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Global and China Electronic Rearview Mirror Industry Report, 2024

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Automotive gateway research: 10BASE-T1S and CAN-XL will bring more flexible gateway deployment solutions

ResearchInChina released "Automotive Gateway Industry Report, 2024", analyzing and researching impact of E/E architecture evolution on gateways, new gateways for passenger cars and commercial vehicles, gateway supplier analysis, gateway chip and gateway security software enterprise analysis.

1. Gateway presents different deployment strategies in the three stages of E/E architecture

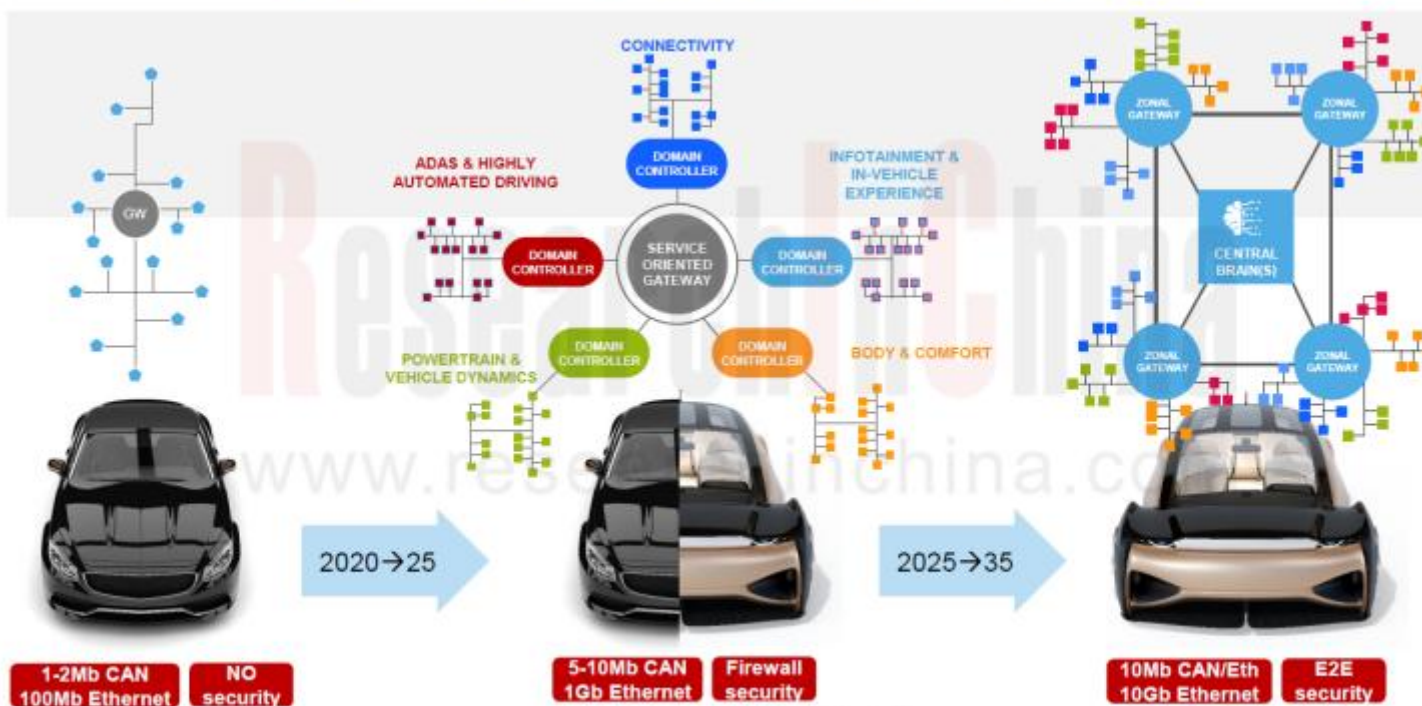
As the hub of in-vehicle network, the deployment strategy of automotive gateway changes with evolution of E/E architecture.

In a distributed architecture, there is a traditional CAN gateway in the vehicle to connect electronic Control Units (ECUs) with different functions in the vehicle.

