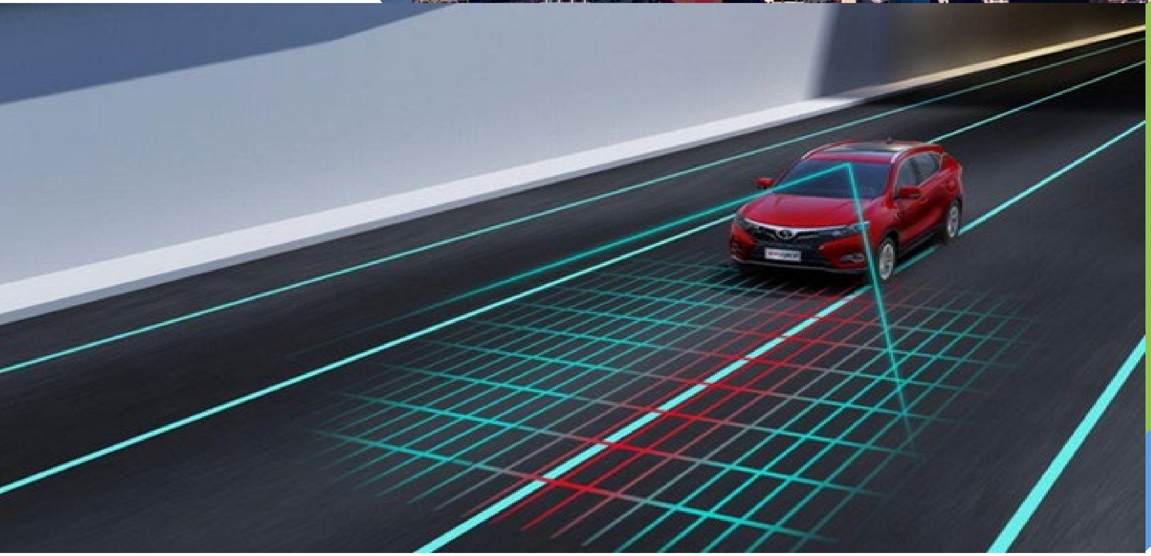


ResearchInChina
www.researchinchina.com

Automotive Domain Control Unit (DCU) Industry Report, 2021

June 2021

Abstract

Domain Controller Research: Four Types of Players in Autonomous Driving Domain Controllers and Three Types of Players in Cockpit Domain Controllers

In the next 2-3 years, OEMs will focus on upgrading EEA to accelerate the introduction of domain controllers

The EEA upgrade will be the focus in the next 2-3 years, which will accelerate the introduction of domain controllers. The automotive EEA upgrade is mainly reflected in three aspects: software architecture, hardware architecture, and communication architecture. Software architecture will gradually realize hierarchical decoupling, hardware will develop from distributed style to Domain controller/centralized style, and automotive network backbone will develop from LIN/CAN bus to Ethernet.

It is expected that most OEMs will still use mixed-domain EEA, that is, part of functional domains will be centralized to form a transition solution of "distributed ECU + domain controllers" and finally forge an architecture of "super controller (central supercomputer) + zonal control Unit (zone controller)". This EEA evolution may take up to 5-10 years.

From the perspective of OEM planning, autonomous driving domain, smart cockpit domain, and central control domain may become three main incremental domains.

