires a vehicle OS to simultaneously support cockpit, intelligent driving, vehicle control and other systems. All vehicle functional domains however have not yet been fully connected, and globally there is no intelligent vehicle operating system that can be directly applied for a long time.

In the past several years, many automakers such as Toyota, Volkswagen, Mercedes-Benz, NIO, and Hongqi have enhanced their deployment in vehicle operating systems. Based on their technology R&D strength, product development requirements and relationships with suppliers, OEMs deploy vehicle OS in three modes: independent R&D, independent R&D + in-depth R&D cooperation, and direct outsourcing. At present, the vehicle OS layout mode is moving from independent R&D to independent R&D + in-depth R&D cooperation.

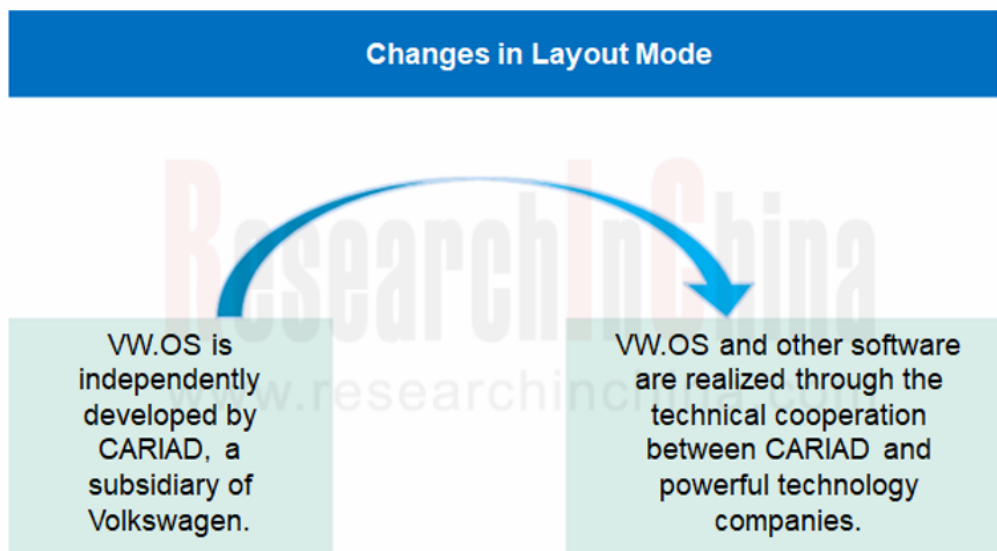
Given vehicle intelligence and the need for new automotive business models, in 2019 Volkswagen announced VW.OS, a vehicle operating system which was independently developed by its software company CARIAD. However, the progress has been slow due to multiple factors.

In the past two years, Volkswagen has been more open to cooperation, and completely changed the direction of "fully independent R&D". Outside the Chinese market, Volkswagen vigorously enhances cooperation on software and autonomous driving, and has partnered with Qualcomm, Bosch, Mobileye, Apple, Google and so on.

In Chinese market, Volkswagen has established joint ventures with Horizon Robotics and ThunderSoft to produce exclusive software products for China. In May 2023, CARIAD's supervisory board approved the company's comprehensive adjustment plan. In addition to large-scale personnel adjustment, it also highlights reforms, for example, closer technical cooperation with powerful technology companies, and new leadership and team models.

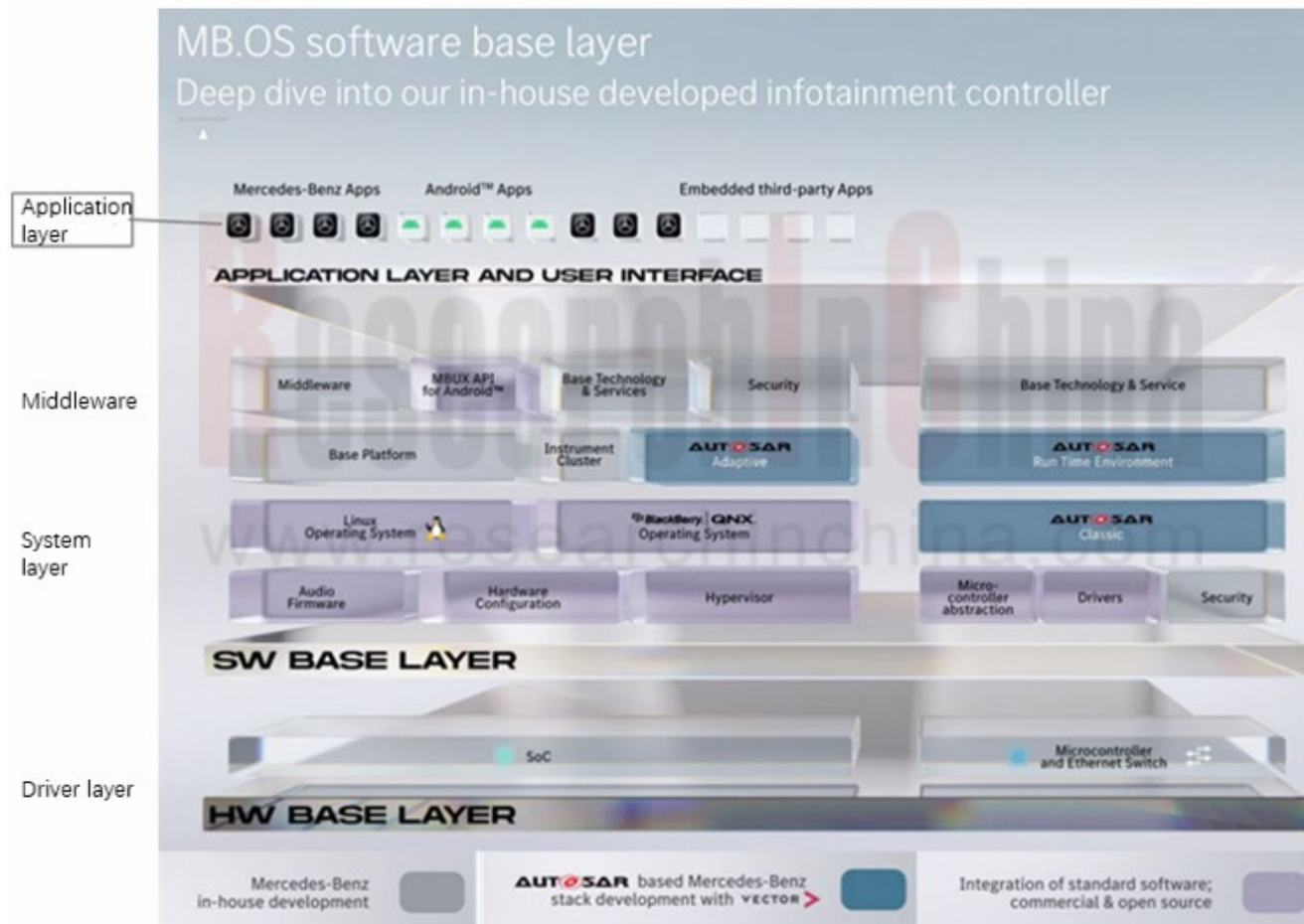
In February 2023, Mercedes-Benz detailed its plans as the architect of its own operating system MB.OS. Mercedes-Benz plans to adopt a layout mode of “independent R&D + R&D cooperation with suppliers”. It has three software development modes for MB.OS. In the figure below, the gray part indicates Mercedes-Benz’s in-house development of interior and data security software; the blue part means Mercedes-Benz’s development of AUTOSAR with its supplier Vector; the purple part refers to the computer underlying software and system for integration with third-party applications. MB.OS was expected to be officially launched on market in 2025.

