GAST Automotive Industry & Technology Research Report

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Subject: In-Depth Interpretation of the *2023 International Congress of Intelligent and Connected Vehicles Technology*

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Conference Introduction

- Title of the conference: The 10th International Congress of Intelligent and Connected Vehicles Technology (CICV 2023)
- Date: May 15~18, 2023
- Venue: Beijing City, China

Main content	➢ Focus: new automotive industrial ecosystems that develop with the next-generation AI, smart transportation, information communication, and smart energy in an integrated manner • 3 plenary sessions and thematic reports + 16 seminars • Topics: ICV strategies, innovative technologies, ecosystems, commercial application, cross-industry integration, etc. The congress gathered global top experts, policymakers, industrial leaders, investment agencies, etc. to share practice, reach a consensus on the ICV industry, promote the development, explore new technologies, further develop ecosystem, and promote the application of cutting-edge technologies
Organizers	➢ Beijing Economic-Technological Development Area, China Society of Automotive Engineers, National Innovation Center of Intelligent and Connected Vehicles, Suzhou Automotive Research Institute of Tsinghua University

Viewpoints of Key Speakers

- China has introduced a series of policies for guiding the adoption of intelligent and connected technologies in the auto industry. The ICV industry has moved into a fast track, thus requiring active cooperation of players at all links to create an open-source and open ecosystem. Such a new ecosystem would require collaboration between OEMs, traditional T1 suppliers, and software vendors

- Operating system is the core of smart vehicles, playing a key role in connecting all links. The discussion about OS is not confined to the underlying kernel, but generalized operating systems that encompass middleware, virtualization, functional SW, etc. It is impossible for a single player to complete the R&D of an automotive OS, which requires efforts of different players from relevant sectors
- "Independent automotive chips and operating systems" are the decisive factors for the second half of the game. Facing a raft of challenges like insufficient core technologies, limited tuning of chips, absent development tool chains, inadequate standards, and weak verification capabilities, China's auto industry requires a set of open-source and open OS kernels to underpin the development of new SW and HW of new technology architectures in a coordinated manner

- Smart vehicle platform is in its infancy and the market pattern has not been crystallized. Chinese and foreign T1 suppliers, OEMs, and AD companies are making efforts to develop diverse computing platforms. Fundamental computing platforms and AD OS architectures that enable layer-by-layer decoupling and cross-domain integration would become the key

Viewpoints of Key Speakers

- There are two factors for players to win the second half of the AD commercialization game, namely promoting the adoption of AD technology at a large scale and providing excellent user experience. Chinese players have made breakthroughs in the relevant key technologies for AD, including perception, control, and decision-making algorithms, as well as AD, C-V2X, HD map, and smart chassis

- Evolving into the third space, smart cockpit requires high-performance CPUs and scalable architectures to enable the development of a new generation of smart cockpits
- Smart cockpit requires development from both hardware and software. From the dimension of hardware, it is necessary to substantially improve the computing power of vehicles and continuously upgrade cameras, DMS, and other hardware. From the dimension of software, which is more important, it is necessary to build the upper-layer ecosystem according to the underlying layer, thus providing user-specific cockpit services and meeting different user needs based on local reality
- It is an inevitable trend to integrate cars and smartphones. Due to the characteristics of software, automotive software would be integrated ahead of hardware. The price chasm between automotive products determines that they would be far more differentiated than smartphones. It would be a more tortuous process for hardware to get integrated

- Consensuses have not been fully reached on the development concept, technology pathways, etc. in the industry, which, to certain extent, has damped the development and commercialization of advanced AD technologies. It is necessary to develop new architectures, R&D modes, test methods, business models, and other aspects and give full play to the core advantage of integrating vehicles, roads, and clouds

Contents

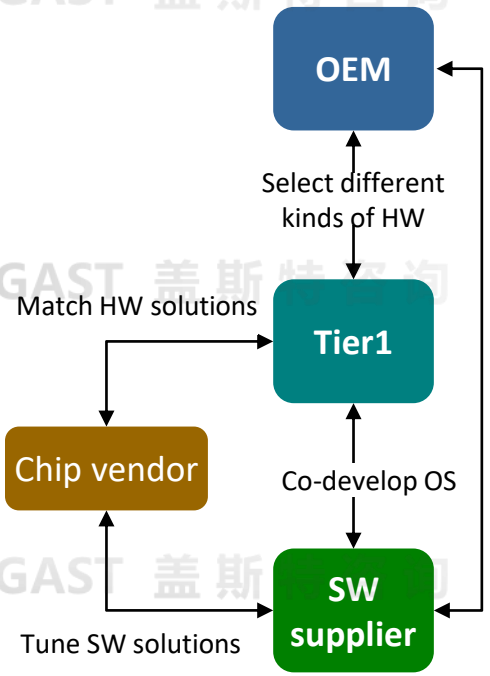
☐ Development Trends of SDVs and Corresponding Technologies

☐ Development Trends of Smart Cockpits and Corresponding Technologies

☐ Development Trends of V2X-Based AD Technologies

SDV Requires Professional Division of Duties

- With SW and HW decoupled layer by layer, the industry requires the division of duties between players. As the auto industry shifts from “traditional supply chain defined by HW and machine” to “digital ecosystems”, all kinds of players face the throes of transformation



Establish SW subsidiary companies/units
- Deploy the self-development of full-stack technologies, bypass traditional T1 suppliers to a certain extent, and co-develop sub-systems with T2

Reach strategic cooperation with SW companies
- Scale up the internal R&D team and establish a strategic alliance with SW suppliers to promote the building of SW ecosystems

Realize product value
Brand premium / HW pile-up → differentiated functions (via OTA)

Forge full-stack SW & HW capabilities
- Integrate HW, underlying SW, middleware, application SW algorithms, and systems to provide integrated platforms

Improve HW capabilities
- Leverage SW to substantially improve the competitive edge of HW and improve HW capabilities based on new EEAs

Way of supply
Universal solution (one for all) → user-specific solutions

Enrich product matrixes
- Provide more and more combinations of SW IP, directly cooperate with OEMs, and participate in the development of platforms and architectures

Adopt SW ecosystems as enablers
- Enable OEMs and T1 suppliers to develop full-stack technology solutions based on the strong R&D capabilities of multi-core, heterogeneous software

Seek ecosystem partners
- Cooperate with OEMs to develop OS and SOA and introduce algorithm suppliers to create developer ecosystems

After defining an architecture, OEMs would join in the application SW development ecosystem with HW providers, algorithm suppliers, OS vendors, middleware suppliers, etc.