EEA and Domain Controller Layout of Some OEMs

OEMs	EEA	Representative models
NIO	"Distributed ECU + smart driving/smart cockpit domain" will further decouple the software and hardware of the vehicle in the future. Software will be completed by OEMs as much as possible, and suitable hardware partners will be found according to functions.	NIO ES6, ES8, EC6, ET7
Xpeng	Intelligent electric SEPA platform architecture; a new generation of EEA, 100% networked controllers based on SEPA platform architecture, independent R&D of the next generation of XPU autonomous driving domain controllers, intelligent control integration of driving and parking	Xpeng P7, Xpeng G3
Lixiang	Like Tesla, Lixiang builds a real-time operating system based on the Linux kernel. After mastering the underlying real-time operating system, it lays the foundation for the subsequent iteration of the underlying vehicle EEA and the upper firmware, which is also the foundation of the future software-defined smart electric vehicles.	Lixiang ONE
Neta	Centralized domain architecture and the new architecture will be based on Ethernet. There are four domain controllers: smart cockpit domain controllers, autonomous driving domain controllers, power domain controllers and AI domain controllers.	Neta U
ZEEKR	SEA and centralized electronic architecture (GEEA2.0): "IVI, air conditioning, seats, etc." domain, sports and energy (chassis, power, etc.) domain, and autonomous driving domain which are controlled by their respective high computing power ECU. Core chips and components will be independently developed	ZEEKR ZERO
Dongfeng Voyah	ESSA Smart Electric Architecture: equipped with a central computing platform and SOA, it supports 5G technology and vehicle OTA. Dongfeng SOA will be mass-produced on Voyah's third model by the end of 2022	Voyah FREE
Toyota	TNGA adopts the combination of central concentration + domain controllers (the whole vehicle is symmetrically divided into multiple zones according to the physical space), which is a typical Zonal-EEA, whose hardware is integrated with ECU to reduce costs and software is based on Adaptive AUTOSAR and Classic AUTOSAR's SOA for convenient software iteration and functional scalability.	--
Great Wall Motor	Coffee Intelligence, V3.5 platform and V4.0 EEA: 5G+ audiovisual domain, driver assistance domain, new energy domain, body domain, and driving control domain. Future upgrade to the growable Zonal EEA with the fourth-generation central computing unit as the core	Great Wall WEY Mocha, etc.

Source: ResearchInChina

Abstract

The competitive landscape among four types of players in autonomous driving domain controllers

With the evolution of automotive EEA from distributed domain to centralized domain, the relationship between automakers and automotive electronics suppliers is undergoing profound changes. The number of automotive electronics suppliers will gradually decrease, while the status of domain controller suppliers will become more important and attract more entrants.

We divide autonomous driving domain controller players into four categories: Global Tier1 suppliers (system integrators), Local Tier1 suppliers (system integrators), autonomous driving domain controller software platform vendors, and OEMs.

Competitive Landscape of Autonomous Driving Domain Controllers (Some Players)

Source: ResearchInChina

Abstract

1.OEMs

In the long run, the number of ECUs in the centralized EEA will decrease and the functions will be weakened. The dominance may be transferred from suppliers to OEMs. For example, the EEA of Tesla's self-developed central computer CCM + zonal body controller is at least 5 years ahead of traditional OEMs. Domestic start-ups, such as NIO, Xpeng, WM Motor, Lixiang, SAIC IM, etc., have developed or will develop autonomous driving domain controllers in order to master the autonomy of the underlying hardware of software-defined cars and achieve more powerful OTA upgrades.

Xpeng plans to self-develop XPU autonomous driving intelligent control unit to break the interaction barriers between the previous four domains, achieve deeper domain integration, and integrate the intelligent control of driving and parking.

Although more and more leading automakers have their own software R&D teams to independently develop domain controller hardware and corresponding software, it is almost impossible for them to research all by themselves. They will still rely on suppliers in terms of hardware design and manufacturing, and more standardized "middleware"; especially from a single domain to cross-domain (body domain, cockpit domain, autonomous driving domain), the complexity has increased exponentially, and the importance of cross-domain (multi-domain integration) high-performance computing software platforms will become more prominent, and the value of domain controller software platforms of Enjoy Move Technology, Neusoft Reach and TTTech will gradually appear.