Under the domain control architecture, the gateway has two forms. One is to use a non-integrated central gateway to securely and reliably transfer data between multiple domains such as Telematics Control Unit (T-BOX), powertrain, body, infotainment system, digital cockpit and ADAS applications. The other is to use an integrated gateway, which integrates the central gateway into a domain controller. It can be divided into several forms, including integrated in central control domain, integrated in body domain, integrated in cockpit domain, integrated in communication domain, and integrated in intelligent computing domain. At this stage, the central gateway is usually a hybrid gateway of CAN + Ethernet.

Under Zonal architecture, the on-board computing platform is at the core of the computing, and Zonal controller mainly acts as a gateway, not only as a data processing center, but also as a power distribution module. Under this architecture, the zonal controller is more divided by physical location, which can further reduce ECU in the car, simplify cable layout and reduce cable length.

Evolution of Vehicle Architecture and Gateway



Source: NXP

2. Deployment method of gateway under domain control architecture

In the domain control stage, there are four main deployment methods of gateway, namely: an independent central gateway, a gateway integrated in vehicle control domain, a gateway integrated in cockpit domain, and a gateway centralized in central domain.

The independent central gateway is mainly responsible for communication between different domains, and Ethernet is used as backbone network to undertake information exchange tasks; the system interconnection within each domain still uses CAN and FlexRay communication buses. At this stage, the central gateway is usually a hybrid gateway of CAN + Ethernet.

The gateway integrated in vehicle control domain realizes integration of central gateway with body control, chassis and even power.

The gateway integrated into cockpit domain supports wireless connection of the vehicle, provides remote interconnection functions, such as remote diagnosis, OTA updates, etc., and provides security services (intrusion detection, firewall, etc.). The intelligent gateway is one of the four key modules of the intelligent cockpit of the car.

In addition, the gateway also appears in the form of integration with the central domain control, such as Li L9.

Gateway Solution under Domain Control Architecture

Gateway Solution under Domain Control Architecture

Gateway Solution	Typical Model/Supplier	Gateway Features
Independent central gateway	Xpeng P7	Developed based on EEA2.0, Xpeng P7 adopts a three-domain (autonomous driving + cockpit + body) architecture, and realizes functions such as data exchange and protocol conversion through an independent central gateway.
Integrated in vehicle control domain	BYD Dolphin	Dolphin is based on BYD's E3.0 platform (centralized EEA, including four domains: vehicle control, power, intelligent driving, and intelligent cockpit), and the central gateway is integrated with vehicle control domain.
Integrated in cockpit domain controller	Tesla Model S Plaid	Model S Plaid's cockpit domain integrates instrument display, entertainment control, gateway, audio amplifier, Tbox, etc. The gateway uses SPC5748GSMMJ6. The cockpit domain controller is relatively concentrated and centralized in terms of function and integration.
Integrated in central domain controller	Li L9	The central gateway is integrated into Li Auto's fully self-developed central domain controller, which uses NXP's S32G automotive-grade chip. It fully develops functions including the extended-range electric system, air-conditioning system, chassis system and seat control system, ensuring the scope and timeliness of Li L9's OTA.