OS and Middleware Become More Important for Ecosystems

- Generalized operating systems for cars (kernel + middleware) are evolving from traditional vertically coupled architectures to those with vertically layered modules, which would eventually become distributed service-oriented architectures with microkernel → The core of OEMs to develop ecosystems

The purpose and value of generalized operating systems

Support open application ecosystems
- Provide safe application development and running environments, allow the integration and decoupling of applications, and realize distributed coordination

Develop scalable service ecosystems
- Develop SOAs based on middle ware with "unified standards, centralized configurations, and distributed manners"

Match more generalized HW ecosystems
- OS kernel follows the and the principle of minimization and least privilege; Allow for plug-and-play peripheral drivers

Business cost
- Permit collaboration and parallel development → save the time cost
- Have unified standards and configurations → save the maintenance cost
- Allow cross-model and cross-platform use → save the production cost and labor cost

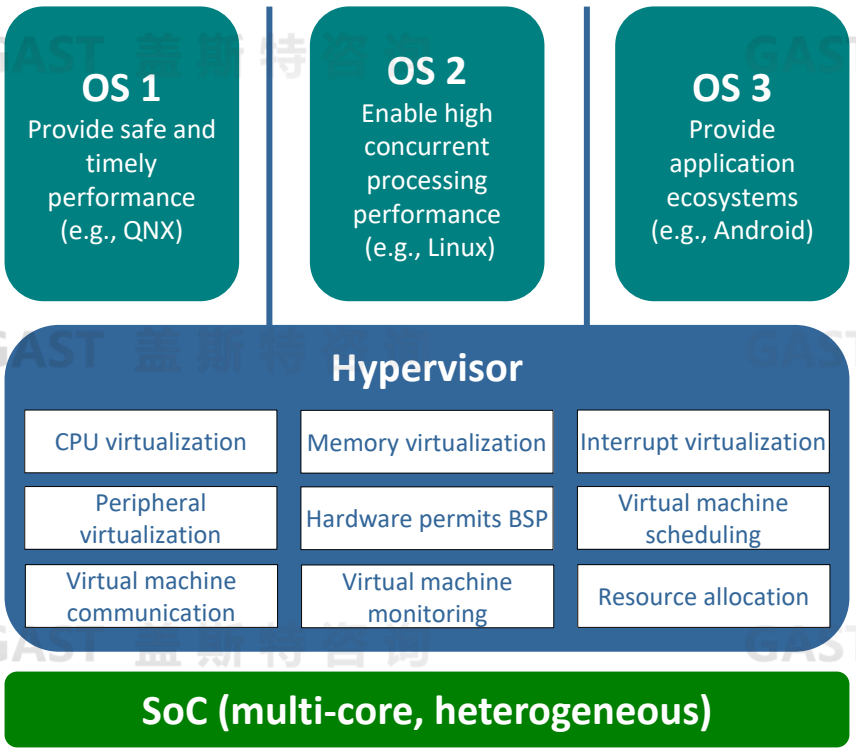
Technology application
- Convenient development; good transplantability and maintainability
- Meet the demand for automotive functional safety and system development
- Enable high-speed response and multi-tasking according to different kinds of applications

Status quo			
	✓ **Automotive OS:** Android, QNX, Harmony OS, AliOS, Linux, etc. coexist → Require integration	✓ **Safety control OS:** most vehicle control units are developed based on AutoSAR at present	✓ **AD OS:** no proven solutions; lack of safe and real-time kernel, middleware, virtual machines, and two-way decoupled functional SW; no general industry-wide consensus on architectures

Two challenges for automotive OS: ① complex technologies + heavy investment + long period; ② risks of new monopoly → It is imperative to develop innovative ecosystems

Virtual Technology Empowers Multi-Domain Integration in the SDV Era

- Different automotive function domains have different requirements on functions and performance
  → Rely on virtual technology to realize "1-to-N" of the OS, thus enabling the integration of domains



Characteristics of Hypervisor:

- Partition isolation (for safety), resource sharing and flexible configuration (performance, cost, modules), permitting multi-OS (ecosystems)

Functions of Hypervisor:

- Realize the match of one hardware and several architectures, enabling a single device to function as composite devices via the software-defined approach
- Shield hardware differences and enable smooth integration between heterogenous OS and multi-domain services, facilitating two-way decoupling and modularization of HW and SW

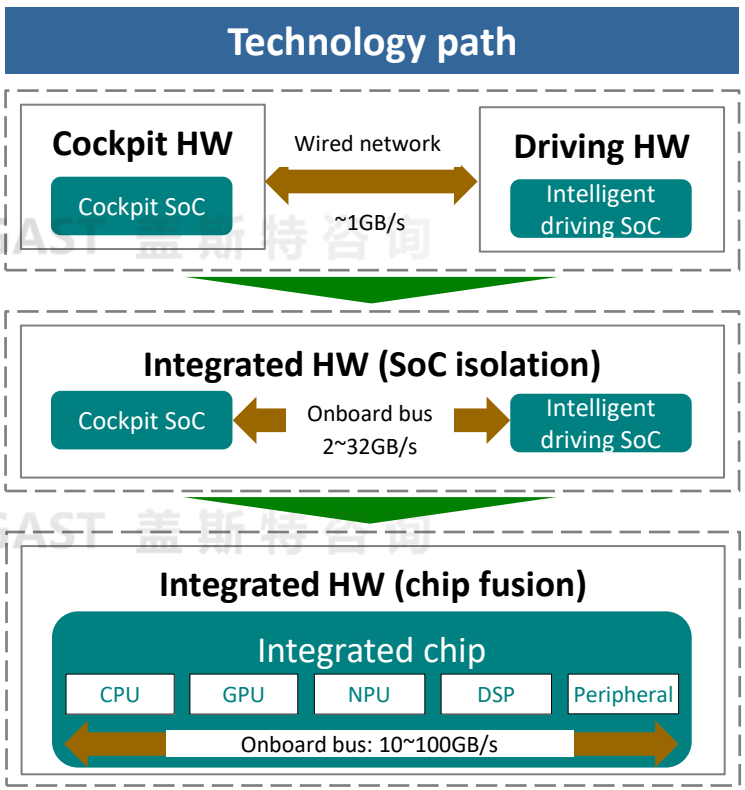
Difficulties of Hypervisor:

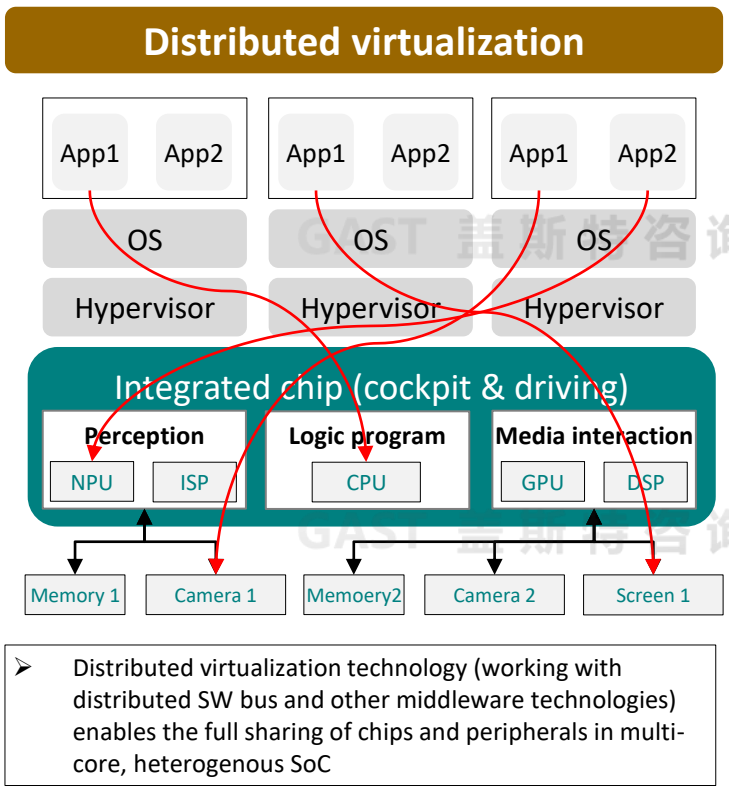
- There are hundreds of peripherals in cars and every peripheral can be sourced from numerous suppliers and in different types → peripheral virtualization is the largest crux

The final purpose of Hypervisor is to enable flexible deployment of applications, chips, and peripherals in cars, enabling computing platforms to accommodate richness, safety, and reliability of functions

Distributed Virtualization Technology Makes the True Integration between Cockpit and Driving Domains Possible

- It is hard to realize low-cost and safe integration between cockpit and driving domains via HW separation and SoC isolation. Distributed virtualization technology provides basic support for chip-level integration between cockpit and driving domains





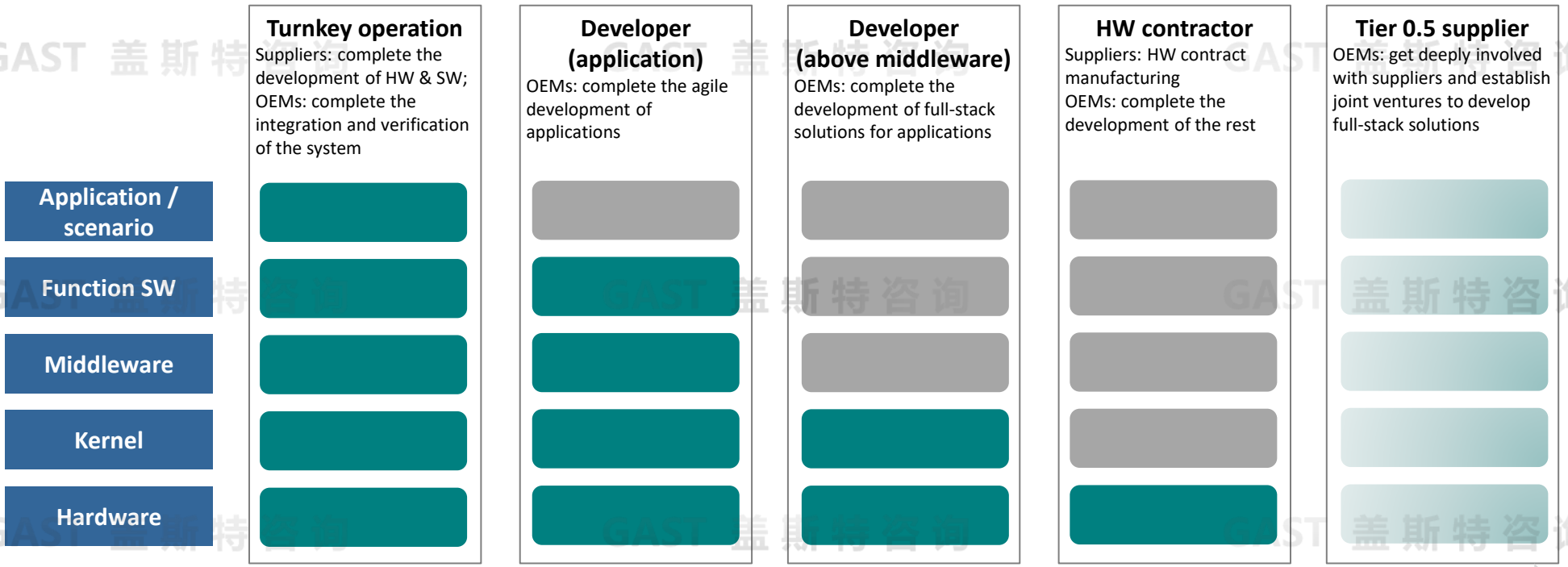
R&D and Industrialization of Computing Platforms are Flourishing

- As the trend of cross-domain integration is becoming increasingly evident, all kinds of participants in industrial ecosystems start to develop computing platforms for smart vehicles, leaving the market pattern uncrystallized

	Typical player	Development strategy
OEM	Tesla, Volkswagen, Toyota, XPeng, etc.	➢ Hope to self-develop controllers and even master-control chips to control the autonomy of underlying hardware ➢ However, most OEMs rely on technology companies for AD computing platforms, algorithms, and chips
Local T1	CAIC, Puhua Soft, Banma, etc.	➢ Most players work on full-stack technology solutions and cooperate with OEMs on a deep level ➢ Bottlenecks in core SW and algorithms entails heavy dependence on foreign players
International T1	Bosch, Visteon, etc.	➢ Have the first-mover advantage in customers and supply chains in basic computing platforms ➢ Complex business lines, slow development of local scenarios, and less flexible
AD technology company	Waymo, Huawei, etc.	➢ Start from software to build universal and module platforms, throw down a challenge to traditional T1 suppliers, and seek opportunities to directly enter the computing platform assembly market ➢ Platforms require cross-model integration; System architectures entail breakthroughs in interconnectivity

Modes of Cooperation on Computing Platforms in the Auto Industry

- Since different OEMs have different needs for the R&D of computing platforms and suppliers can provide different services, there are various modes of cooperation on computing platforms



- **OEMs should strike a good balance between short-term and long-term targets based on their capabilities and select the most suitable mode of cooperation**

Contents

☐ Development Trends of SDVs and Corresponding Technologies

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Improving Smart Cockpit Experience Requires Professional Collaborative Development

OEM: Define products based on user experience and collaborate with all parties to develop smart cockpits

Demand → ① User demand → ② Vehicle definition → ③ Cockpit concept design → ④ Physical model → ⑤ Trial production → ⑥ Whole vehicle → ⑦ Vehicle purchase → Product

Supplier Service provider

- Marketing and consulting agencies: Target users; Consultation services
- Design & modeling companies: Design products; Create models
- Suppliers: collaborative development; R&D and test agencies: test and verification
- Operation and service providers: Resource services; Cloud applications

Research institution: Universities, research institutes, industrial organizations: provide advanced technologies and talents, formulate standards, etc.