2.Global Tier1 suppliers (systems integrators)

In the future automotive EEA, especially in the “central computing unit + zone controller” stage, the software and hardware are completely decoupled, and the hardware is peripheral. The real challenge for automakers lies in the software architecture. The traditional automotive supplier system will be greatly impacted, while the value of software suppliers will be further highlighted, and there will be some giants in domain controller software.
In response to this trend change, global Tier1 giants are also actively building independent software platform products to cope with the competition. Both Bosch and ZF launched middleware designed for autonomous driving in 2020.

In July 2020, Bosch launched Iceoryx, a middleware for advanced autonomous driving, compatible with ROS2 and Adaptive AutoSAR interfaces to meet the requirements of different development periods (pre-ROS, mass production of Autosar).

In December 2020, ZF released ZF Middleware, providing a modular solution that can be integrated into automakers’ software platforms. At the same time, the middleware will be installed on mass-produced vehicles in 2024.

It is worth noting that foreign Tier 1 suppliers dabble in underlying system R&D and build a bridge between system and software applications while accomplishing functions. Bosch and ZF have successively released middleware products, hoping to centrally configure autonomous driving solutions for OEMs through a comprehensive sensor layout so as to simplify system integration, lower development costs and accelerate product launch.

Abstract

In addition, ZF will establish a global software center in 2021 in order to meet the challenges of future automobile software requirements.

The Latest Middleware Released by ZF

Source: ZF

3.Autonomous driving domain controller software providers

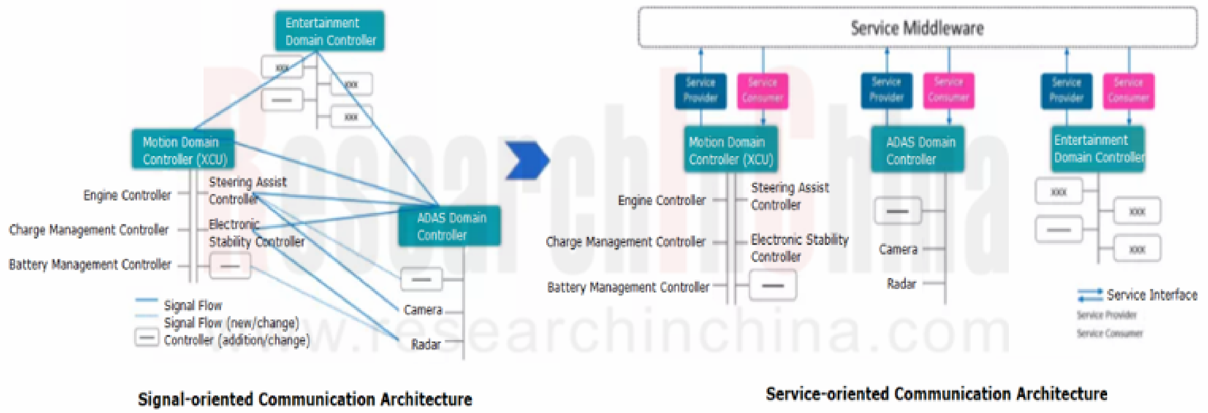
New vendors focusing on the development of autonomous driving software platforms are particularly worthy of attention. The domain controller platform vendors starting from software may challenge traditional Tier1 suppliers.

Taking TTTech (the domain controller software supplier of Audi zFAS) as an example, more than 25 models equipped with "MotionWise" (TTTech's domain controller software platform) have been mass-produced globally. In China, TTTech and SAIC have established a joint venture named Technomous, which has already produced iECU autonomous driving domain controllers for SAIC's member companies.

Domestic companies such as Enjoy Move Technology, Neusoft Reach, Untouch, and Nullmax have also launched domain controller software platforms to seize market opportunities. Domain controller software platforms (middleware) (between automotive operating systems and software applications) mainly abstract computer hardware from software applications, and also serve as a communication bridge between applications. As the communication architecture transfers from the "signal-oriented" type to the "service-oriented" type, the value of domain controller middleware will become more prominent.