## Changes in Volkswagen’s Software Layout Mode



Source: ResearchInChina

## MB.OS

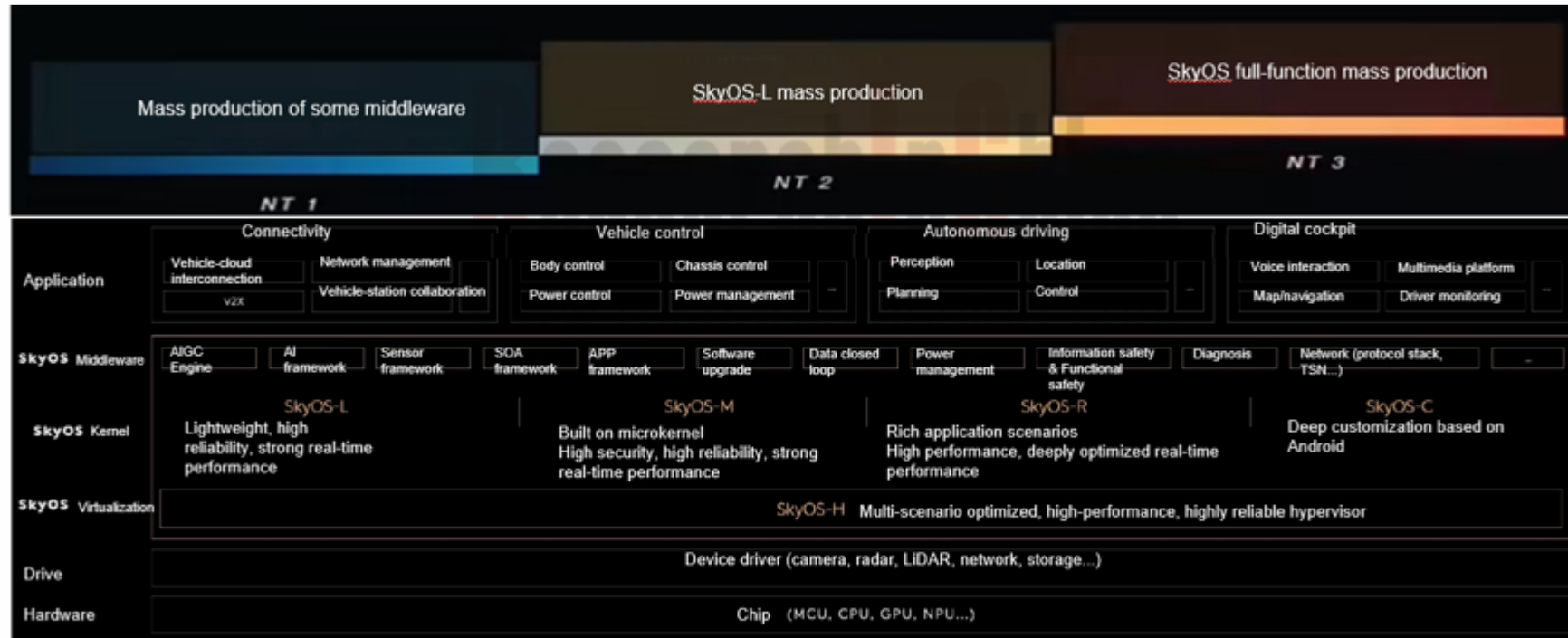


Source: Mercedes Benz

# NIO released SkyOS

In September 2023, NIO released SkyOS, a full-stack self-developed operating system for intelligent electric vehicles. As the underlying operating system, SkyOS establishes an all-round, three-dimensional technology system for vehicle R&D, allowing various devices to be organically integrated for efficient cooperation. SkyOS boasts a "1+4+N" technology cluster, covering multiple fields from vehicle control, intelligent driving and cockpit to mobile Internet. It has become a leading intelligent digital technology base in all aspects.

## NIO SkyOS



Source: NIO

# The pace of vehicle application and mass production of GPT quickens, especially in the human-computer interaction field

Facing the lucrative vehicle OS market, software providers have aggressively changed their strategies and introduced corresponding development products and solutions, such as ArcherMind's Fusion OS, KOTEL's KCar-OS and ETAS's end-to-end OS. To meet the customization demand from OEMs, software development teams of suppliers are ideal partners for customers, as they can cooperate with customers in research and development, and help customers develop products quickly to shorten the time to market.

In terms of business model, in the short term, in addition to licensing fees charged for software tools, vehicle OS will still mainly charge custom development fees. In the future, the profitability of OEMs will shift from only vehicle sales to application software and service upgrades. The business model between OEMs and vehicle OS providers is not just a one-off deal in current stage, and charging models such as SaaS, mass production sharing or open source subscription services may emerge.

## **The pace of vehicle application and mass production of GPT quickens, especially in the human-computer interaction field.**

Since its launch in November 2022, Chat GPT has gone viral around the world. Its excellent human-like dialogue learning capability and highly intelligent tool attributes cause a disruption to the information society. Because foundation models can be quickly integrated with the original knowledge system of the automotive industry to build more scenario-based modules, they have cutting-edge technical advantages in the fields of intelligent driving and intelligent cockpit.