Developing smart cockpit and user experience ecosystems enables value in terms of products, R&D, and services

① Address technological problems to build connectivity between cockpit technologies, products, and services
② Integrate resources to develop new smart cockpits across the industrial chain in a collaborative way
③ Establish a positive development process for smart cockpit and user experience
④ Formulate domestic and international standards for smart cockpits and user experience

Improving smart cockpit user experience entails new ecosystems co-developed by players in a collaborative manner, covering the whole process from demand to product

High-Performance Chips Enables Better User Experience in the Cockpit

- Increasingly diverse functions and interactions in the cockpit entail larger computing power

Improve functions in the cockpit

Functional linkage

HMI: 4K screen; Multi-screen linkage; Voice algorithm; 3A game

Integrate domains (e.g., cockpit and driving domains)

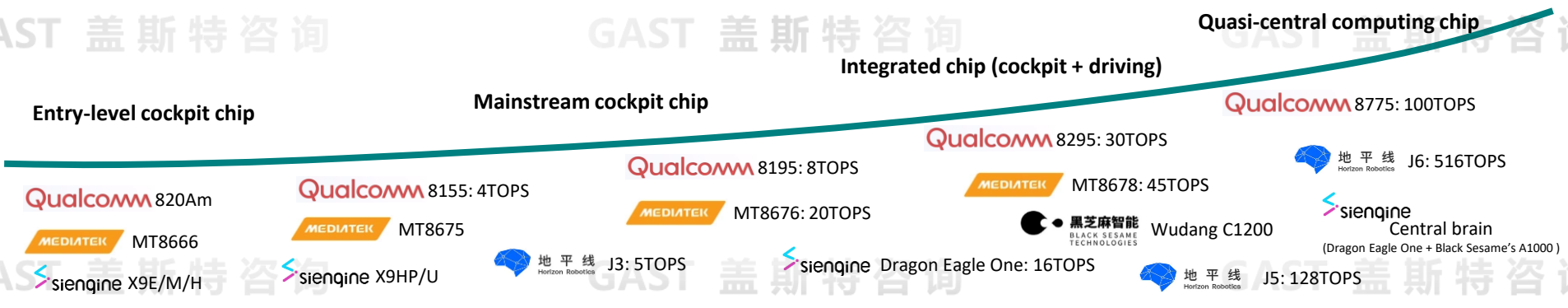
Cockpit + parking

Cockpit + driving

Cockpit + driving + gateway

Centralized domain

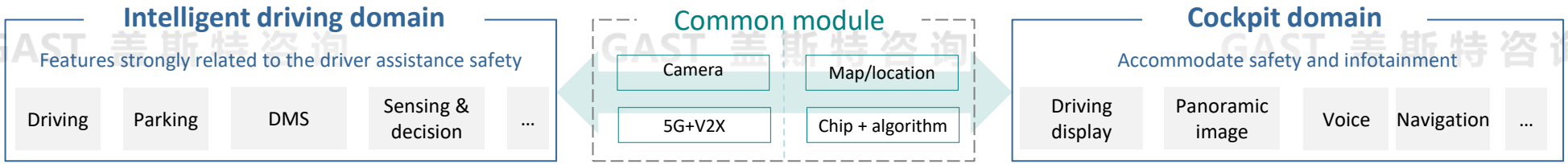
The increasing demand for cockpit chips with higher computing power intensifies the competition between chip vendors



With the demand for chips with large computing power increasing, local cockpit chip providers embrace a new round of opportunities, who are constantly making their products more competitive, gradually narrowing the gap with international giants

Integration of Cockpit and Driving Domains Enables Innovative Interactions

■ Information interactions of intelligent driving and smart cockpit domains get closely integrated, enabling the sharing and reuse of key sensors, functions, algorithm modules, etc.



Demand for integrative interactions	① Safer	② More convenient	③ More comprehensive
	• Timely and intuitive feedback • Real-time monitoring of driver status	• Simplified logic of operation • Simple and intuitive interfaces that highlight certain content	• Intelligent decisions (judgment/prediction) • Multi-mode integration (environment perception/decision analysis)

Scenarios for integrative interactions	
Driving status monitoring	• When the intelligent driving system receives an instruction that may influence driving safety, the cockpit system would detect the drive's status and make judgment → achieve safety redundancy
Environment information display	• The intelligent driving system would perform real-time simulation of surrounding traffic conditions and display information in the cockpit → enable immersive perception of reality
User-friendly access to functions	• Allow the activation of intelligent driving functions via voice/key in the cockpit → more convenient and safer
Driving safety feedback	• In case of a warning/danger, the cockpit would inform the driver via vibration, sound, etc. to require take-over

□ **HMI would enable connection between people, cars, and environment during the integration of cockpit and intelligent driving domains, thus making user experience safe and immersive**

Unified OS is the Key to Connecting Automotive and Smartphone Ecosystems

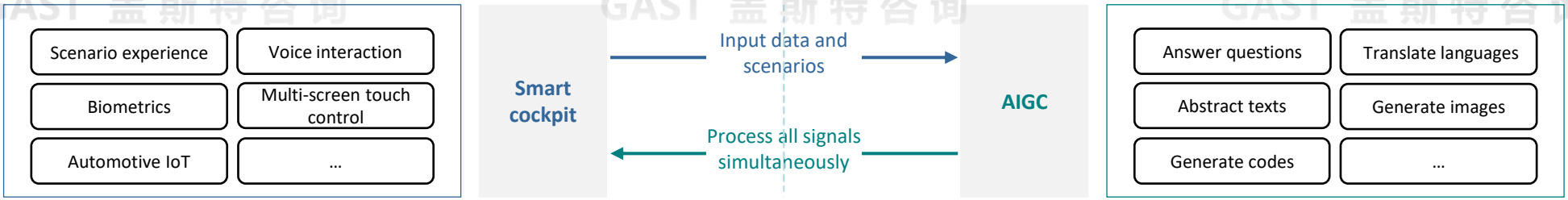
Connection form	Information transmission	Content mapping	Seamless connection
OS architecture	Smartphone application ⟷ Automotive application Smartphone middleware / Automotive middleware Smartphone OS / Automotive OS	Unified application layer General middleware Smartphone OS / Automotive OS / Other OS	Unified application layer Unified middleware Microkernel / Microkernel / Microkernel
Functional characteristics	Data transmission and reception • Transmit information via wired and wireless networks (e.g., in-car Bluetooth call, audio and video, remote control based on smartphone APPs)	Cross-system application services • Migrate smartphone applications to cars (e.g., directly operating smartphone apps via Carplay, HiCar, etc.)	Unified OS collaboration → no data barriers • Permit free sharing of ecosystem resources in different scenarios and between various devices (e.g., Harmony OS)
Major OEMs' selection of paths	① Self-built head unit ecosystem	• Tesla: hardly related to the smartphone ecosystem; products and technologies are more for cars; heavy investment and limited ecosystem resources	
	② Access smartphone ecosystem	• Mercedes-Benz, BYD: direct join in Apple and Android application ecosystems; extremely low investment but limited by the smartphone ecosystem	
	③ Build a connected ecosystem	• Huawei, Geely/Meizu: create seamless user experience between cars and smartphones, but relying on smartphones	

