Global and China Automotive Domain Control Unit (DCU) Industry Report, 2018-2019

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STUDY GOAL AND OBJECTIVES

This report provides the industry executives with strategically significant competitor information, analysis, insight and projection on the competitive pattern and key companies in the industry, crucial to the development and implementation of effective business, marketing and R&D programs.

REPORT OBJECTIVES

- To establish a comprehensive, factual, annually updated and cost-effective information base on market size, competition patterns, market segments, goals and strategies of the leading players in the market, reviews and forecasts.
- To assist potential market entrants in evaluating prospective acquisition and joint venture candidates.
- To complement the organizations' internal competitor information gathering efforts with strategic analysis, data interpretation and insight.
- To suggest for concerned investors in line with the current development of this industry as well as the development tendency.
- To help company to succeed in a competitive market, and

METHODOLOGY

Both primary and secondary research methodologies were used in preparing this study. Initially, a comprehensive and exhaustive search of the literature on this industry was conducted. These sources included related books and journals, trade literature, marketing literature, other product/promotional literature, annual reports, security analyst reports, and other publications. Subsequently, telephone interviews or email correspondence was conducted with marketing executives etc. Other sources included related magazines, academics, and consulting companies.

INFORMATION SOURCES

The primary information sources include Company Reports, and National Bureau of Statistics of China etc.

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Abstract

Electronic control unit (ECU) serves as an automotive computer controller. Automotive electronic controller is used to receive and process signals from sensors and export control commands to the actuator to execute. Microprocessors, the core of an automotive ECU, embrace micro control unit (MCU), microprocessor unit (MPU), digital signal processor (DSP) and logic integrated circuits (IC). The global ECU leaders are Bosch, Denso, Continental, Aptiv, Visteon, among others.

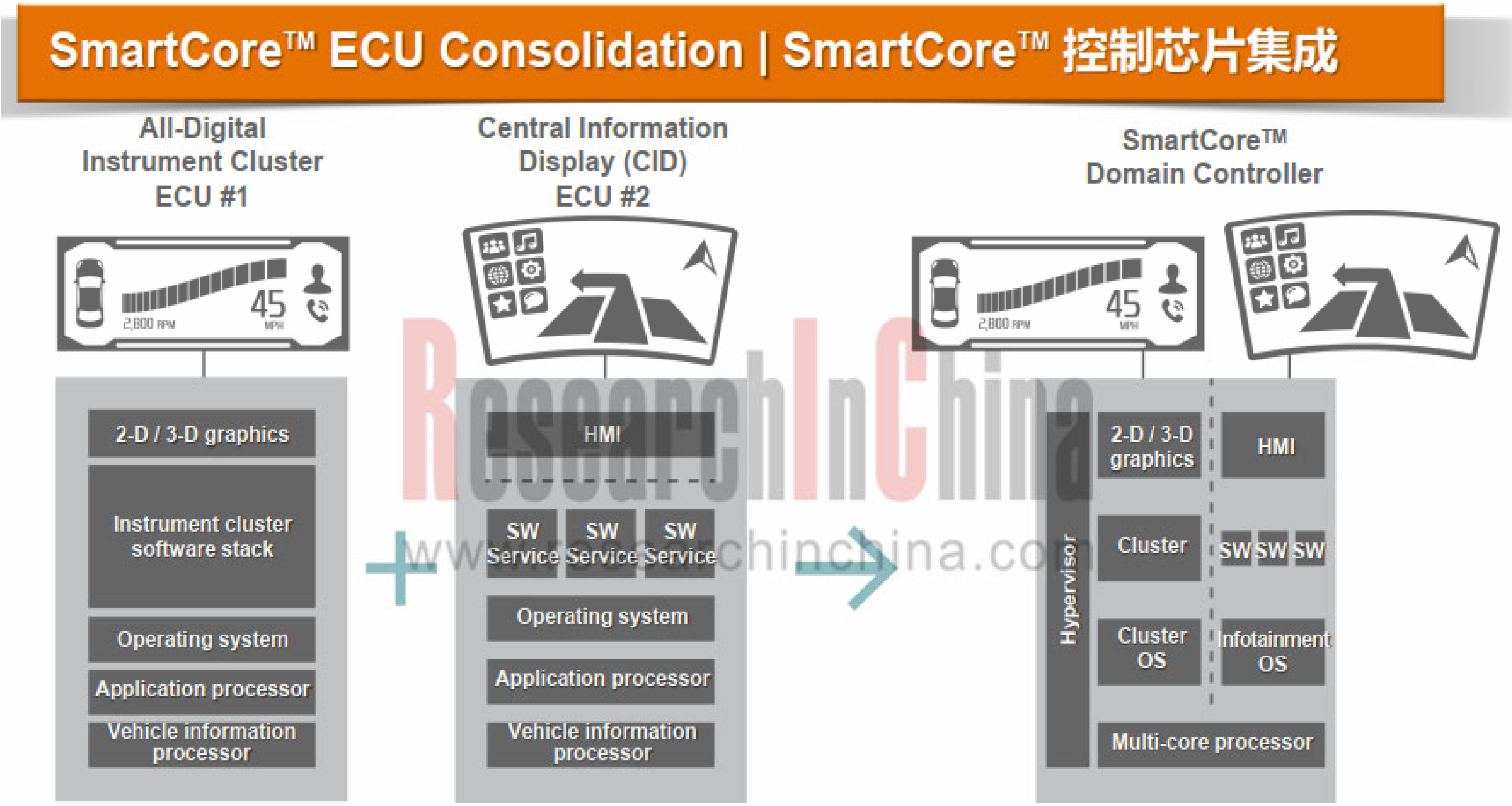
As vehicle trend to use more electronics, ECU is making its way into all auto parts from anti-lock braking system, four-wheel drive system, electronically controlled automatic transmission, active suspension system and airbag system to body safety, network, entertainment and sensing and control systems. Vehicles' consumption of ECU then booms: high-class models use 50-70 ECUs on average, and some even carries more than 100 units.