The introduction of large AI models into vehicles has become a main trend this year. OEMs try hard to build large AI models in three ways:

**First**, they start from the underlying layer, and develop and build by themselves;

**Second**, they build the application layer on the underlying layer built by platform-level companies;

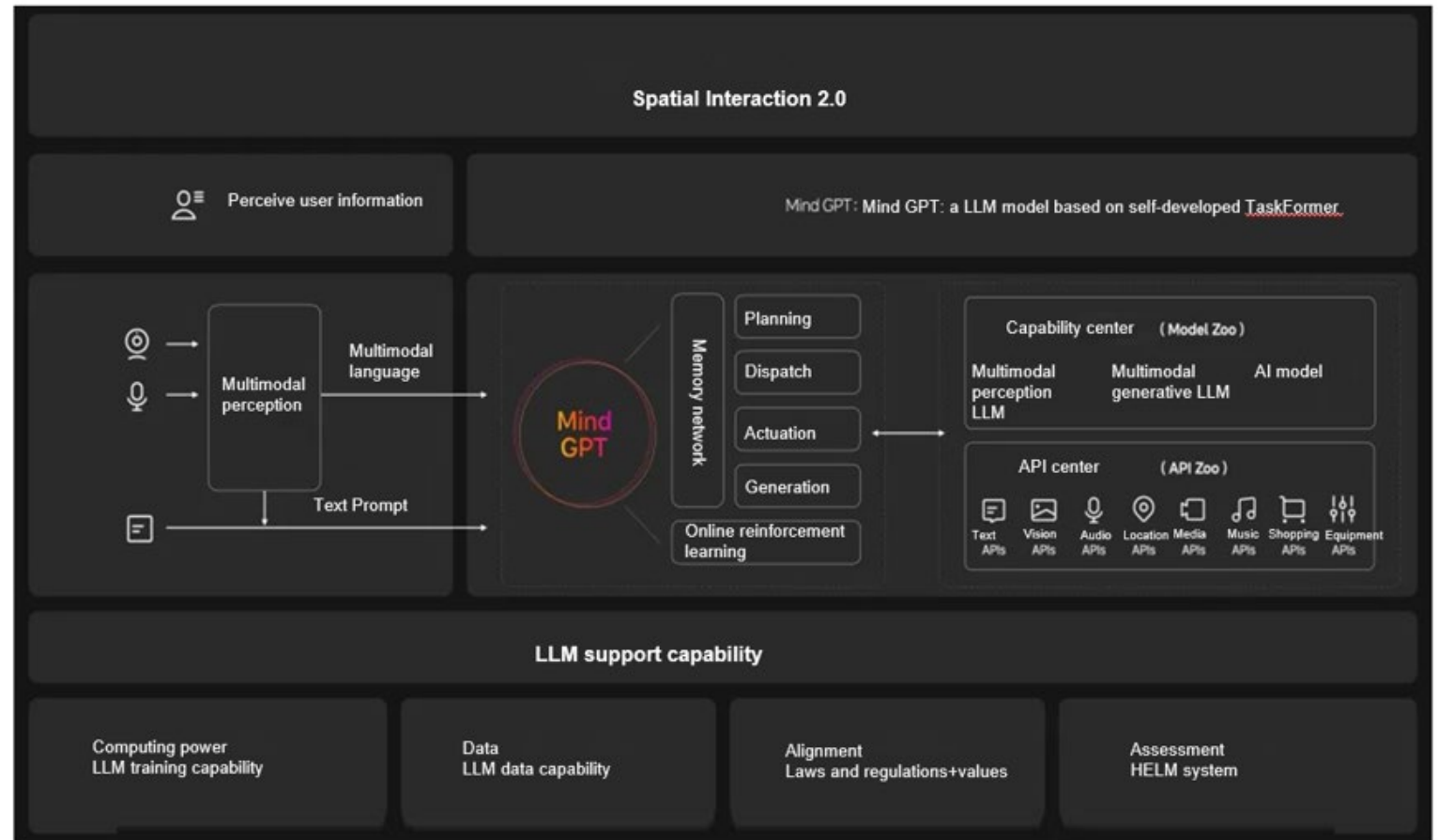
**Third**, they directly build in some foundation model.

# Li Auto's independent R&D model

**Li Auto's independent R&D model:** At the 2023 Li Auto Family Technology Day Conference, Li Auto released Mind GPT, its self-developed model which not only controls the car, but also performs functions such as storytelling, children's encyclopedia creation, trip planning, intelligent diagnosis, and complex task understanding. In the process of foundation model training, Li Auto finally chose to fully self-develop foundation models after considering solutions of many suppliers.

The spatial algorithm team of Li Auto builds a data platform and training platform based on foundation model training, and uses a "controller unit model" to connect external capabilities to make up for the model's deficiencies in some aspects. Starting from the bottom layer, the team builds up the whole structure of Mind GPT, applies the technology and capabilities to actual scenarios, and makes differentiated innovations through iteration, in a bid to continuously improve the product strength and competitiveness of Mind GPT.

## Li Auto's Self-developed Mind GPT Facilitates Spatial Interaction 2.0



Source: Li Auto



# Mercedes-Benz adopts ChatGPT direct supply mode

**Mercedes-Benz adopts ChatGPT direct supply mode:** In June 2023, Mercedes-Benz launched a three-month ChatGPT test program in the United States. Customers can participate via the Mercedes me App or directly from the vehicle using the voice command “Hey Mercedes, I want to join the beta program”, and then the MBUX Voice Assistant's Hey Mercedes will automatically connect to ChatGPT. Mercedes-Benz is integrating ChatGPT through Azure OpenAI Service, leveraging the enterprise-grade capabilities of Microsoft's cloud and AI platform. With ChatGPT in preview in Azure OpenAI Service, developers can integrate custom AI-powered experiences directly into their own applications.

Via Microsoft's Azure OpenAI Service customers can begin using ChatGPT today. It is priced at USD0.002/1,000 tokens and billing for all ChatGPT usage begins March 13, 2023.

## Foundation Model Applications such as ChatGPT Are Enabled via Azure OpenAI Service

The diagram illustrates the Azure OpenAI Service ecosystem. At the center, the text "Azure OpenAI Service" is displayed above four colored boxes representing different models: GPT-3 (blue), Codex (purple), DALL-E *preview* (green), and ChatGPT (yellow). To the right, five key features are listed, each with a corresponding icon: 1. A blue triangle icon for "Deployed within your Azure subscription, secured by you, accessed only by you, and tied to your datasets and applications". 2. A blue circular icon with a padlock for "Large, pretrained AI models to unlock new scenarios". 3. A blue icon of a document with a checkmark for "Custom AI models fine-tuned with your data and hyperparameters". 4. A blue icon of a person with a shield for "Built-in responsible AI to detect and mitigate harmful use". 5. A blue icon of a shield with a key for "Enterprise-grade security with role-based access control (RBAC) and private networks".