The essence of car-to-phone connection: build a bridge connecting the cockpit with other terminals → create seamlessly connected user experience

AIGC Shapes a New Generation of Smart Cockpit Interaction

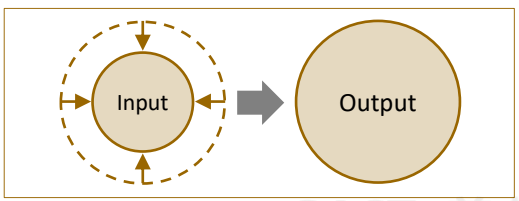
■ AIGC would disrupt the way humans interact with machines in the smart cockpit

Evolve from multi-mode input to a unified AIGC foundation model in the smart cockpit → more comprehensive and efficient



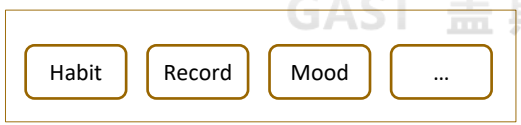
AIGC enables more efficient interaction, better memory, and more considerate experience for users in the smart cockpit

Break the existing balance between the input and output of cockpit interactions



- AIGC could greatly reduce the input → Only require simple instructions/selections
  - For example, the user would get a high-quality picture after a simple description of the content and the style of the picture

Smarter intelligent assistants



- Provide accurate and comprehensive judgment and advice based on people, things, environment, etc.
  - For example, the system would recommend destinations/points of interest based on the weather, schedule, mood, etc.

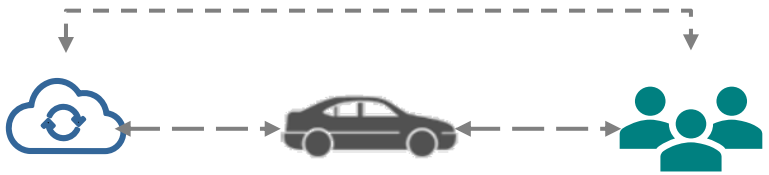
□ **AIGC would make cockpits better understand people and free them from the driving task → become a smarter third space**

*AIGC: AI Generated Content

Case: Banma's AI Foundation Model Enables Novel Cockpit Interactions

■ Banma's AliOS is weaved into Tongyi Qianwen for testing, creating human-like interactions and providing user-specific experience

Tested based on Tongyi Qianwen



Cloud
- ➢ Cloud AI capabilities based on the foundation model
- • Multi-source data, expertise, service access, etc

Vehicle
- ➢ Platform frame layer: SOA based on the foundation model → enabling faster co-development
- ➢ Underlying system layer: automatic code generation, increasing the programming efficiency

User
- ➢ Safe, smooth, personalized, and emotional experience

Co-Pilot experience

Emotional interaction

Data drives interactions in different scenarios
- • Automatically create atmosphere in line with emotions according to the weather, user mood, etc. based on the foundation model

↓

Translate the cockpit into a space that "would change according to the user's mood"

Full-stack AI capability

The foundation model would complete the production after the input of user demand

Scenario customization | Behavior prediction | Multi-source perception | Product realization

□ **Smart cockpit interactions would involve numerous players and diverse modes, which would become an important arena for the application of AI foundation models**

*Information source: 2023 Shanghai Auto Show

Contents

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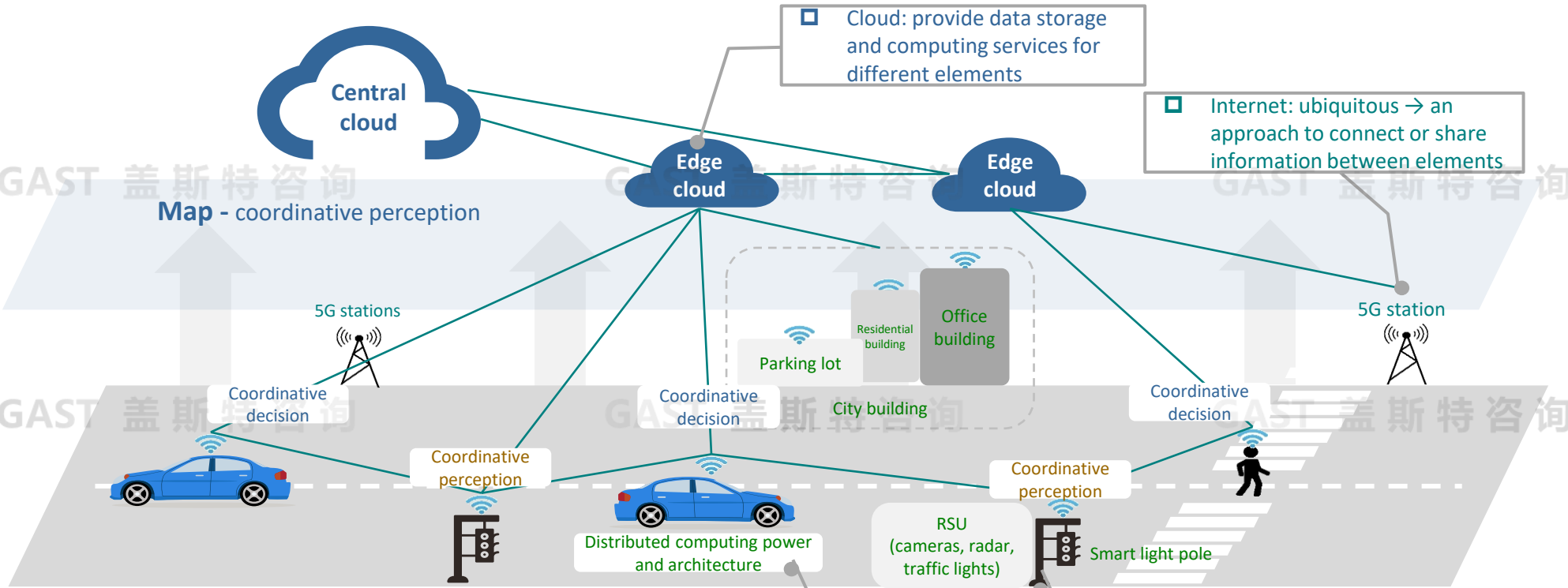
Development Trend of AD: Multi-Player Coordination