When the one-to-one correspondence between the growing number of sensors and ECUs gives rise to underperforming vehicles and far more complex circuits, more powerful centralized architectures like domain control unit (DCU) and multi-domain controller (MDC) come as an alternative to the distributed ones.

The concept of domain control unit (DCU) was initiated by tier-1 suppliers like Bosch and Continental as a solution to information security and ECU development bottlenecks. DCU can make systems much more integrated for its powerful hardware computing capacity and availability of sundry software interfaces enable integration of more core functional modules, which means lower requirements on function perception and execution hardware. Moreover, standardized interfaces for data interaction help these components turn into standard ones, thus reducing the spending on research and development or manufacture. In other words, unlike peripheral parts just playing their own roles, a central domain control unit looks at the whole system.

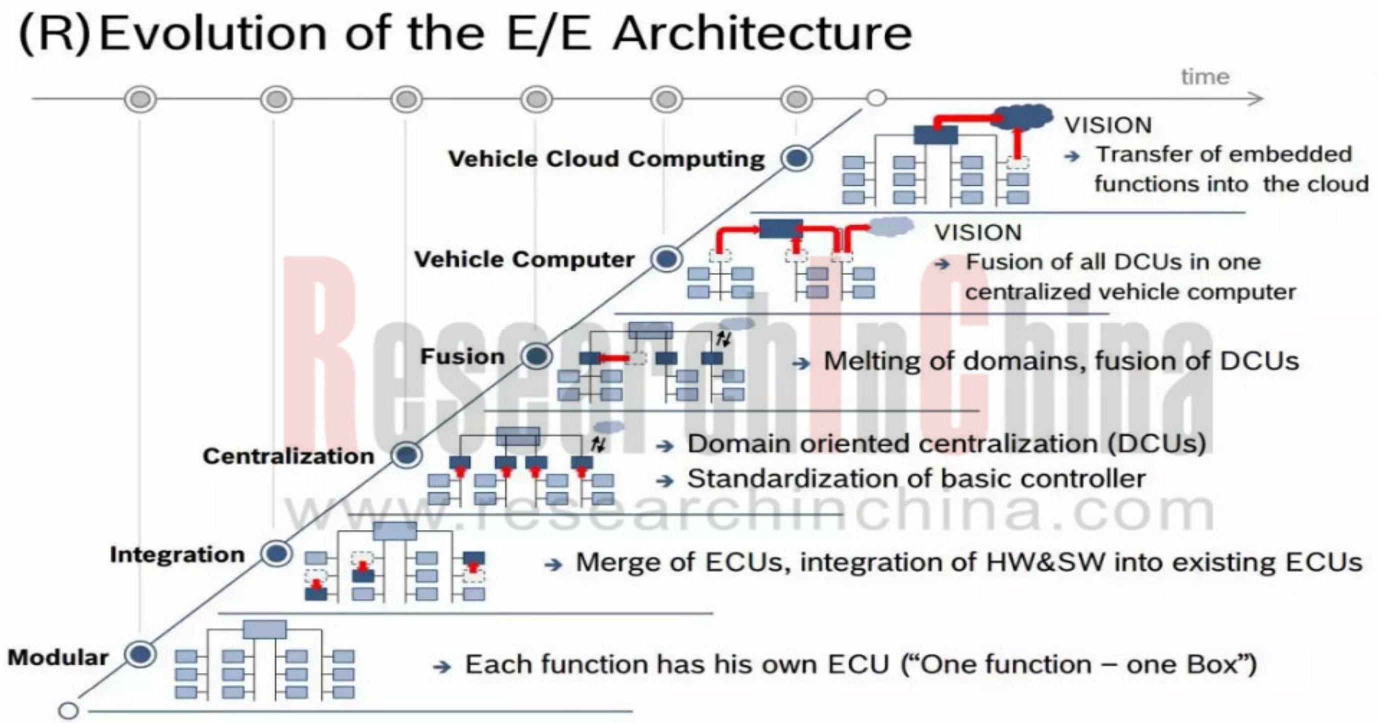
Autonomous vehicle requires domain controllers not only to be integrated with versatile capabilities such as multi-sensor fusion, localization, path planning, decision making and control, V2X and high speed communication, but to have interfaces for cameras (mono/stereo), multiple radars, LiDAR, IMU, etc.