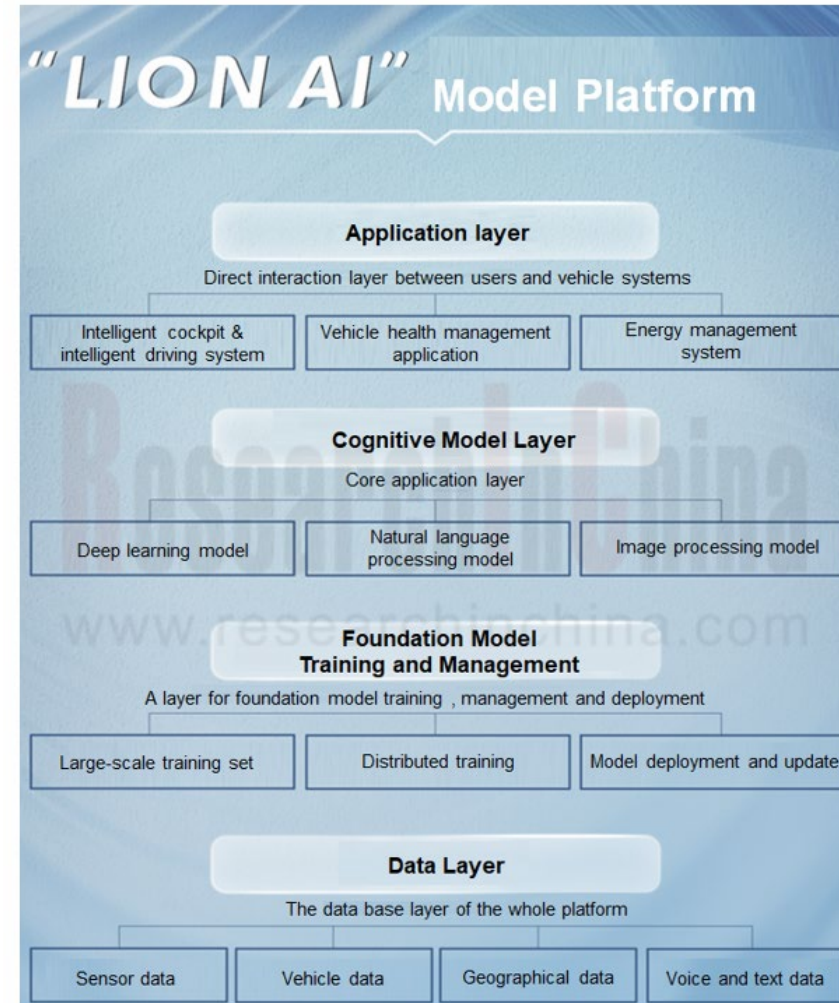
Source: Camlan

# iFlytek Spark landed on EXEED STERRA ES

**iFlytek Spark landed on EXEED STERRA ES, involving a joint development and custom model:** In August 2023, Chery released STERRA ES, the first model equipped with iFlytek Spark, a cognitive foundation model of iFlytek. Based on Chery's "LION AI" foundation model platform and iFlytek Spark, EXEED STERRA ES brings better cockpit interaction capabilities.

Chery and iFlytek give full play to the key benefits of the foundation model in an AI voice assistant through cross-border integration and deep link of technologies. Driven by 6 major technologies, including cross-business scenarios, deep semantic understanding, multi-round interaction, learning evolution, real-time update & loading and multiple styles, the foundation model solves the three major enduring problems for users in current human-computer interaction, namely, single conversation style, separation of chats and skills, and lack of cross-scenario business, and finally realizes five core application scenarios, becoming a vehicle function instructor, an empathic partner, a knowledge encyclopedia, a travel manager and a health consultant. The two parties cooperate to deeply integrate the functions of the foundation model, jointly develop and customize it, and quickly install it on vehicles.

## Chery LION AI LLM Platform

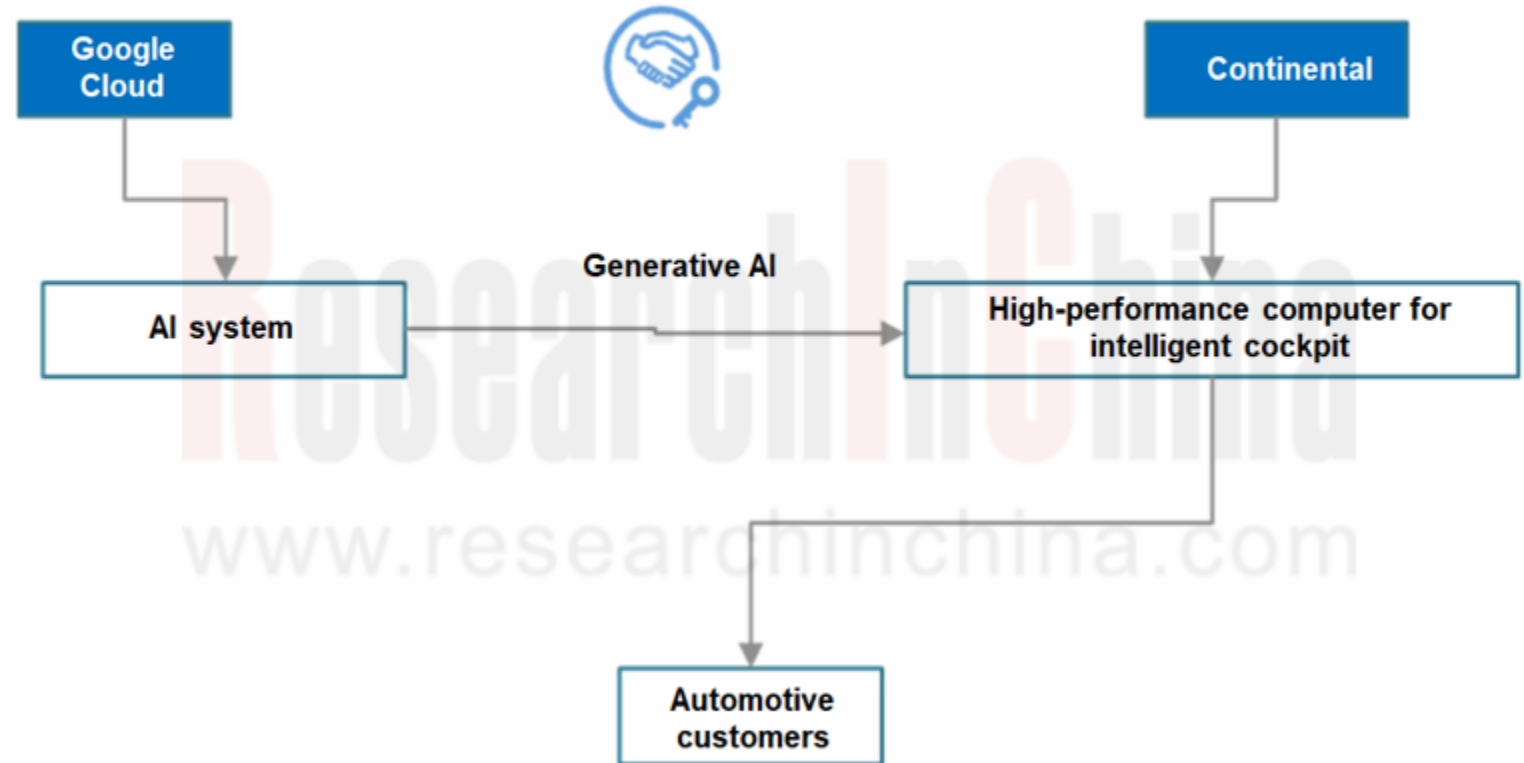


Source: Chery

# Continental announced a partnership with Google Cloud

Moreover as the application of large AI models in vehicles speeds up, suppliers also create the foundation model pre-integrated supply mode. For example, Continental announced a partnership with Google Cloud during its press conference at the IAA MOBILITY 2023. Together, the two companies are equipping cars with generative Artificial Intelligence (AI), and they expect a fast time to market – from order receipt to production and delivery in 18 months.