Abstract

The communication architecture transfers from the "signal-oriented" type to the "service-oriented" type



Source: UAES

Domain controller middleware builds a bridge between automakers and Tier 2, namely the so-called Tier 1.5 that connects the software of automakers and Tier 1 to the hardware of Tier 2. The new development model will promote software suppliers to become important players in the automotive industry. Domain controller middleware requires high-level software, and more and more start-up software vendors have begun to dabble in this market, which will challenge Tier1 suppliers who are good at hardware.

Some Domain Controller Software Vendors

- TTTech: Autonomous driving software platform: MotionWise
- BOSCH 博世: Autonomous driving application middleware: Iceoryx
- ZF: Autonomous driving application middleware: ZF Middleware
- 映驰科技 Enjoy Move: EMOS multi-domain high-performance computing software platform
- Neusoft REACH: NeuSAR and NeuLink
- nullmax: Autonomous driving middleware: MaxOS platform
- UNTOUCH 未动科技: High-safety and high-performance autonomous driving middleware
- AICC 国汽智控: ICV OS: iVBB 1.0
- Elektrobit: Software platform for next-generation automotive EEA: EB xelor
- 诚迈科技 ARCHERMIND: Domain controller software and SOA software platform
- Megatronix: SmartMega OS+ middleware
- ThunderSoft 中科创达: Integrated SOA software platform

Source: ResearchInChina

4.Local Tier1 suppliers (systems integrators)

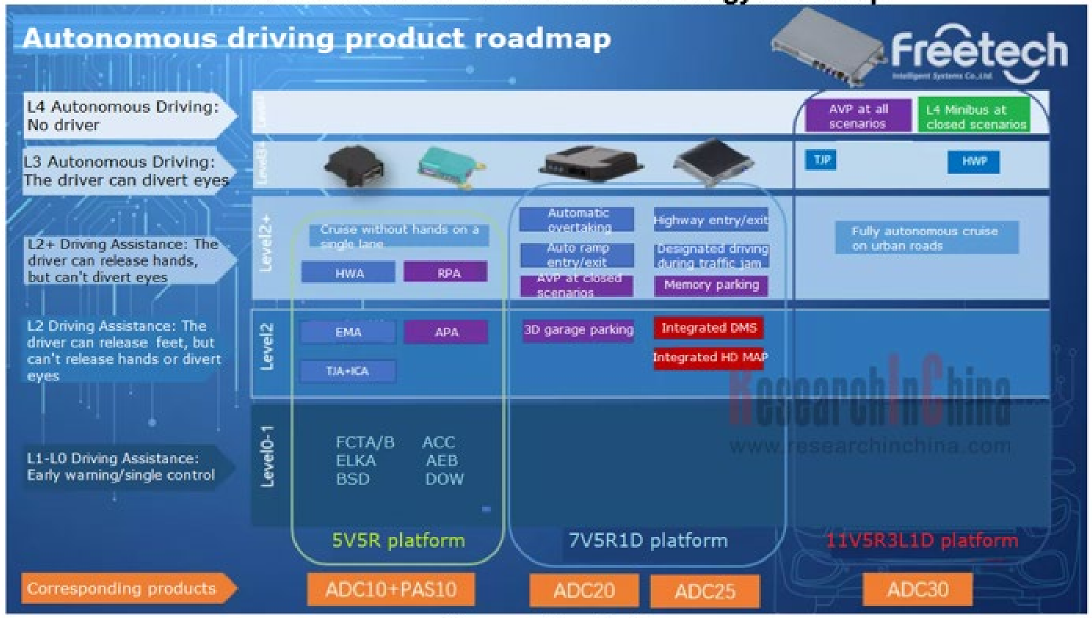
More and more local Tier1 suppliers have self-developed domain controllers to build an autonomous driving full-stack solution that integrates software and hardware. The innovatively developed intelligent driving operating systems AOS, VOS and MDC Core run on Huawei's MDC computing platform hardware, with a complete development tool chain. Partners can develop algorithms and applications on the basis of MDC to form an industrial ecosystem. The Huawei MDC810 computing platform has been mass-produced on the BAIC ARCFOX αS (Huawei HI).