Source: ResearchInChina

3. Zonal gateway under Zonal architecture will be gradually mass-produced from 2024 to 2025

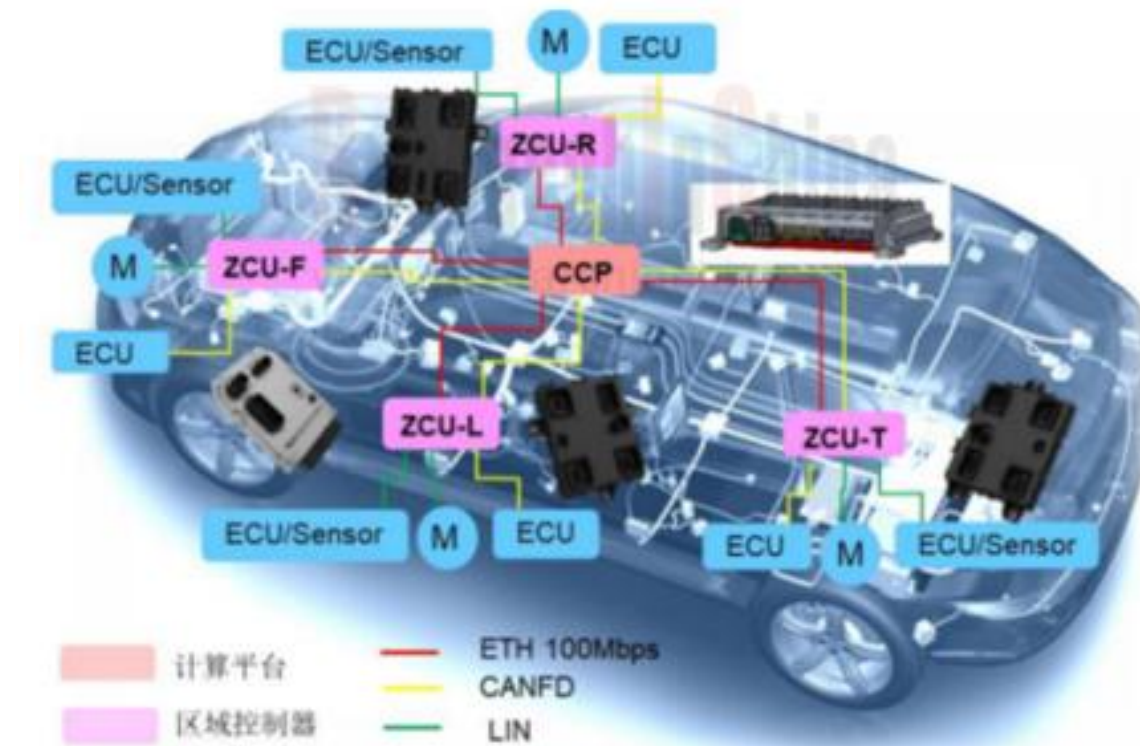
Zonal architecture consists of a central brain and several zonal controllers, among which the central brain is mainly responsible for the complex data processing and calculation of the upper layer, and several zonal controllers are mainly responsible for functions of gateways, power distribution, data collection, and load control. Under Zonal architecture, there are mainly two kinds of gateways, one is integrated in central computing platform, and the other is integrated in zonal controller.

Under the general trend of software-defined vehicles, automotive E/E architectures require more flexible, personalized, and scalable network architectures, and the need for zonal control has become increasingly prominent. In 2024, a number of Zonal architecture models have been launched or will be launched soon, such as Chery STERRA ET, Changan Qiyuan E07, Neta Shanhai 2.0 models, etc.

Changan Qiyuan E07 is expected to be launched in October 2024. It adopts a "central + zonal" ring network architecture, composed of C2 (central computer) + EDC (experience computer) to form a central computing platform, plus three VIU (zonal controllers). It adopts ring network communication technology. The backbone is mainly 100-megabit Ethernet, and the core controllers are equipped with Gigabit network. The three VIU are responsible for network management and power distribution and control of nearby devices, and have realized cross-domain integration of 15 controllers for power, chassis, air conditioning thermal management, and body.

In 2025, Neta Shanhai 2.0 platform model will be mass-produced and launched, which adopts the central controller and zonal controller solutions of HiRain, among which the central computing platform integrates the central gateway, body and comfort control, new energy vehicle power control, air conditioning and thermal management, vehicle management, full data collection, OTA upgrade, SOA services and many other functions; Zonal Control Unit has zonal gateway routing function, 100MB Ethernet, CAN-FD, LIN, etc.