## Continental Cooperates with Google Cloud to Pre-integrate the Generative AI Model



Source: ResearchInChina

# Table of Content (1)

## **1 Analysis of Automotive Software Business Model and Trend**

- 1.1 Overview of Intelligent Vehicle Software Industry Chain
  - 1.1.1 Intelligent Vehicle Software Architecture
  - 1.1.2 Automotive Software Architecture Step Towards "Service-Oriented (SOA)" From "Signal-Oriented"
  - 1.1.3 Transformation of Automobile Software Development Mode of OEMs
  - 1.1.4 Types of Intelligent Vehicle Software
  - 1.1.5 Automotive Software Supplier Categories
  - 1.1.6 Software Empowers Automakers to Realize Value
- 1.2 Summary of Business Models of Intelligent Vehicle Software Related Suppliers
  - 1.2.1 Main Business Types of Software Suppliers
  - 1.2.2 Main Charging Models of Software Suppliers
  - 1.2.3 Single Vehicle Software License Fee of Some Software Modules for Intelligent Vehicles
  - 1.2.4 Automotive Software Sales Model
  - 1.2.5 Summary of Business Models of Major Automotive Software Suppliers by Product (1)
  - 1.2.6 Summary of Business Models of Major Automotive Software Suppliers by Product (2)
  - 1.2.7 Summary of Business Models of Major Automotive Software Suppliers by Product (3)
  - 1.2.8 Summary of Business Models of Major Automotive Software Suppliers by Product (4)
  - 1.2.9 Summary of Business Models of Major Automotive Software Suppliers by Product (5)
  - 1.2.10 Business Models of Major Automotive Software Products
  - 1.2.11 Business Models of Major Automotive Software Suppliers
  - 1.2.12 Evolution Trend of Role of Software Suppliers under SVD Trend

- 1.2.13 Software Development Strategies of OEMs
- 1.2.14 Software Value Realization Solution of Suppliers
- 1.2.15 Evolution Trend of Value Realization Mode of Intelligent Vehicle Software
- 1.2.16 Proportion of Value Realization Mode of Intelligent Vehicle Software
- 1.3 Development Trend of Smart Vehicle Software Business Model
  - 1.3.1 Change of Role of Software Suppliers under SVD Trend
  - 1.3.2 Automotive Software Market Size
  - 1.3.3 Ecological Trend of Flattening and Joint Development of Automotive Supply
  - 1.3.4 Software Suppliers Ecological Cooperation, Deep Binding with Upstream Partners
  - 1.3.5 Exploration of Software Suppliers Cooperation Model
  - 1.3.6 Charging Strategy of Software Suppliers
  - 1.3.7 Exploration of Charging Model of Software Suppliers (1)
  - 1.3.8 Exploration of Charging Model of Software Suppliers (2)
  - 1.3.9 Exploration of Future Development Trends and Business Models of Automotive Software Product (1)
  - 1.3.10 Exploration of Future Development Trends and Business Models of Automotive Software Product (2)

## **2. Analysis on OEMs' Response to Software Innovation Strategy**

- 2.1 OEMs' Response to Software Innovation Strategy
  - 2.1.1 OEMs' Software Innovation Layout Strategy (1)
  - 2.1.2 OEMs' Software Innovation Layout Strategy (2)
  - 2.1.3 OEMs' Software Innovation Layout Strategy (3)
  - 2.1.4 OEMs' Software Innovation Layout Strategy (4)
  - 2.1.5 OEMs' Software Innovation Layout Strategy (5)
  - 2.1.6 OEMs' Software Innovation Layout Strategy (6)
  - 2.1.7 OEMs' Software Innovation Layout Strategy (7)



# Table of Content (2)

- 2.1.8 OEMs' Software Innovation Layout Strategy (8)
- 2.1.9 OEMs' Software Innovation Layout Strategy (9)
- 2.1.10 OEMs' Software Innovation Layout Strategy (10)
- 2.1.11 OEMs' Software Innovation Layout Strategy (11)
- 2.1.12 OEMs' Software Innovation Layout Strategy (12)

## 2.2 Mercedes-Benz

- 2.2.1 Mercedes-Benz Software Business Layout
- 2.2.2 Mercedes-Benz Software Business Unit
- 2.2.3 Localized Software Business Layout in China
- 2.2.4 Software Layout Strategy
- 2.2.5 Mercedes-Benz Software Level Partners

## 2.3 BMW

- 2.3.1 BMW Software Business Layout (1)
- 2.3.2 BMW Software Business Layout (2)
- 2.3.3 Localized Software Business Layout in China (1)
- 2.3.4 Localized Software Business Layout in China (2)

## 2.4 VW

- 2.4.1 Software Platform Planning
- 2.4.2 Volkswagen Software Business Team Building
- 2.4.3 Organizational Structure Adjustment of Software Department and Software Talent Strategy
- 2.4.4 Software Team Layout in China
- 2.4.5 Software Platform System Planning of Chinese Team
- 2.4.6 Global Partners

## 2.5 Ford

- 2.5.1 Ford Software Business Layout
- 2.5.2 Ford Software Business Team (1)
- 2.5.3 Ford Software Business Team (2)
- 2.5.4 Software Business Layout Strategy

## 2.6 SAIC Motor Group

- 2.6.1 SAIC Software Business Layout
- 2.6.2 SAIC Software Business Layout Strategy (1)
- 2.6.3 SAIC Software Business Layout Strategy (2)
- 2.6.4 SAIC Software Business Layout Strategy (3)
- 2.6.5 SAIC Software Business Layout Strategy (4)

## 2.7 Great Wall Motors

- 2.7.1 Intelligent Business Layout
- 2.7.2 Forest Ecosystem Map
- 2.7.3 Software Team Building
- 2.7.4 Software Layout Strategy (1)
- 2.7.5 Software Layout Strategy (2)
- 2.7.6 Software Cooperation Ecosystem

## 2.8 Geely Automobile

- 2.8.1 Software Business Layout
- 2.8.2 Software Business Layout Strategy
- 2.8.3 Software Business Layout Planning

## 2.9 Changan Automobile

- 2.9.1 Software Business Layout

# Table of Content (3)

- 2.9.2 Software Business Planning
- 2.9.3 Software Business Team Construction (1)
- 2.9.4 Software Business Team Construction (2)

- 2.10 XPeng Motors
- 2.10.1 Software Business Layout
- 2.10.2 Software Business Strategy
- 2.10.3 R&D Center Distribution
- 2.10.4 Organization Structure
- 2.10.5 AI-oriented Transformation
- 2.10.6 Organizational reconstruction