Figure 1: Visteon integrates instrument ECU and head unit ECU into SmartCore cockpit domain controller



To complete number crunching, a domain control unit often needs a built-in core processor with strong computing power for smart cockpit and autonomous driving at all levels. Solution providers include NVIDIA, Infineon, Renesas, TI, NXP and Mobileye. The scheme that powerful multi-core CPU/GPU chips are used to control every domain in a centralized way can replace former distributed automotive electric/electronic architectures (EEA).

Figure 2: evolution of Bosch E/E architecture. It has six layers, i.e., Modular，Integration, Centralization, Fusion, Vehicle Computer and Vehicle Cloud Computing. DCU is applied to the third layer (Centralization), and MDC the fourth (Fusion).



In current stage, most new vehicles adopt DCU-based E/E architectures. In Singulato iS6's case, a DCU + automotive Ethernet based network topology is used to divide E/E architecture into 5 domains: intelligent driving, smart cockpit, body, chassis and power; an integrated design allows fusion of all sensor data into the intelligent driving domain controller which is in charge of data processing and decision making to implement ADAS functions such as adaptive cruise control, lane keeping and automatic parking. All imply that automakers need to develop their own ADAS/AD systems.

The study by "Cool Wax Gourd", a technical expert's Twitter-like Sina Weibo account, shows that: the evolution of three generations of Tesla models from Model S to Model X to Model 3, is actually a process of functional redistribution, namely, developing capabilities based on those from suppliers; Model S E/E architecture has been a fifth-layer one (Vehicle Computer) at the start.

As automotive E/E architectures evolve, there is a big shift in relationship between OEMs and automotive electronics suppliers, too. The trend for integrated automotive electronic hardware leads to the smaller number of electronics suppliers and the more important role of DCU vendors.

Being generally integrated with instrument clusters and head unit, a cockpit domain controller for instance, will be fused with air conditioner control, HUD, rearview mirror, gesture recognition, DMS and even T-BOX and OBU in future.

An autonomous vehicle that generates 4TB data an hour, needs a domain control unit to have some advanced competencies such as multi-sensor fusion and 3D localization.

Central gateway closely tied with domain controllers, takes charge of sending and receiving key security data, and is directly and only connected to the backstage of automakers. Through OTA updates to domain controllers, carmakers can develop new capabilities and ensure network security for faster deployment of functions and software.

DCU vendors and automakers will deepen their partnerships in research and development.

Typical Cockpit DCU Vendors and Their Solutions and Customers

Vendors	Computing Platform	Cockpit DCU	Operating System/Hypervisor	Cockpit DCU Clients
Visteon	Qualcomm	SmartCore	ANDROID,LINUX	Geely, Daimler Benz, Dongfeng Motors, GAC
Continental	Qualcomm/Renesas	Integrated body electronic platform IIP	QNX/PikeOS	
Bosch	Qualcomm	AI car computer	AGL	GM
Aptiv	Intel	ICC (integrated cockpit controller)	LINUX/ACRN	Great Wall Motor, Audi, Ferrari, Volvo
Desay SV	Qualcomm 820A TI J6	Smart cockpit DCU		CHJ Automotive
COOKOO	NXP	Auto Cabin		Four OEMs
Neusoft REACH	Intel	C4-Alfus	LINUX/ACRN	

Desay SV argues that: tier-1 suppliers and OEMs will collaborate in the following two ways in the area of autonomous driving domain controller:

First, tier-1 suppliers are devoted to making middleware and hardware, and OEMs develop autonomous driving software. As tier-1 suppliers enjoy edges in producing products at reasonable cost and accelerating commercialization, automakers are bound to partner with them: OEMs assume software design while tier-1 suppliers take on production of hardware and integration of middleware and chip solutions.

Second, tier-1 suppliers choose to work with chip vendors in solution design and research and development of central domain controllers, and then sell their products to OEMs. Examples include Continental ADCU, ZF ProAI and Magna MAX4.

It can be seen from the two tables below that there is a tendency towards cooperation between controller vendors and OEMs, domain controller suppliers and chip vendors, in both cockpit and autonomous driving domain controllers.