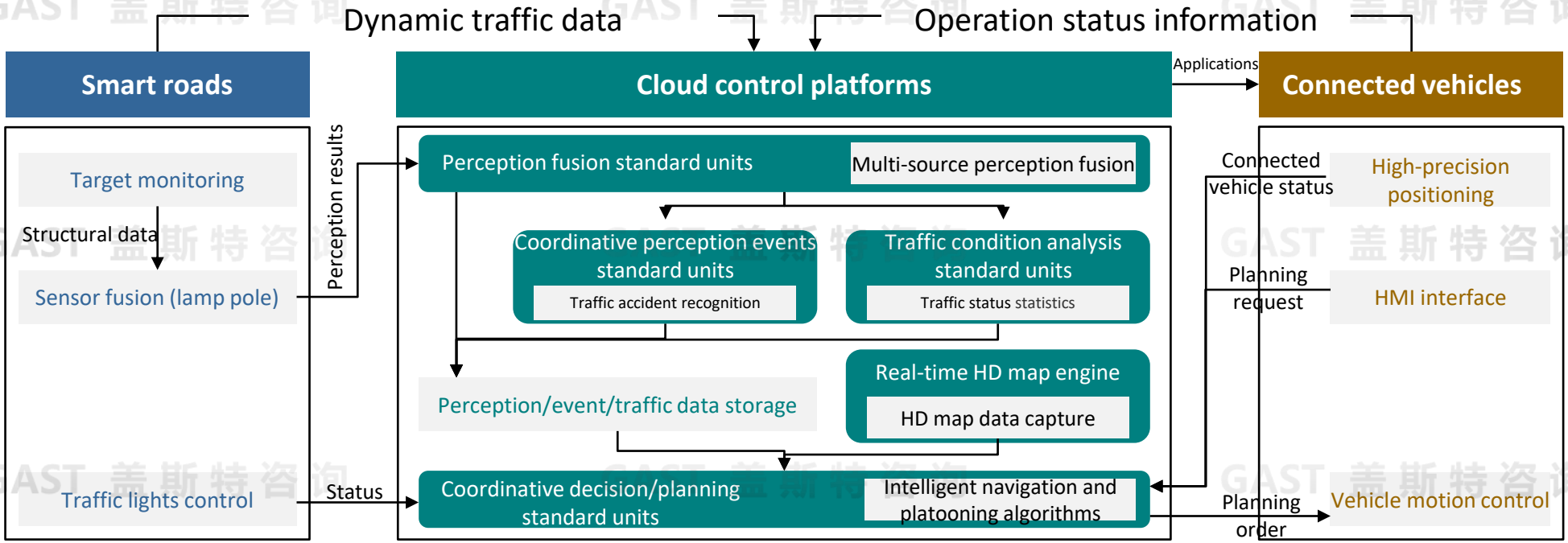


- Cloud: provide data storage and computing services for different elements
- Internet: ubiquitous → an approach to connect or share information between elements
- Distributed computing power: coordination between vehicles, roads, and clouds → secure the storage computing
- Distributed architecture: coordination between vehicles, roads, and clouds → enable comprehensive connection
- Distributed perception: coordination between vehicles, roads, and maps → full interaction of information

Truly realizing AD relies on various elements (vehicles, roads, clouds, networks, maps, etc.) and players to work in a coordinated manner: achieve seamless connection of data by interconnecting computing power, architecture, perception, etc.

Architectures Enabling V2X-Based Autonomous Driving

- Some or all of "perception, decision, planning, control, and execution" are available on the cloud, enabling integrated perception, decision, planning, and control based on the integrated computing and connectivity



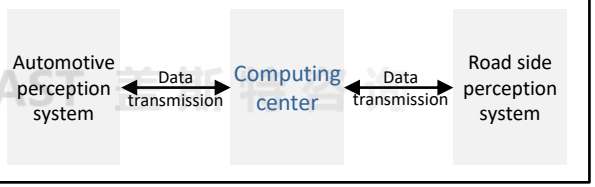
- **Integrate physical-cyber space of vehicles, roads, and clouds and help vehicles to handle global improvement and edge cases based on cooperative sensing, decision, and planning → enabling safe, energy-saving, and efficient operation**

Classifications of Sensor Solutions for V2X-Based Autonomous Driving

- Coordinative perception boasts the characteristics of open view, large perception scope, and long range of perception, which can address the weakness of automotive and roadside sensors and facilitate the development of global perception

Centralized coordinative perception

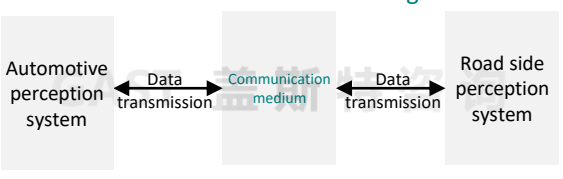
- Deploy multiple sensors in a centralized manner to collect and process data



- Advantages: all data are integrated and processed in a unified manner → high processing efficiency, high reliability, more comprehensive environmental views, enabling real-time processing and quick decision-making
- Disadvantages: such a resource-intensive mode requires higher computing power of the central computing module; higher requirements on communication load capacity in case of too many traffic participants

Distributed coordinative perception

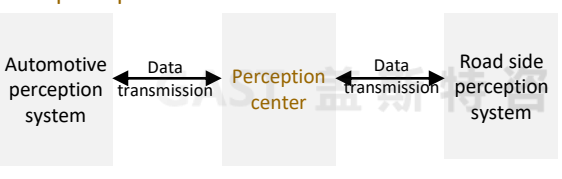
- Integrate automotive and road-side perceptual computing and every vehicle generates local environment maps based on its perception data and shares data with surrounding vehicles



- Advantages: each intelligent unit process data processing separately → low requirements on the computing power of the computing module, less resource-intensive but still effective even in heavy traffic
- Disadvantages: there is a risk of unreliable detection in the identification system and contradictory perception results might arise from intelligent units, casting a shadow over the reliability

Hybrid coordinative perception

- Integrate the centralized and distributed solutions and combine the results of the centralized perception and distributed perception results of connected vehicles

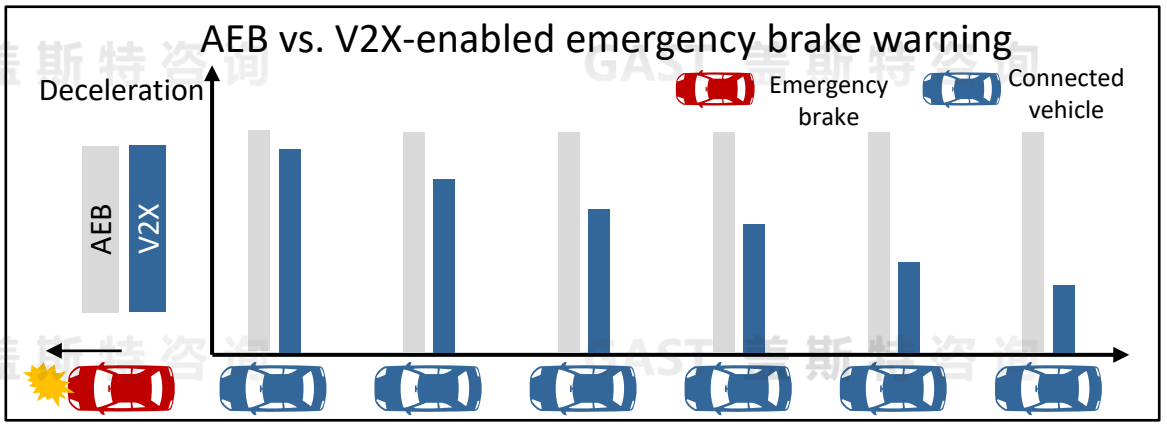


- Advantages: the central computing module can process data primarily processed by intelligent units, reducing the demand on computing power to a certain extent → broader coverage and higher perception accuracy
- Disadvantages: complicated and fickle sources of processed data, raising higher requirements on the development of data processing strategies