## **3. Analysis on Automotive Operating System (OS) Innovation Requirements and Layout Model**

- 3.1 Development Status Quo and Trend of Automotive OS Business Mode
  - 3.1.1 Types of Automotive OS
  - 3.1.2 OS in Narrow Sense and Generalized Sense Coexist
  - 3.1.3 Types of Automotive OS Business Mode
  - 3.1.4 Business Model of Each Module of Automotive OS in Generalized Sense
  - 3.1.5 Business Model of Major Automotive OS Enterprises
  - 3.1.6 Business Model of Smart Cockpit OS
  - 3.1.7 Business Model of Autonomous Driving OS Suppliers
  - 3.1.8 Automotive OS Development Trend and Business Model Exploration
- 3.2 Exploration of OEM OS Innovation Requirements and Layout Mode: Vehicle OS
  - 3.2.1 OS Demand Changes under EEA Evolution
  - 3.2.2 Automotive OS Requirements Step Towards Vehicle OS
  - 3.2.3 Vehicle OS

- 3.2.4 Vehicle OS Architecture
- 3.2.5 Vehicle OS Purpose
- 3.2.6 Core Software Layer of Vehicle OS
- 3.2.7 Evolution of Vehicle OS Development Model
- 3.2.8 Main Layout Mode of OEM Vehicle OS
- 3.2.9 Main Limiting Factors of OEMs Self-developed Vehicle OS
- 3.2.10 Typical Case of OEM OS Layout (1)
- 3.2.11 Typical Case of OEM OS Layout (2)
- 3.2.12 Typical Case of OEM OS Layout (3)
- 3.2.13 Typical Case of OEM OS Layout (4)
- 3.2.14 Typical Case of OEM OS Layout (5)
- 3.2.15 Typical Case of OEM OS Layout (6)
- 3.2.16 Typical Case of OEM OS Layout (7)
- 3.2.17 Typical Case of OEM OS Layout (8)
- 3.2.18 Selection Strategy of Basic Software Module such as Underlying OS When Building Vehicle OS
- 3.2.19 Market Opportunities of Vehicle OS of Suppliers
- 3.2.20 Role Evolution of Automotive OS Software Vendors
- 3.2.21 Evolution of Business Model under Vehicle OS Trend
- 3.2.22 Automotive OS Market Development Trends in 2023 (1)
- 3.2.23 Automotive OS Market Development Trends in 2023 (2)
- 3.2.24 Vehicle OS Layout Case of Suppliers (1)
- 3.2.25 Vehicle OS Layout Case of Suppliers (2)
- 3.2.26 Vehicle OS Layout Case of Suppliers (3)
- 3.2.27 Vehicle OS Layout Case of Suppliers (4)
- 3.2.28 Vehicle OS Layout Case of Suppliers (5)
- 3.2.29 Vehicle OS Layout Case of Suppliers (6)
- 3.2.30 Vehicle OS Layout Case of Suppliers (7)
- 3.2.31 Vehicle OS Layout Case of Suppliers (8)

# Table of Content (4)

- 3.2.32 Vehicle OS Layout Case of Suppliers (9)
- 3.2.33 Vehicle OS Layout Case of Suppliers (10)
- 3.2.34 Vehicle OS Layout Case of Suppliers (11)
- 3.2.35 Vehicle OS Layout Case of Suppliers (12)
- 3.2.36 Vehicle OS Layout Case of Suppliers (13)
- 3.2.37 Vehicle OS Layout Case of Suppliers (14)

## 3.3 Major Automotive OS Suppliers and Business Model

- 3.3.1 Basic Automotive OS and Business Model
- 3.3.2 Automotive RTOS and Business Model (1)
- 3.3.3 Automotive RTOS and Business Model (2)
- 3.3.4 Automotive OS and Business Model (1)
- 3.3.5 Automotive OS and Business Model (2)
- 3.3.6 Automotive OS and Business Model (3)
- 3.3.7 Automotive OS and Business Model (4)

## 4. Analysis on Automotive Intelligent Cockpit Innovation Requirements and Layout Model

- 4.1 Business Model and Trend of Intelligent Cockpit Software System
  - 4.1.1 Development and Evolution Trend of Intelligent Cockpit System
  - 4.1.2 Four Supply Modes of Intelligent Cockpit System
  - 4.1.3 Intelligent Cockpit Software Platform Suppliers and Business Models (1)
  - 4.1.4 Intelligent Cockpit Software Platform Suppliers and Business Models (2)
  - 4.1.5 Intelligent Cockpit Software Platform Suppliers and Business Models (3)
  - 4.1.6 Automotive Cockpit Application Software Layer Industry Chain
  - 4.1.7 Business Model of Main Cockpit Application Software Module
  - 4.1.8 Business Model Trends of Main Cockpit Application Software Module

- 4.2 Innovation Requirements and Layout Model of OEM Cockpit Software (1)
  - 4.2.1 OEMs Actively Promote Chat GPT and Other AI Large Model Platforms to Get on Smart Cockpit
  - 4.2.2 Application Field of AI Large Model in Automotive
  - 4.2.3 Layout and Business model of GPT Large Model of Major Suppliers (1): Generative AI Large Model
  - 4.2.4 Layout and Business model of GPT Large Model of Major Suppliers (2): Generative AI Large Model
  - 4.2.5 Layout and Business model of GPT Large Model of Major Suppliers (3): Generative AI Large Model
  - 4.2.6 Business Model Exploration of AI Large Model
  - 4.2.7 Layout Model of AI Large Model of OEMs
  - 4.2.8 Typical Case of Layout Model of AI Large Model in Automotive (1)
  - 4.2.9 Typical Case of Layout Model of AI Large Model in Automotive (2)
  - 4.2.10 Typical Case of Layout Model of AI Large Model in Automotive (3)
  - 4.2.11 Typical Case of Layout Model of AI Large Model in Automotive (4)
  - 4.2.12 Typical Case of Layout Model of AI Large Model in Automotive (5)
  - 4.2.13 Typical Case of Layout Model of AI Large Model in Automotive (6)
  - 4.2.14 Typical Case of Layout Model of AI Large Model in Automotive (7)
  - 4.2.15 Typical Case of Layout Model of AI Large Model in Automotive (8)
- 4.3 Innovation Requirements and Layout Model of OEM Cockpit Software (2)
  - 4.3.1 More and More Automakers Apply 3D Engines to Intelligent Cockpit
  - 4.3.2 Layout and Business Model of Automotive 3D Engine Application in Intelligent Cockpit
  - 4.3.3 Typical Case of Layout Model of 3D Engine Application in Intelligent Cockpit (1)
  - 4.3.4 Typical Case of Layout Model of 3D Engine Application in Intelligent Cockpit (2)
  - 4.3.5 Typical Case of Layout Model of 3D Engine Application in Intelligent Cockpit (3)