Zonal Architecture Solution of HiRain



Source: HiRain

4 Ethernet 10BASE-T1S and CAN-XL will provide more flexible gateway deployment options

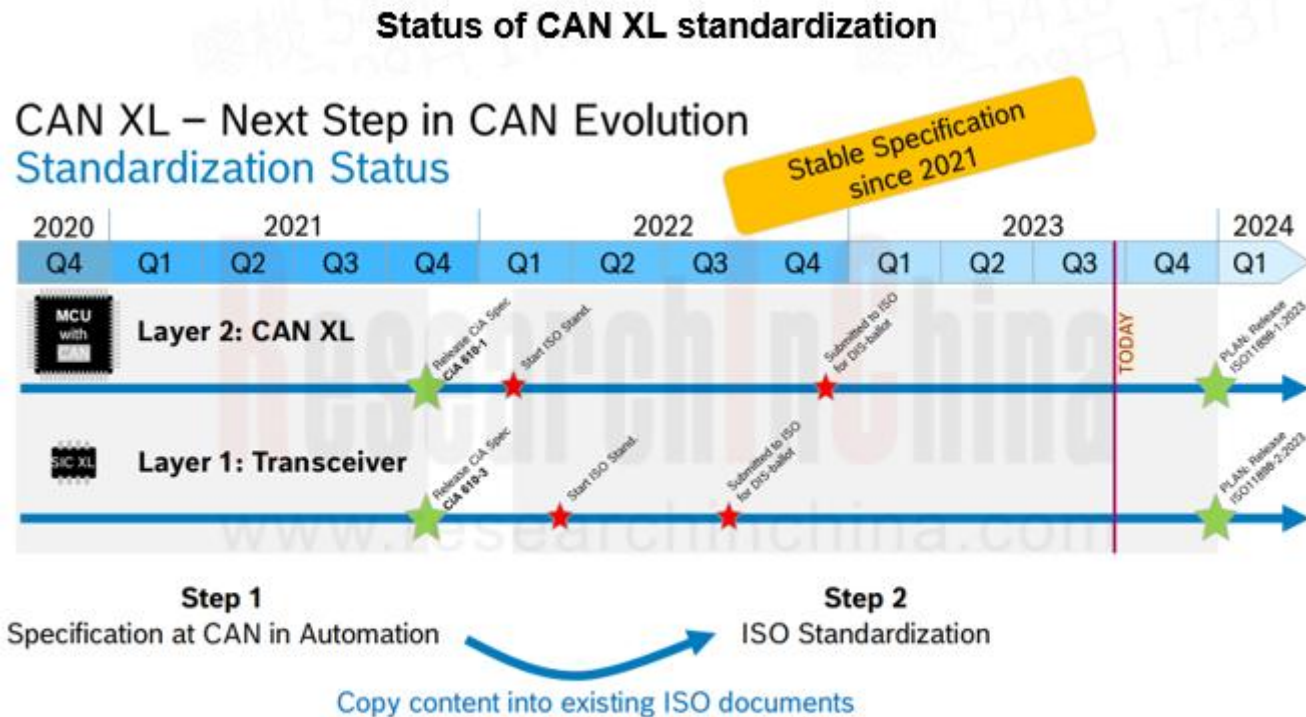
With faster transmission speeds and more stable communication connections, Ethernet is gradually becoming the backbone of in-car transmission. Xpeng G9, Voyah Zhuiguang, Lynk & Co 08, EXEED Yaoguang, IM LS7, Li L9, etc. are all equipped with Gigabit Ethernet, and GAC Aion's Xingling architecture even claims to use 10 Gigabit Ethernet data transmission.

In March 2024, BMW and ADI announced that they would be the first to adopt ADI's 10BASE-T1S E 2 B ? (Ethernet-Edge Bus) technology. Using ADI's 10BASE-T1S E 2 B technology, BMW eliminates microcontrollers and moves software from edge nodes to central processing units, thus enabling full hardware edge nodes and reducing software development and authentication tasks. That is to say, based on 10BASE-T1S E 2 B technology, traditional gateways will no longer be a required option.

While Ethernet quickly grabbed the market, CAN family welcomed the third generation member - CAN XL, and the performance was upgraded. The main advantages of CAN XL are:

- 1. High speed:** CAN XL communication rate up to 20 Mbit/s, payload size increased to 2048 bytes, providing greater data throughput
- 2. Compatibility:** On the one hand, it inherits the characteristics of CAN FD; and on the other hand, it has greatly expanded its protocol, allowing TCP/IP to run on CAN XL. It is expected to achieve good compatibility with Ethernet upper-layer protocols (especially service-oriented communication methods).
- 3. Cost-effective:** Combining CAN and Ethernet functions while maintaining the low price of CAN.

In terms of standardization, ISO standardization work has begun to incorporate CAN XL into ISO standards ISO 11898-1 and ISO 11898-2, and CAN XL has also obtained AUTOSAR support. In terms of productization, Bosch and Daimler trucks use CAN XL networks instead of FD networks in the car for performance verification, and Infineon, NXP, STMicroelectronics, Renesas, etc. are also deploying CAN XL.