Existing Application Value of V2X-Based Autonomous Driving

- With a low level of intelligent driving or a low penetration rate of connected vehicles, V2X would continue to function

Value of V2X to L2 driver assistance

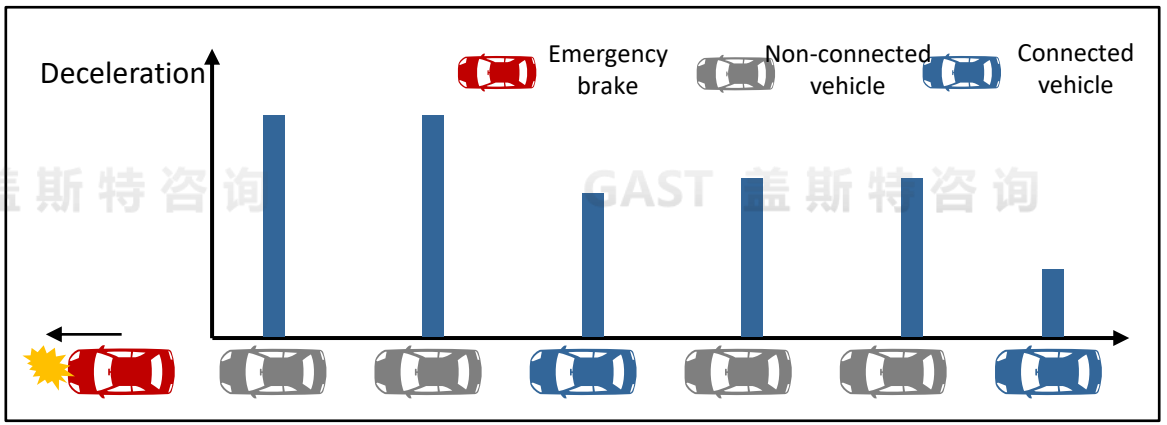


- Misunderstanding: V2X-based safety warning and ADAS are overlapped in functions → no new value

Analysis

- The rear-end collision risk avoided by AEB may affect the following vehicles. As a supplement to ADAS, V2X could further reduce the risk of rear-end collision and protect more non-connected vehicles

Value of V2X during the technology trigger



- Misunderstanding: V2X has limited contributions to traffic safety in case of a low penetration rate

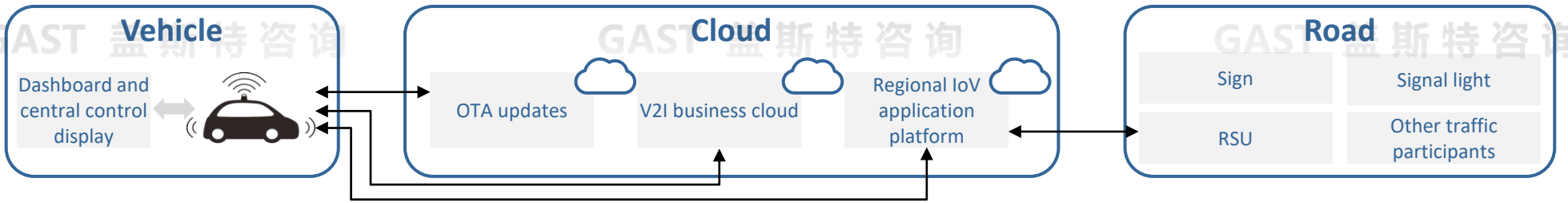
Analysis

- With a penetration rate of 10%, 1% of double-vehicle accidents and 10% of connected vehicle accidents would be directly avoided → V2X could recognize 29%* of emergency braking events and protect more non-connected vehicles

*Data source: "*Practice in Integrating Content Value-Oriented V2X with Intelligent Technologies for Vehicles*" by Ph.D. Wang Yinsong

Case: Status and Plan of Ford for the Application of V2X to Production Cars

- Ford adopts the "vehicle-road-cloud" network to apply its V2X technology to production cars, connecting the dashboard, road signs, and signal lights. Ford has launched 6 primary V2X functions



Commercialization

Six features

Traffic light signal	Green light reminder	Green wave speed guidance	Red light warning	Road information broadcast	Electronic road sign

➢ **Available for large-scale and standard commercial applications,** it is a starting point for the commercialization of V2X

Seven cities

2021				2022				2023	
Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
Wuxi	Changsha		Guangzhou		Xi'an		Nanjing/Wuhan		Changchun

Short- & medium-term plans

➢ V2X, as an independent product, works closely with L2+ systems. PC5 is directly connected with V2V to enable more applications when vehicles run on highways

- V2V and V2P: "direct connection" has a competitive edge in scenarios with higher safety requirements, which would enable emergency brake light warning, intersection collision warning, etc.
- V2I (vehicle to highway infrastructure): further improve driving safety and efficiency, enabling the warning of scattered objects on the road, etc.

Case: Status and Challenges of Fords' V2X Application in Commercial Service

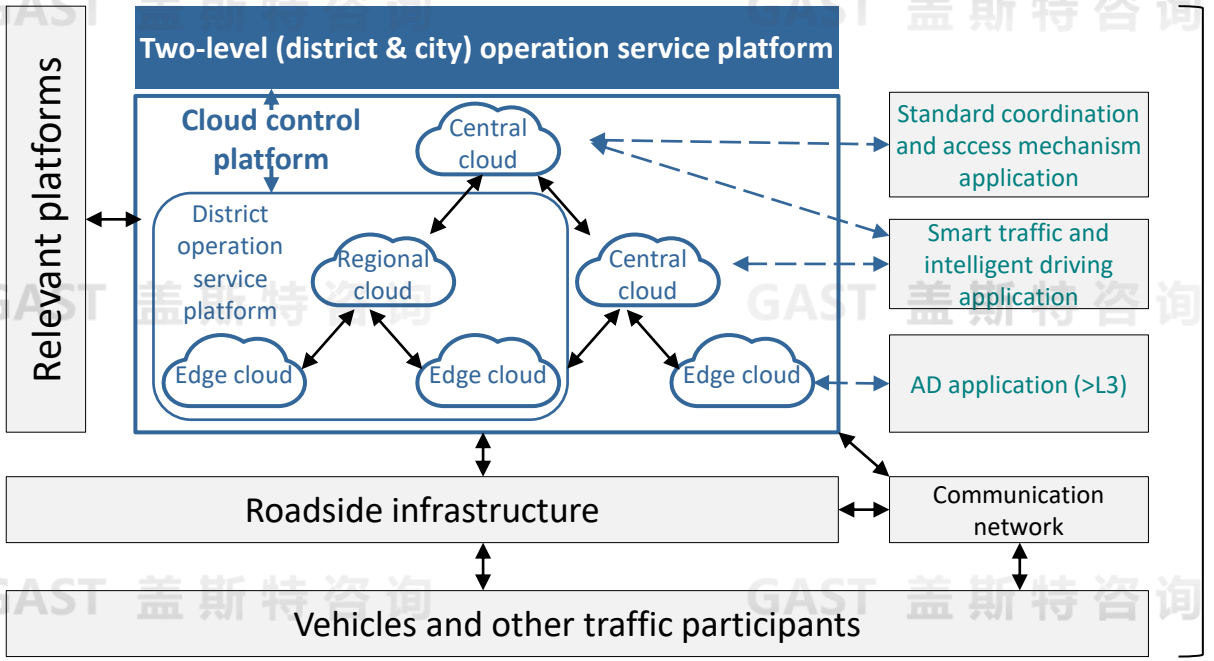
- Ford's V2X is deeply integrated with vehicles, requiring no addition of hardware, enabling OTA updates, and prioritizing user experience based on road conditions in China