Freetech, a Chinese ADAS supplier supporting Geely, Changan, Chery and Baoneng, has begun the research and development of domain controllers. It is committed to providing full-stack solutions for cost-sensitive mass-produced passenger cars. Based on the mature L2 system, Freetech has designed a modular, tailorable, and expandable software and hardware integration technology architecture, developed and launched an autonomous driving domain controller solution for mass production, including ADC20, ADC25, and ADC30 domain controllers, as well as provided OEMs with autonomous driving systems with flexible configuration.

Huawei MDC Computing Platform Industry Ecosystem

Source: Huawei

Freetech's Domain Controller Technology Roadmap



Source: Freetech

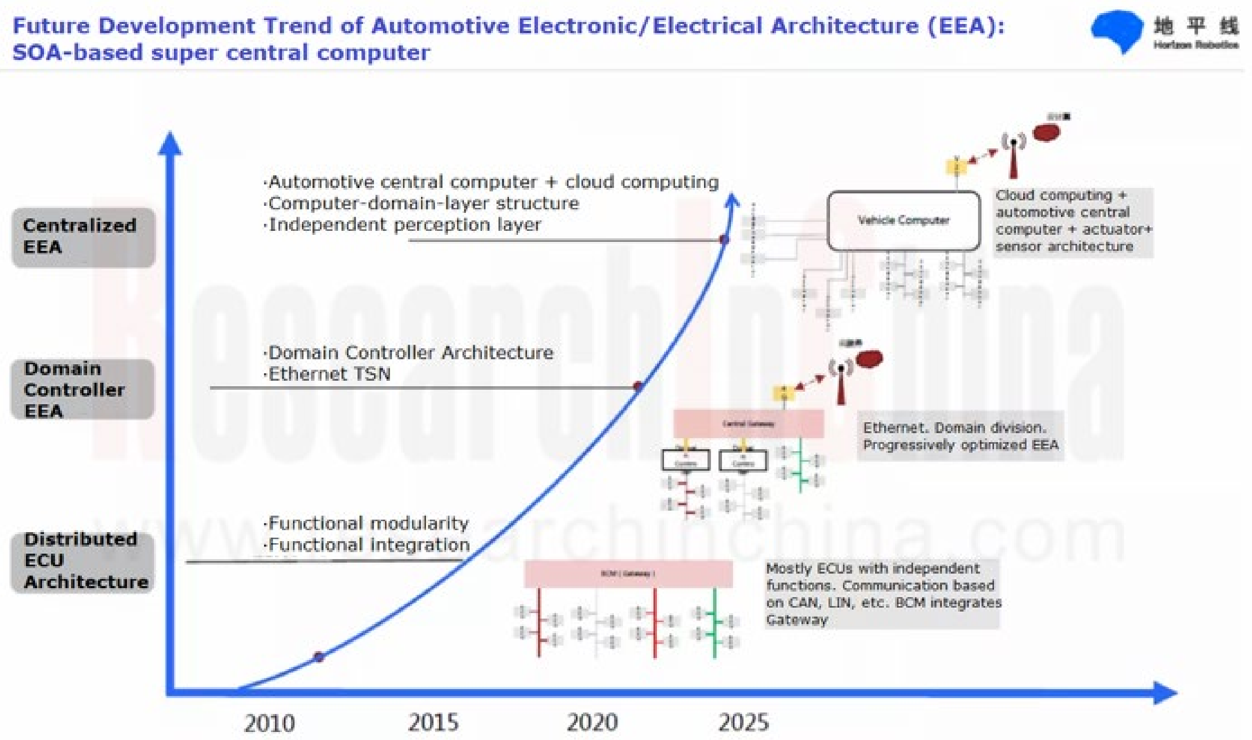
Abstract

Desay SV provides the autonomous driving domain controller IPU03 for Xpeng P7, with the shipments exceeding 10,000 units in 2020 and mass production, IPU04 based on NVIDIA's ORIN computing platform is also under development and is planned to be launched in Lixiang in large scale in 2022. As one of Nvidia's six global partners, Desay SV has occupied the core position.