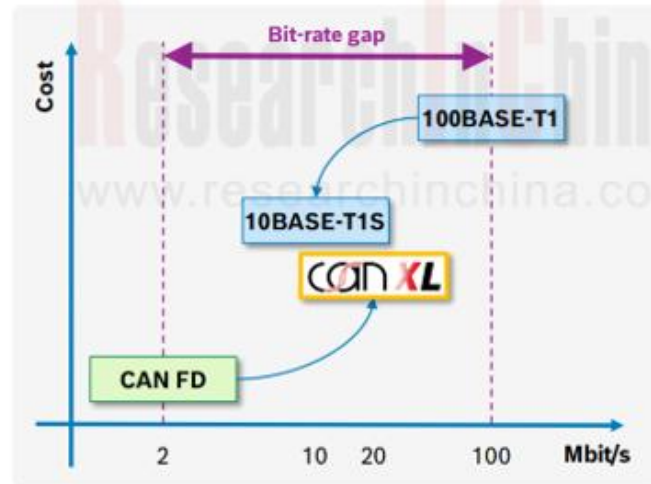
Source: Bosch

Bit Rate Gap between CAN FD and 100BASE-T1

In short, 10BASE-T1S, which sank from high-speed communication technology, and CAN XL, which was upgraded from low-rate bus upgrades, are expected to "divide the world" in the 10 Mbit/s communication range, providing a more flexible solution for the future deployment of automotive communication networks, and will also have a practical impact on gateway requirements. After all, pure Ethernet architectures do not require gateways, while CAN-XL requires gateways to achieve protocol conversion.

Bit Rate Gap between CAN FD and 100BASE-T1

Issue: Bit-rate gap between
CAN FD and 100BASE-T1



Source: Bosch

Table of Content (1)

1 Overview of Automotive Gateway Industry

- 1.1 Automotive Gateway Concept
- 1.2 Automotive Gateway Function
- 1.3 Automotive Gateway Deployment Solution
- 1.4 Requirement of Automotive Intelligence on Intelligent Gateways
 - 1.4.1 Intelligent Gateway is one of the four key modules of Intelligent Cockpit
 - 1.4.2 Software-defined Vehicle Hasten Service-oriented Gateway
 - 1.4.3 E/E Architecture Drive New Forms of Gateway Deployment
 - 1.4.4 Ethernet in the car to Give Birth to Ethernet Gateway
 - 1.4.5 Commercial Vehicle Domain Control Architecture will Drive Demand for Central Gateway
- 1.5 Automotive Gateway Industry Chain
- 1.6 Gateway Price Comparison

2 Impact of E/E Architecture Evolution on Gateway

- 2.1 Under EEA Evolution, Gateways Move from Independence to Integration
- 2.2 Gateway Deployment Solution under Distributed Architecture
 - 2.2.1 Distributed Architecture Corresponds to Traditional CAN Gateway
 - 2.2.2 Traditional CAN Gateway Case (1)
 - 2.2.3 Traditional CAN Gateway Case (2)
 - 2.2.4 Traditional CAN Gateway Case (3)
 - 2.2.5 Traditional CAN Gateway Case (4)
 - 2.2.6 Traditional CAN Gateway Case (5)
 - 2.2.7 CAN + Ethernet Hybrid Gateway Case (1)
 - 2.2.8 CAN + Ethernet Hybrid Gateway Case (2)
- 2.3 Gateway Deployment Solution under Domain Centralized Architecture
 - 2.3.1 Domain Centralized Architecture Corresponds to Centralized Gateway