User operation	Registered users: **64,000+**	User visits: **32,000+**	Service users: **10,000+**	MAU: **50%+**
Feedback	➢ Users are not well aware of the functions like green wave guidance speed, electronic road signs, road information broadcast, etc.	➢ Users are less likely to pay and prefer one-off payment		
Operation problems	➢ Many uncertainties: road construction, power cut, equipment failure, inclement weather, etc.	➢ Complicated operation and maintenance: numerous V2X facilities, heavy load, massive interactive units, and too many maintenance interfaces		
Challenges	➢ Data source and authority are the main roadblocks that hinder the large-scale commercialization of V2X ➢ Major problems: unclear division of duties between data, platforms, and terminals; non-business-oriented operations	Commercializing V2X requires better division of duties and cooperation	**Data operators** Have regional characteristics; asset-heavy operation + **Platform operators** Data collection, compilation, distribution; full competition + **Terminals** Smart vehicles, smartphones…	

- **Ford plans to accelerate the large-scale application of V2X into services, improving the coverage and quality of data, extending the safety levels to platforms and roads, and driving V2X and AD to develop in a coordinated manner**

Case: Development of V2X Platforms for Three Districts in Suzhou City

- Suzhou adopts a three-level ("center-region-edge") cloud architecture that covers Xiangcheng District, Industrial Park District, Changshu City and G524, forming a cloud control platform system composed of "three districts and one corridor"



Features

Industrial application

- Perception of all transportation environmental elements, accurate space-time information service, V2X services, ICVs supervision, global traffic situation analysis, traffic information control optimization, integrated simulation test evaluation, real-time and holographic digital-twin models

Infrastructure application

- Multi-sensor fusion, real-time AI video recognition, real-time holographic road network, vehicle-road-cloud gateway, multi-source heterogeneous data access and processing, test scenario library, dedicated technology engine, security verification, monitoring and command centers

Suzhou's V2X cloud control platform has been initially available for local facility takeover, data analysis, information release, and safety regulation. However, cross—district construction and operation would result in different standards and regulations, making it hard to develop in a coordinated manner

Summary

Key Takeaways of the CICV 2023

- **SDV emphasizes the construction of ecosystems in which players work in a coordinated manner to jointly create SW & HW ecosystems**
  - After defining an architecture, OEMs would join in the application software development ecosystem with HW providers, algorithm suppliers, OS vendors, middleware suppliers, etc.
  - Generalized operating systems for cars are evolving from traditional vertically coupled architectures to those with vertically layered modules, which would eventually become distributed service-oriented architectures with microkernel → The core of OEMs to develop ecosystems
  - Different automotive function domains have different requirements on functions and performance → Rely on virtual technology to realize "1-to-N" of the OS, thus enabling the integration of domains
  - Since the development and industrialization of computing platforms are flourishing, all kinds of participants in industrial ecosystems start to develop computing platforms for smart vehicles
- **Smart cockpits involves numerous factors and players, making it impossible for one player to complete the development, thus requiring ecosystems the most**
  - Numerous players develop new ecosystems for smart cockpit products in a coordinated manner, covering the whole life cycle from demand to products
  - Unified OS is the key to connecting car-phone ecosystems → creating seamlessly connected user experience
  - Information interactions of intelligent driving and smart cockpit domains get closely integrated, enabling the sharing and reuse of key sensors, functions, algorithm modules, etc.
- **The true realization of AD entails various factors (cars, roads, clouds, networks, maps, etc.) to work in a coordinated and intelligent manner**
  - Build interconnectivity between cars, roads, clouds, etc. in computing power, architectures, sensors, etc. to enable seamless connection of data
  - Integrate physical-cyber space of vehicles, roads, and clouds and help vehicles to handle global improvement and edge cases based on cooperative sensing, decision, and planning
  - With a low level of intelligent driving or a low penetration rate of connected vehicles, V2X would continue to function
  - OEMs take active steps to develop feasible V2X applications and improve user experience, which would accelerate the development of V2X and AD technologies

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Company Profile

Setting its foothold in China automotive industry, GAST Strategy Consulting, LLC is oriented to the globe to focus on the ecosystem of the whole automotive industry and starts from three dimensions (industry, enterprise and technology) to carry out in-depth study on strategy design, business positioning, management improvement, system building, business process reengineering, product planning, technology choices and business models. It is dedicated to providing governments at all levels with decision-making support and implementation advice and enterprises in the automotive industry chain and relevant industries with all-dimensional high-level professional consulting services in strategies, management and technologies. Since the establishment, GAST is dedicated to becoming a world top auto think tank as the vision and sharing wisdom as the mission. Adhering to creating value for clients and focusing on actual effects, GAST commits itself to forging long-term partnership and providing guidance service. It has fostered strategic partnership with and is providing services for nearly 100 domestic and international enterprises, organizations in the automotive industry and governments at all levels by virtue of comprehensive, systematic, advanced and pragmatic consulting methods.

Range of Service

Provide diversified and open services and flexible ways of cooperation for customers, including but not limited to:

- Executive-oriented strategy, management and technology consulting services
- All-round and customized special project research: covering macro strategy, industrial development, interpretation of policies and regulations, the internet, business models, corporate strategy and management, auto market, product research, product design methodology, research on auto shows, interpretation of forums, energy conservation and emission reduction, new energy vehicles, intelligent vehicles and comprehensive automotive technologies
- Serve as reliable resource that can win customers' long-term dependence and provide open cooperation that can meet customers' specific requirements at any time
- Provide a high-end sharing platform (CAIT) for industrial communication, exchange and in-depth research
- The company provides nearly 1,000 research reports in Chinese, English and Japanese at present

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