

Introduction to MEC-based C-V2X System standards and the industry in China

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(1) Technology and Standardization of MEC-based C-V2X System in CCSA

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		Application			
	Assisted Driving	Automated Driving Remote Driving Traffic Efficiency Telematics			
	Platform-Platform	Platform			
Message —Data — Interface	Roadside-Platform	V2X (Vehicle to Everything) Platform Management Platform, Traffic Monitoring Platform, TSP, Location Server, etc.)			
	·``	Networking Communication			
	Vehicle-Platform	Wire communication Wireless communication			
	Vehicle-Roadside	Vehicle - Roadside - Pedestrian			
	Vehicle-Vehicle	Roadside Sensing and Computing EquipmentNetwork InfrastructurePositioning InfrastructureOther InfrastructureOther Communication 			

Technology and Standardization Architecture of MEC-based C-V2X SystemCAICT 中国信通院

CCSA TC10 focuses on the standardization of application-oriented C-V2X services based on MEC architecture.

	Application					
A	ssisted Driving	Automatic Driving Remote Driving Traffic Efficiency Telematics				
Message — Data — Interface	Platform-Platform	Platform				
	Roadside-Platform	V2X (Vehicle to Everything) Platform Others (including Mobility Service Platform, Traffic Management Platform, Traffic Monitoring Platform, TSP, Location Server, etc.)	c			
		Networking Communication				
	Vehicle-Platform	Wire communication Wireless communication				
	Vehicle-Roadside	Vehicle - Roadside - Pedestrian				
	Vehicle-Vehicle	Roadside Sensing and Computing Equipment Network Positioning Infrastructure Other Other Equipment Infrastructure Infrastructure Terminal	on			

Capability Requirement:

- Business Platform: Service architecture, technical requirements, functions and performance testing methods for platform services.
- Operation and Maintenance Management Platform: Technical requirements and test methods for operation and maintenance management of RSU, roadside sensing equipment, and roadside computing equipment



Architecture of MEC-based C-V2X System

Interface Requirements:

- Northbound Interface: Platfom capability opening and interface technical.
- □ Southbound Interface: Data interface and communication protocol with roadside equipment
- Eastbound and Westbound Interface: Cross domain collaborative interaction between MEC.

Capability Requirement (1) : Service Architecture and Requirements CAICT 中国信通院

□ YD/T 4358-2023 MEC service architecture and requirements for LTE-V2X

Standardize the business functional requirements, performance requirements, business architecture, system interface and application interface requirements for the integration of MEC and LTE-V2X.



- MEC platforms for LTE-V2X can be divided into two categories based on platform location:
 - Uu type MEC : When the MEC platform is located within the LTE network, the terminal can access the LTE network through the Uu interface and then access the MEC platform.
 PC5 type MEC : When the MEC platform is relatively independent of the LTE network, the terminal can connect to the RSU through the PC5 interface and then connect to the MEC platform.

□ YD/T 4477-2023 Technical Specification of MEC platform for C-V2X Services

Standardize the technical requirements and test methods of the multi access edge computing (MEC) platform for C-V2X



Function:

- **Device**: device access (RSU, RSCU, radar, camera, business terminal, etc.)
- Data: data type, data operation, data analysis and processing, data usage
- Events: event type, event operation, event processing
- Service capability openness: middleware, service output layer
- Supporting capabilities: edge application management, dynamic resource allocation, security, and business monitoring

Performance:

storage performance, stability

Interface Requirements (1) : Southbound Interface

- TCCSA 455-2023 Internet of vehicles platform and roadside infrastructure-requirements for data interface and communication protocol
- Vehicle-road coordination system—technical requirements for operation and maintenance management platform of roadside equipment

Technical requirements and test methods for the southbound interface between the platform and roadside equipment

Business interface:

Standardize the interaction content and communication protocol of business data between the platform and roadside units and roadside computing units



> Operation and maintenance management interface

Standardize the interaction content and communication protocol of operation and maintenance management data between the platform and roadside units, roadside sensing devices, and roadside computing devices

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□ YD/T 4359-2023 Technical requirements of message layer of LTE-based vehicular communication

Standardize the corresponding capability requirements, dataset requirements, and API requirements for various scenarios of C-V2X.



Interface Requirements (3) : Eastbound and Westbound Interface CAICT 中国信通院

Technical requirements of cross domain collaborative interaction based on edge computing (Draft for Examination)

Research on Business Migration Process and Context Specification of C-V2X Based on MEC.



- Heterogeneity exists among MEC service providers within the city.When vehicles move from MEC Host1 to MEC Host2, C-V2X service migration involves service providers and data interfaces.
- Solving the business continuity problem of C-V2X services between heterogeneous MEC service providers at the application level



(2) Industry of MEC-based C-V2X System in China

IMT-2020(5G) Promotion Group C-V2X WG has established the testbed to verify **cross manufacturer, multi perception, multi roadside terminals, and multi application service** environment based on the MEC-based C-V2X System.

2019-2021

2021-2023

• MEC-based C-V2X System Testbed (First Batch)

Promote the formation of consensus among various parties in the industry on **concepts**, **system architecture**, **and basic capability requirements**. Typical C-V2X applications have been **small-scale validated** in scenarios such as **factory**, **smart public transportation**, **urban operations and park testing environments**



Consensus on the three-layer platform architecture of roadside, edge and region

System capability verification, including platform functionality, performance, etc

Testing and verification of typical application environments

MEC-based C-V2X System Testbed (Second Batch)

Driverless solutions for

vehicles

factory offline

Closed park

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2019-2021 • MEC-based C-V2X System Testbed (First Batch)

2021-2023 • MEC-based C-V2X System Testbed (Second Batch)

The solution of multi-level MEC platforms combination has been deeply practiced. A larger, standardized environment for interconnectivity across provinces, regions, and manufacturers has been validated.



Deployment Practice of Multi level MEC Platform System Architecture



Cross regional and interconnected application environment

Application Cases of MEC-based C-V2X System Testbed (Second Batch) CAICT 中国信通院



Changzhou Testbed: Two level platforms of "5G edge+region". **5G independent experimental network**. Low latency, secure and reliable, and resilient **computing network environments** based on QoS, slicing, IPsec, and other technologies. **Dual broadcast application** services of 5G and V2X.

Nanjing Testbed: : 5G+V2X integrated networking architecture. Three level platforms of "Roadside+Edge+Region". Rich application scenarios such as precision bus, autonomous driving, and intelligent networking.





Chongqing Testbed: Three level platforms of "Roadside+Edge+Region". **Self-developed rapid calibration tools** greatly improve the accuracy, efficiency and safety of equipment calibration. Explore the application of **pure vision multi-source perception fusion and perception quality monitoring**.

Application Cases of MEC-based C-V2X System Testbed (Second Batch) CAICT 中国信通院



Gansu&Beijing Testbed: Two level platforms of "5G edge+region". Develop a **remote upgrade system** for MEC and vehicle road collaborative applications. Realize **traffic control, vehicle road collaboration, and autonomous driving scenarios**

Jingjinji Testbed: Interconnected three-level platform environment across Beijing, Tianjin, and Xiong'an. Realize **100+ intelligent travel service scenarios** for car hailing, driving, and parking.





Tianjin Testbed: Provide 5G-based applications of security, efficiency and information reminder **through apps, mini programs, rearview mirrors**, etc. Achieve cross-brand terminal connectivity

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CAICT has built MEC-based C-V2X System testing capabilities, including interfaces, services, operations and maintenance capabilities, to assist the industry in product development and application deployment





THANKS