# Table of Content (5)

- 4.3.6 Typical Case of Layout Model of 3D Engine Application in Intelligent Cockpit (4)
- 4.3.7 Typical Case of Layout Model of 3D Engine Application in Intelligent Cockpit (5)
- 4.3.8 Typical Case of Layout Model of 3D Engine Application in Intelligent Cockpit (6)
- 4.3.9 Typical Case of Layout Model of 3D Engine Application in Intelligent Cockpit (7)
- 4.3.10 Typical Case of Layout Model of 3D Engine Application in Intelligent Cockpit (8)
- 4.3.11 Typical Case of Layout Model of 3D Engine Application in Intelligent Cockpit (9)
- 4.3.12 Typical Case of Layout Model of 3D Engine Application in Intelligent Cockpit (10)
- 4.3.13 Typical Case of Layout Model of 3D Engine Application in Intelligent Cockpit (11)
- 4.3.14 Game Engine Business Model
- 4.3.15 Automotive HMI Software Business Model
- 4.3.16 Latest Products and Business Models of Major HMI Design Software Suppliers (1)
- 4.3.17 Latest Products and Business Models of Major HMI Design Software Suppliers (2)
- 4.3.18 Latest Products and Business Models of Major HMI Design Software Suppliers (3)
- 4.3.19 Latest Products and Business Models of Major HMI Design Software Suppliers (4)
- 4.3.20 Latest Products and Business Models of Major HMI Design Software Suppliers (5)
  
- 4.4 Innovation Requirements and Layout Model of OEM Cockpit Software (3)
  - 4.4.1 Deep Integration of Head Unit and Mobile Phone
  - 4.4.2 Barriers of Head Unit and Mobile Phone Integration
  - 4.4.3 Direction of Deep Integration of Head Unit and Mobile Phone (1)
  - 4.4.4 Direction of Deep Integration of Head Unit and Mobile Phone (2)
  - 4.4.5 Direction of Deep Integration of Head Unit and Mobile Phone (3)
  - 4.4.6 Direction of Deep Integration of Head Unit and Mobile Phone (4)
  - 4.4.7 Direction of Deep Integration of Head Unit and Mobile Phone (5)
  - 4.4.8 Direction of Deep Integration of Head Unit and Mobile Phone (6)
  - 4.4.9 OEMs' Layout in Deep Integration of Head Unit and Mobile Phone (1)
  - 4.4.10 OEMs' Layout in Deep Integration of Head Unit and Mobile Phone (2)
  - 4.4.11 OEMs' Layout in Deep Integration of Head Unit and Mobile Phone (3)
  - 4.4.12 OEMs' Layout in Deep Integration of Head Unit and Mobile Phone (4)
  - 4.4.13 OEMs' Layout in Deep Integration of Head Unit and Mobile Phone (5)
  - 4.4.14 OEMs' Layout in Deep Integration of Head Unit and Mobile Phone (6)
  - 4.4.15 Exploration of Business Model of Deep Integration of Head Unit and Mobile Phone
  - 4.4.16 Typical Case of Deep Integration of Head Unit and Mobile Phone (1)
  - 4.4.17 Typical Case of Deep Integration of Head Unit and Mobile Phone (2)
  - 4.4.18 Typical Case of Deep Integration of Head Unit and Mobile Phone (3)
  - 4.4.19 Typical Case of Deep Integration of Head Unit and Mobile Phone (4)
  - 4.4.20 Typical Case of Deep Integration of Head Unit and Mobile Phone (5)
  
- 4.5 Innovation Requirements and Layout Model of OEM Cockpit Software (4)
  - 4.5.1 New Requirement of Automotive Acoustics
  - 4.5.2 Status Quo of Acoustic Software Business Models
  - 4.5.3 Summary of Acoustic Software Vendors Business Model
  - 4.5.4 Evolution of Acoustic Software Procurement Model of Automakers
  - 4.5.5 Exploration of Acoustic Software Business Model
  - 4.5.6 Acoustic Software Vendors Business Model (1)
  - 4.5.7 Acoustic Software Vendors Business Model (2)
  - 4.5.8 Acoustic Software Vendors Business Model (3)



# Table of Content (6)

4.5.9 Acoustic Technology Layout and Business Models of Major Suppliers

4.5.10 Typical Case (1)

4.5.11 Typical Case (2)

4.5.12 Typical Case (3)

4.5.13 Typical Case (4)

4.5.14 Typical Case (5)

4.6 Innovation Requirements and Layout Model of OEM Cockpit Software (5)

4.6.1 AR-HUD Becomes a Hot Spot

4.6.2 Core Technology of AR HUD Industry

4.6.3 Main Direction of AR-HUD Software Upgrade

4.6.4 AR Creator becomes the core element of AR-HUD, software capabilities are particularly important

4.6.5 AR Creator integrated Head Unit System

4.6.6 Supply Mode of AR HUD Software (1)

4.6.7 Supply Mode of AR HUD Software (2)

4.6.8 Business Models of AR HUD Software Suppliers (1)

4.6.9 Business Models of AR HUD Software Suppliers (2)

4.6.10 Business Models of AR HUD Software Suppliers (3)

4.6.11 Typical Case (1)

4.6.12 Typical Case (2)

4.6.13 Typical Case (3)

4.7 Innovation Requirements and Layout Model of OEM Cockpit Software (6)

4.7.1 Advanced Evolution of HMI Driven by New technologies such as AI Large Model

4.7.2 Multimodal Interactive Software Supply Trend: Shift from Single Module to Integrated Supply

4.7.3 Product Layout Strategy of HMI Suppliers (1)

4.7.4 Product Layout Strategy of HMI Suppliers (2)

4.7.5 Product Layout Strategy of HMI Suppliers (3)

4.7.6 Multimodal Fusion Interactive Layout (1)

4.7.7 Multimodal Fusion Interactive Layout (2):

4.7.8 Multimodal Fusion Interactive Software Suppliers and Business Models (1)

4.7.9 Multimodal Fusion Interactive Software Suppliers and Business Models (2)

4.7.10 Multimodal Fusion Interactive Software Suppliers and Business Models (3)

4.7.11 Voice Software Suppliers and Business Models (1)

4.7.12 Voice Software Suppliers and Business Models (2)

4.7.13 Voice Software Suppliers and Business Models (3)

4.7.14 Voice Software Suppliers and Business Models (4)

4.7.15 DMS Visual Perception Algorithm Suppliers and Business Models (1)

4.7.16 DMS Visual Perception Algorithm Suppliers and Business Models (2)

4.7.17 DMS Visual Perception Algorithm Vendors and Business Models (3)

## 5. Analysis on Autonomous Driving Innovation Requirements and Layout Model

5.1 Business Model and Trend of Autonomous Driving System Software

5.1.1 Autonomous Driving Supply Chain Model

5.1.2 Layout of OEM Autonomous Driving: Cooperation + Establishment of Subsidiaries + Self-research (1)

5.1.3 Layout of OEM Autonomous Driving: Cooperation + Establishment of Subsidiaries + Self-research (2)

5.1.4 Autonomous Driving Business Model

5.1.5 OEMs' Ecological Layout of Autonomous Driving Software

5.1.6 Autonomous Driving Commercial Landing Scenarios and Autonomous Driving Enterprise Business Models

5.1.7 Autonomous Robotaxi Business Model Exploration

5.1.8 Autonomous Driving Software Layer Industry Chain

5.1.9 Business Model of Autonomous Driving Corresponding Software Module

5.1.10 Autonomous Driving System Suppliers and Business Models (1)

# Table of Content (7)

- 5.1.11 Autonomous Driving System Suppliers and Business Models (2)
- 5.1.12 Autonomous Driving System Suppliers and Business Models (3)
- 5.1.13 Autonomous Driving System Suppliers and Business Models (4)
- 5.1.14 Autonomous Driving System Suppliers and Business Models (5)
- 5.1.15 Business Model of ADAS System aftermarket Suppliers