In addition, Hong Jing Drive, Pony AI, IDRIVERPLUS, Jingwei Hirain Technologies, and Yingbo Supercomputing have also deployed autonomous driving domain controllers. On the one hand, they provide support for their own system integration solutions. On the other hand, they are actively developing OEMs as customers and offer them with software and hardware solutions. For example, Hong Jing Drive has reached deep cooperation with JAC and formed a joint venture named "Yuchi Smart", and Yingbo Supercomputing has provided Chery New Energy with L2.99 autonomous driving domain controllers.

Smart cockpit domains incorporating more and more ADAS functions will prevail

In the end, a smart car will become a mobile supercomputer and data center, and a new Wintel will be born. In the future, the core technologies of the advanced autonomous vehicle era will include computing platforms, operating systems and application software. After 2030, autonomous driving high-performance chips and cockpit control chips will be further integrated into central computing chips as the autonomous driving technology roadmap matures, hereby improving computing efficiency and reducing costs through integration.



Source: Horizon Robotics

Abstract

Under this trend, cockpit electronics companies, including Tier1 suppliers and software vendors, are seeking to integrate more and more ADAS functions (typically autonomous parking, DMS, and more advanced L1/L2 ADAS functions) into the cockpit domain and enhance the functional safety level of the smart cockpit domain.

Similar to intelligent driving domain controllers, a large number of domain controller software vendors have emerged in the field of smart cockpits. Megatronix, a software infrastructure provider that only has a history of two years, recently announced that it has raised over USD100 million in financing, and has accepted cockpit platform orders from OEMs such as HYCAN 007 and Lixiang. Investors have begun to attach importance to the broad prospects of this market.

From the perspective of OEMs, the urgency of self-developed cockpit domain controllers may not be as obvious as that of autonomous driving, mainly because: in the short to medium term, it is difficult for consumers to pay for cockpit function customization. For OEMs, they may potentially choose third-party software partners, and can actively explore the realization of software and hardware decoupling to achieve a better customer experience at low costs. In this context, ThunderSoft, Megatronix and other companies have emerged.