- 2.3.2 Independent Central Gateway Case (1)
- 2.3.3 Independent Central Gateway Case (2)
- 2.3.4 Gateway Integrated in Vehicle Body Domain Control Case (1)
- 2.3.5 Gateway Integrated in Vehicle Body Domain Control Case (2)
- 2.3.6 Gateway Integrated in Vehicle Body Domain Control Case (3)
- 2.3.7 Gateway Integrated in Vehicle Body Domain Control Case (4)
- 2.3.8 Gateway Integrated in Cockpit Domain Control Case (1)
- 2.3.9 Gateway Integrated in Cockpit Domain Control Case (2)
- 2.3.10 Gateway Integrated in Central Control Domain Case
- 2.3.11 Other Forms of Gateway Integration Case(1)
- 2.3.12 Other Forms of Gateway Integration Case(2)
- 2.4 Gateway Deployment Solution under Hybrid Zonal Architecture
 - 2.4.1 Gateway Case under Hybrid Zonal Architecture (1)
 - 2.4.2 Gateway Case under Hybrid Zonal Architecture (2)
 - 2.4.3 Gateway Case under Hybrid Zonal Architecture (3)
- 2.5 Gateway Deployment Solution under Zonal architecture
 - 2.5.1 Central Computing Platform and Zonal Gateway under Zonal Architecture
 - 2.5.2 Case of Gateway Integrated into Central Computing platform and Zonal Gateway
 - 2.5.3 Gateway Integrated into Central Computing platform
 - 2.5.4 Case of Integration into Zonal Controller Gateway (1)
 - 2.5.5 Case of Integration into Zonal Controller Gateway (2)
 - 2.5.6 Case of Integration into Zonal Controller Gateway (3)
- 2.6 Iteration History of OEM Gateway Solution
 - 2.6.1 Xiaomi SU7
 - 2.6.2 Huawei HI Selection
 - 2.6.3 Xpeng
 - 2.6.4 Chery

Table of Content (2)

- 2.6.5 NIO
- 2.6.6 Li Auto
- 2.6.7 Neta
- 2.6.8 GAC
- 2.6.9 SAIC
- 2.6.10 Leapmotor
- 2.6.11 Great Wall
- 2.6.12 Geely

3 New Automotive Gateway

- 3.1 Service Gateway
 - 3.1.1 Features
 - 3.1.2 Service Gateway Drives Software Defined Vehicles
 - 3.1.3 Case (1)
 - 3.1.4 Case (2)
- 3.2 Ethernet Gateway
 - 3.2.1 Development History of Vehicle Ethernet
 - 3.2.2 Features
 - 3.2.3 Characteristics of Vehicle Ethernet and Necessity of Gateway
 - 3.2.4 Application of Vehicle Ethernet in Domain Architecture and Central Computing + Zonal Architecture
 - 3.2.5 Case (1)
 - 3.2.6 Case (2)
 - 3.2.7 Case (3)
- 3.3 Security Gateway
 - 3.3.1 top 10 Cyber Security Attack Scenarios for Smart Cars
 - 3.3.2 Tesla's Car Attack and Defense

- 3.3.3 Case

3.4 Commercial Vehicle Intelligent Gateway

- 3.4.1 Features
- 3.4.2 Case

4 Automotive Gateway Suppliers

- 4.1 Continental
 - 4.1.1 Profile
 - 4.1.2 Operation
 - 4.1.3 Automotive Gateway
 - 4.1.4 Body HPC
 - 4.1.5 Cross-domain High-performance Computing Unit
 - 4.1.6 HPC Production Plan
 - 4.1.7 EE Architecture
- 4.2 Bosch
 - 4.2.1 Profile
 - 4.2.2 Operation
 - 4.2.3 Gateway Development History and Functions
 - 4.2.4 Automotive Central Gateway: Passenger Cars
 - 4.2.5 Automotive Central Gateway: Commercial Vehicles
- 4.3 Aptiv
 - 4.3.1 Profile
 - 4.3.2 Gateway Products
 - 4.3.3 Gateway Computing Platform
 - 4.3.4 Next Generation of High-performance Intelligent Cockpit Platform

Table of Content (3)

- 4.3.5 SVA Architecture
- 4.3.6 Development Route of SVA Architecture

- 4.4 Lear
 - 4.4.1 Profile
 - 4.4.2 Gateway Products
 - 4.4.3 Gateway Business Layout

- 4.5 Micron
 - 4.5.1 Introduction and Gateway products

- 4.6 TTTech
 - 4.6.1 Profile
 - 4.6.2 Ethernet Technologies and Products
 - 4.6.3 Auto N4

- 4.7 FEV
 - 4.7.1 Profile
 - 4.7.2 Gateway Product Iteration
 - 4.7.3 Gateway Product Comparison
 - 4.7.4 Gateway product Application

- 4.8 UAES
 - 4.8.1 Profile
 - 4.8.2 Development Strategy
 - 4.8.3 Gateway Development History
 - 4.8.4 Gateway Application Scenario
 - 4.8.5 Interconnection/Ethernet Gateway Platform Project
 - 4.8.6 E/E Architecture
 - 4.8.7 Computing Platform (VCP)
 - 4.8.8 First Generation Vehicle Computing Platform - VCP1.0
 - 4.8.9 Body Domain Controller
 - 4.8.10 Fusion System Solution
 - 4.8.11 Develop a Cross-domain Central Computing Platform for the next generation