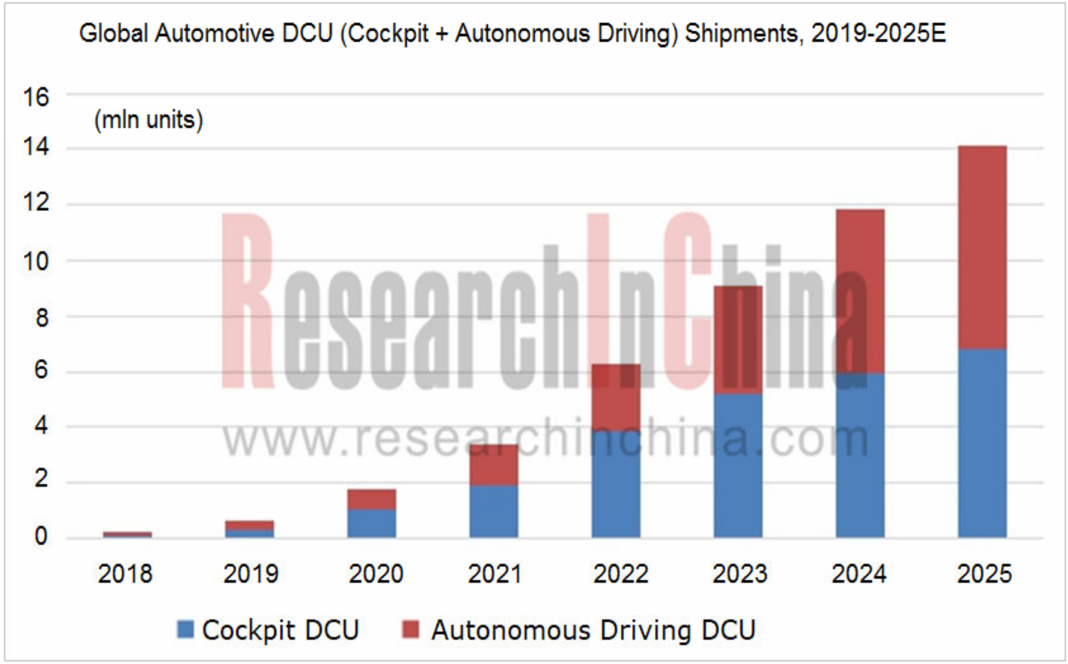
Typical Autonomous Driving DCU Vendors and Their Customers and Partners

Vendors	Computing Platform	DCU	Partners	Customers
Visteon	Compatible multiprocessor architecture	DriveCore	Tencent	GAC
Continental	Compatible multiprocessor architecture	ADCU		
TTTech	NVIDIA	zFAS/iECU	Aptiv, SAIC, Samsung	Audi, SAIC
Aptiv	Intel	CSLP	Mobileye, Intel, Ottomatika	
Veoneer	NVIDIA Xavier	"Zeus" supercomputer	Zenuity	
ZF	NVIDIA Xavier	Central controller ProAI	Baidu	Chery
Magna		MAX4	Innoviz	BMW
HiGo Automotive	Intel, Nvidia, NXP, Zhaoxin,Cambricon	WiseADCU AD computation domain control unit, WiseIMCU chassis motion domain control unit	Maxieye, Smarter Eye, Cheng-Tech, RoboSense, SureStar, OuBaiTuo, etc.	Baidu, a Baidu's AD leading enterprise, a port logistics leading enterprise, SF Motors, Hanteng Auto, Leopaard, BAIC
In-driving	Nvidia	TITAN		
COOKOO	NXP	Auto Wheel	NXP, RENESAS, AMBARELLA, Sony, etc.	Five OEMs
Baidu	TI Nvidia	BCU-MLOC BCU-MLOP	Desay SV United Automotive Electronic Systems	
iMotion	TI/NXP	iMo DCU central controller	Mobileye	Zotye
HiRain Technologies	NXP	ADAS Domain Controller		
Neusoft REACH	Xilinx	AD DCU	Xilinx	Passenger car manufacturers and commercial vehicle manufacturers
Desay SV	NVIDIA	AD Computing Platform	Nvidia, XPENG Motors	XPENG Motors

DCU, as a kind of OEM automotive electronics, usually takes over two years from design to mass production and launch. Most of the above suppliers are still researching and developing DCU. Aptiv and Visteon are far ahead of peers and have mass-produced DCU.

The global automotive DCU (cockpit + autonomous driving) shipments will exceed 14 million sets in 2025, with the average annual growth rate of 50.7% between 2019 and 2025, according to ResearchInChina.

Throughout the DCU industry, Chinese companies have emerged strikingly in the past two years, such as Desay SV, Baidu, Neusoft, HiGO Automotive, COOKOO, In-driving, iMotion, etc., all of which now takes emerging and non-first-tier traditional automakers as their key clients.



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