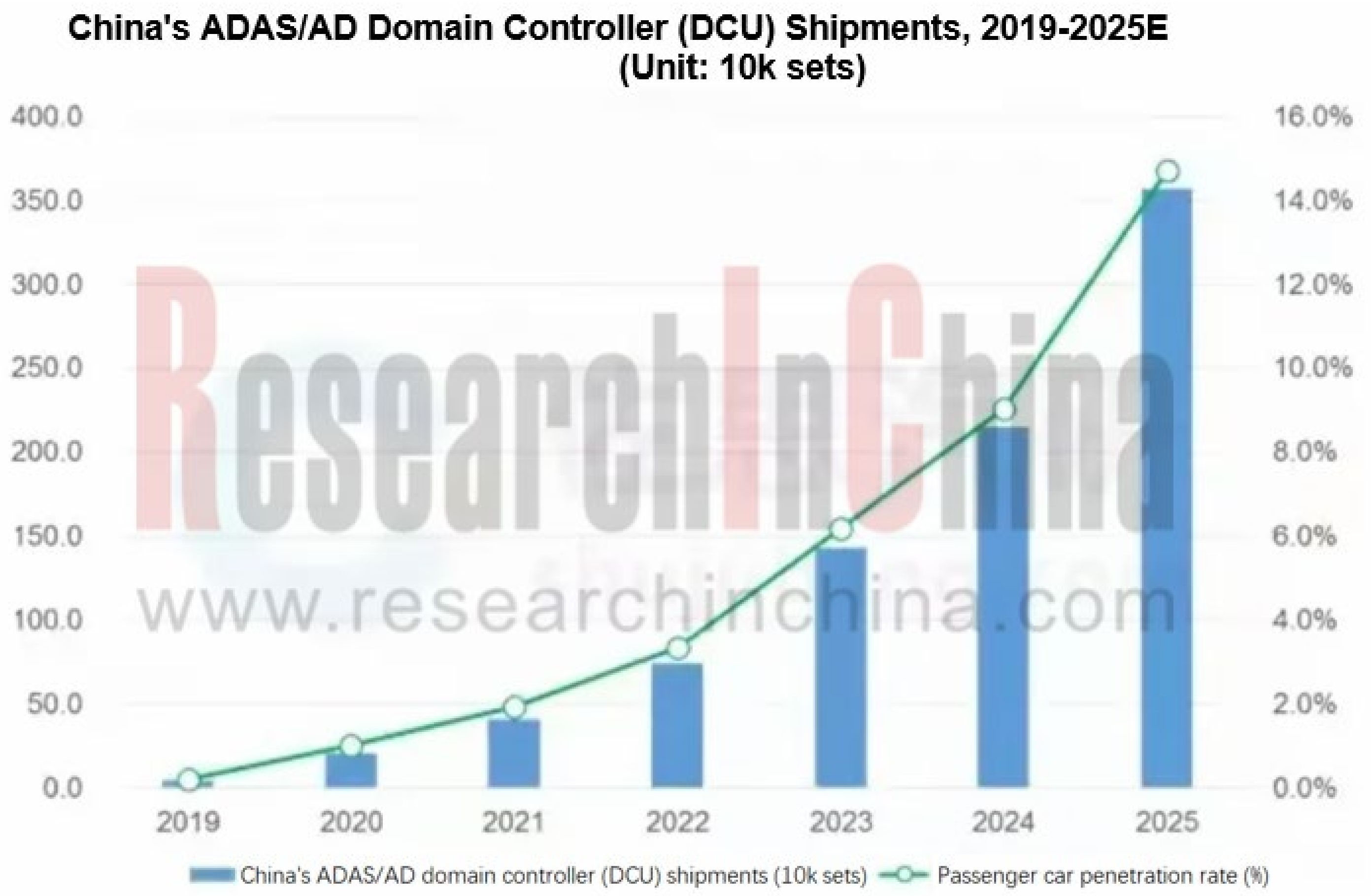
Competitive Landscape in Smart Cockpit Domain Controllers (Some Players)

Source: ResearchInChina

Abstract

The penetration rate of the domain controller market will swell in the next 5 years

In China, the industry is currently promoting mass production of L2+ autonomous cars on a large scale, and even L2++ or L2.9 autonomous driving, which is infinitely close to L3, is also rapidly being realized, mainly thanks to the impetus of Tesla Model series, NIO ES, Xpeng P7 and other models. ResearchInChina estimates that by 2025, the annual shipments of ADAS/AD domain controllers for passenger cars in China will reach 3.565 million sets, and the penetration rate of passenger car OEM autonomous driving domain controllers will reach 14.7%.



Source: ResearchInChina

Companies Mentioned

伟世通	大陆汽车	福瑞泰克	博世	华阳集团	创时智驾	英博超算	百度
安波福	维宁尔	采埃孚	电装	超星未来	环宇智行	经纬恒润	宏景智驾
佛吉亚	歌乐	松下	三星	航盛电子	北斗星通	海微科技	天准
哈曼	LG电子	TTTech	华为	布谷鸟	优控智行	智行者	大疆
德赛西威	东软	东软睿驰	诺博汽车	联合汽车电子			

Table of Content (1)

Table of Content (2)

Table of Content (3)

Table of Content (4)

Table of Content (5)

Table of Content (6)

Table of Content (7)

Table of Content (8)

Table of Content (9)

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