- 4.9 Neusoft Group
 - 4.9.1 Profile
 - 4.9.2 Automotive Cyber Security Products
 - 4.9.3 Intelligent Cockpit Architecture
 - 4.9.4 General Domain Controller
 - 4.9.5 Autonomous Driving Central Computing Platform Products
 - 4.9.6 NetEye Intelligent Connected Vehicle Security Solution

- 4.10 HiRain
 - 4.10.1 Profile
 - 4.10.2 Operation
 - 4.10.3 Gateway Product Development History
 - 4.10.4 Gateway Products and Customers
 - 4.10.5 Ethernet Gateway Products and Customers
 - 4.10.6 Zonal Controller (Integrated Zonal Gateway Routing Function) and Customers
 - 4.10.7 Central Computing Platform (Integrated Central Gateway) and Customers
 - 4.10.8 Vehicle Electronic and Electrical Development

- 4.11 Ofilm
 - 4.11.1 Business
 - 4.11.2 Operations
 - 4.11.3 5th Generation Vehicle Domain Controller Integrated Gateway

Table of Content (4)

4.12 ZLG Electronics

- 4.12.1 Profile
- 4.12.2 Main Business
- 4.12.3 Intelligent Connection Solution
- 4.12.4 Automotive Ethernet Solutions
- 4.12.5 Vehicle Ethernet Products

4.13 Yaxun Network

- 4.13.1 Profile
- 4.13.2 Gateway Product Summary
- 4.13.3 Yaxun Network Gateway Products (1)
- 4.13.4 Yaxun Network Gateway Products (2)
- 4.13.5 Yaxun Network Gateway Products (3)
- 4.13.6 Yaxun Network Gateway Products (4)
- 4.13.7 Yaxun Network Gateway Products (5)
- 4.13.8 Yaxun Network Gateway Products (6)

4.14 Inhand

- 4.14.1 Profile
- 4.14.2 Gateway Products (1)
- 4.14.3 Gateway Products (2)
- 4.14.4 Gateway Products (3)

4.15 Inchtek

- 4.15.1 Profile
- 4.15.2 Vehicle Gateway Product Summary
- 4.15.3 Gateway products (1)
- 4.15.4 Gateway Products (2)

4.16 Luxshare

- 4.16.1 Operation
- 4.16.2 Gateway Business

5 Automotive Gateway Chip Suppliers

5.1 NXP

- 5.1.1 Operations
- 5.1.2 Gateway Block Diagram
- 5.1.3 S32G Automotive Network Processor
- 5.1.4 S32G Partner Ecosystem and Universal Applications
- 5.1.5 S32G Software Ecosystem Cooperation System Block Diagram
- 5.1.6 S32G Gateway Chip Solution
- 5.1.7 S32G2 Series Chip
- 5.1.8 S32G2 Series Chip Application
- 5.1.9 S32G3 Series Chip
- 5.1.10 S32G3 Series Chip Block Diagram
- 5.1.11 S32G3 Series Chip Reference Design
- 5.1.12 S32G3 Series Chip Application

5.2 ST

- 5.2.1 Revenue
- 5.2.2 Main Products
- 5.2.3 Automotive Gateway Chip
- 5.2.4 Automotive Gateway Chip SPC5 Series
- 5.2.5 SPC5 MCU Ecosystem Overview
- 5.2.6 SPC5 MCU Development Support
- 5.2.7 Stellar Series Platforms
- 5.2.8 Stellar Series Product Classification
- 5.2.9 Smart Gateway Platform SGP

Table of Content (5)

- 5.2.10 Automotive Gateway Solutions
- 5.2.11 Automotive Gateway Competitive Advantage

5.3 Renesas

- 5.3.1 Profile
- 5.3.2 R-Car Platform
- 5.3.3 Gateway Chip R-Car-S4
- 5.3.4 Gateway Chip Application (1)
- 5.3.5 Gateway Chip Application (2)
- 5.3.6 Gateway Chip Application (3)
- 5.3.7 Internet/Gateway Application Integrated Development Platform
- 5.3.8 Develop New Technology for Automotive Communication Gateway SoCs
- 5.3.9 Gateway Product Route
- 5.3.10 Next Generation E/E Architecture