## 5.2 Innovation Requirements and Layout Model of OEM Autonomous Driving Software (1)

- 5.2.1 Accelerated Installation Realization of NOA Function
- 5.2.2 OEMs NOA Layout (1)
- 5.2.3 OEMs NOA Layout (2)
- 5.2.4 OEM NOA Layout Case (1)
- 5.2.5 OEM NOA Layout Case (2)
- 5.2.6 OEM NOA Layout Case (3)
- 5.2.7 OEM Urban NOA Charging Model
- 5.2.8 NOA Supplier Competition
- 5.2.9 Supply Strategies of Major NOA Suppliers (1)
- 5.2.10 Supply Strategies of Major NOA Suppliers (2)
- 5.2.11 Trend of "Off Map" NOA
- 5.2.12 Layout of NOA without HD Map
- 5.2.13 Supply Strategies of Major NOA Suppliers (3)

## 5.3 Innovation Requirements and Layout Model of OEM Autonomous Driving Software (2)

- 5.3.1 AI Large Model fully Empowers Autonomous Driving (1)
- 5.3.2 AI Large Model fully Empowers Autonomous Driving (2)
- 5.3.3 Intelligent Driving Car Equipped with AI Large Model
- 5.3.4 AI Model to Promote Profitable Development of OEM Software

- 5.3.5 GPT Large Model and Business Model of Major Suppliers (1)
- 5.3.6 GPT Large Model and Business Model of Major Suppliers (2)
- 5.3.7 GPT Large Model and Business Model of Major Suppliers (3)
- 5.3.8 Layout of OEM GPT Large Model

- 5.3.9 Typical Case (1)
- 5.3.10 Typical Case (2)
- 5.3.11 Typical Case (3)
- 5.3.12 Typical Case (4)

## 5.4 Innovation Requirements and Layout Model of OEM Autonomous Driving Software (3)

- 5.4.1 Current Mainstream Autonomous Driving Algorithm is a Modular Architecture
- 5.4.2 Types of Autonomous Driving Algorithm Suppliers
- 5.4.3 Supply Mode of Autonomous Driving Algorithm
- 5.4.4 Software 2.0 Drives Autonomous Driving Algorithms to Evolve End-to-End
- 5.4.5 End-to-end Autonomous Driving Algorithm becomes Long-term Consensus
- 5.4.6 Development Roadmap of End-to-end Autonomous Driving Model
- 5.4.7 End-to-end Autonomous Driving Model Layout (1)
- 5.4.8 End-to-end Autonomous Driving Model Layout (2)
- 5.4.9 Suppliers' Layout of End-to-end Autonomous Driving Algorithm (1)
- 5.4.10 Suppliers' Layout of End-to-end Autonomous Driving Algorithm (2)
- 5.4.11 BEV + Transformer Delivers High-quality Perception Data to End-to-end
- 5.4.12 OEMs BEV + Transformer Applications
- 5.4.13 Tesla's self-developed End-to-end Autonomous Driving Model

## 6. Analysis on Automotive Cloud Platform Innovation Requirements and Layout Model

- 6.1 Business Model and Trend of Cloud Platform Layer Software
  - 6.1.1 Business Model of Corresponding Modules of Cloud Platform Layer
  - 6.1.2 vehicle to everything business model

# Table of Content (8)

- 6.1.3 V2X payment model exploration
- 6.1.4 Cloud Platform Service Provider and OEM Cooperation Model
- 6.1.5 Cloud Platform Service Forms and Charging Models
- 6.1.6 Service Form of Main Cloud Platform Providers
- 6.1.7 Development Trend of Automotive Cloud Service
- 6.1.8 Three Development Directions of Automotive Cloud Service Requirements
- 6.1.9 Five Features of Automotive Cloud Service Requirements
- 6.1.10 Key Decisions of OEMs to Procure Cloud Service
- 6.1.11 Cloud Application of OEMs
- 6.1.12 Automotive Cloud Business Model
- 6.1.13 Cloud Layout Strategy
- 6.1.14 Development Trend of Vehicle Cloud Integration
- 6.1.15 Cloud Service Business Model for Future Vehicles
  
- 6.2 Innovation Requirements and Layout Model of OEM Cloud Related Software (1)
  - 6.2.1 Cloud Native Development Course
  - 6.2.2 Application of Cloud Native Architecture Gradually Realize Concept of Cloud Empowering Car and Car Serving People
  - 6.2.3 Cloud Native Technology Development
  - 6.2.4 Combination of Data Lake and Cloud Native has become a hot spot for Cloud Platform Enterprises to Explore
  - 6.2.5 Cloud Native Technology Business Model
  - 6.2.6 OEMs Cloud Native Layout
  - 6.2.7 OEM Cloud Native Layout Case (1)
  - 6.2.8 OEMs Cloud Native Layout Cases (2)
  - 6.2.9 OEMs Cloud Native Layout Cases (3)
  - 6.2.10 OEMs Cloud Native Layout Cases (4)
  - 6.2.11 Cloud Native Supply Strategy
  
- 6.2.12 Cloud Native Product Case (1)
- 6.2.13 Cloud Native Product Case (2)
- 6.2.14 Cloud Native Product Case (3)
  
- 6.3 Innovation Requirements and Layout Model of OEM Cloud Related Software (2)
  - 6.3.1 OTA Industry Chain
  - 6.3.2 OTA Business Model
  - 6.3.3 OTA Operating Business Model
  - 6.3.4 Evolution Trend of OTA Technology Complying with Intelligent Vehicle Development
  - 6.3.5 OTA Supplier Supply Strategy (1)
  - 6.3.6 OTA Supplier Supply Strategy (2)
  - 6.3.7 OTA-related Suppliers Business Model (1)
  - 6.3.8 OTA-related Suppliers Business Model (2)
  - 6.3.9 OTA-related Suppliers Business Model (3)



## Beijing Headquarters

TEL: 13718845418

Email: [report@researchinchina.com](mailto:report@researchinchina.com)



## Chengdu Branch

TEL: 028-68738514

FAX: 028-86930659

Website: [ResearchInChina](http://ResearchInChina.com)

WeChat: Zuosiqiche