5.4 TI

- 5.4.1 Profile
- 5.4.2 Automotive-grade Chip
- 5.4.3 Jacinto 7 Platform
- 5.4.4 Gateway Chip Products (1)
- 5.4.5 Gateway Chip Products (2)
- 5.4.6 Gateway Reference Design (1)
- 5.4.7 Gateway Reference Design (2)
- 5.4.8 Gateway Roadmap

5.5 Infineon

- 5.5.1 Profile
- 5.5.2 32-bit TriCore ? Microcontroller Product Development History
- 5.5.3 Gateway Chip Products (1)

5.5.4 Gateway Chip Products (2)

5.5.5 Gateway Chip Products (3)

5.5.6 Gateway Chip Products (4)

5.5.7 Continental Develops Modular Platform for E/E Architecture with Infineon's high-end AURIX TC4 Microcontroller

5.5.8 Central Gateway Design

5.5.9 Body Control Module Integrated Gateway Solution

5.6 SemiDrive

5.6.1 Profile

5.6.2 Gateway Chip Products (1)

5.6.3 Gateway Chip Products (2)

5.6.4 Advantages of Gateway Chip Products

5.6.5 Gateway Solution Reference Design (1)

5.6.6 Gateway Solution Reference Design (2)

5.6.7 Gateway Solution Reference Design (3)

5.6.8 Centralized Computing Architecture

5.6.9 "1 + N" Central Computing Platform and Zonal Controller Family

5.7 China Core

5.7.1 Profile

5.7.2 Automotive Electronic Chip Products

5.7.3 Guoxin Technology and HiRain jointly launched AUTOSAR CP Solution

5.7.4 Cooperation in Automotive Field and Future Planning

6 Automotive Gateway Security Software Suppliers

6.1 EB

6.1.1 Profile

6.1.2 All-in-one Software platform: EB xelor

Table of Content (6)

- 6.1.3 Gateway Software Products (1)
- 6.1.4 Gateway Software Products (2)
- 6.1.5 Gateway Software Products (3)
- 6.1.6 Cooperation Case

- 6.2 ETAS
 - 6.2.1 Profile
 - 6.2.2 AUTOSAR Adaptive Platform
 - 6.2.3 Cyber Security Products
 - 6.2.4 Cyber Security Product Application Case

- 6.3 KPIT
 - 6.3.1 Profile
 - 6.3.2 AUTOSAR
 - 6.3.3 AUTOSAR Classic Platform
 - 6.3.4 Adaptive AUTOSAR Platform
 - 6.3.5 Cooperation Dynamics

- 6.4 Arilous
 - 6.4.1 Profile
 - 6.4.2 Intrusion Detection and Prevention System
 - 6.4.3 Parallel Intrusion Prevention System
 - 6.4.4 Ethernet Security Center, Arilou Backend Solutions and Cooperation Cases

- 6.5 GuardKnox
 - 6.5.1 Profile
 - 6.5.2 Secure SOA Framework
 - 6.5.3 Gateway Software Products (1)
 - 6.5.4 Gateway Software Products (2)

- 6.5.5 Cooperation

- 6.6 EnjoyMove Technology
 - 6.6.1 Profile
 - 6.6.2 Intelligent Driving High-performance Computing Software Platform
 - 6.6.3 Intelligent Domain Control Solution
 - 6.6.4 High-performance Computing Group XCG Ssolution
 - 6.6.5 Open Source Intelligent Application Power Builder Kit
 - 6.6.6 Cooperation Trends and Partners

7 Summary and Trends of Automotive Gateway Industry

- 7.1 Gateway Suppliers Summary
- 7.2 Gateway Chip Suppliers Summary
- 7.3 Gateway Security Software Enterprise Summary
- 7.4 Latest Generation Gateway Products of Gateway Suppliers
- 7.5 Independent Gateway Demand: still the main market
- 7.6 Automotive Gateway Trends
 - 7.6.1 Trend 1
 - 7.6.2 Trend 2
 - 7.6.3 Trend 3
 - 7.6.4 trend 4
 - 7.6.5 Trend 5
 - 7.6.6 Trend 6
 - 7.6.7 Trend 7



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