



中国汽车工程学会  
China Society of Automotive Engineers



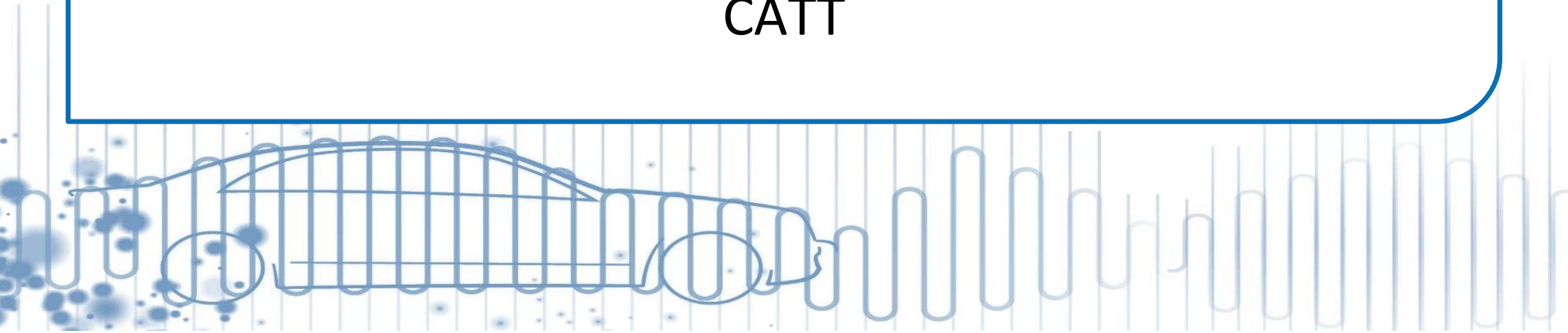
中国智能网联汽车产业创新联盟  
China Industry Innovation Alliance for the Intelligent and Connected Vehicles

中信科智联

China Academy of Telecommunication Technology

# CAICV ICV Future Requirements

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CATT



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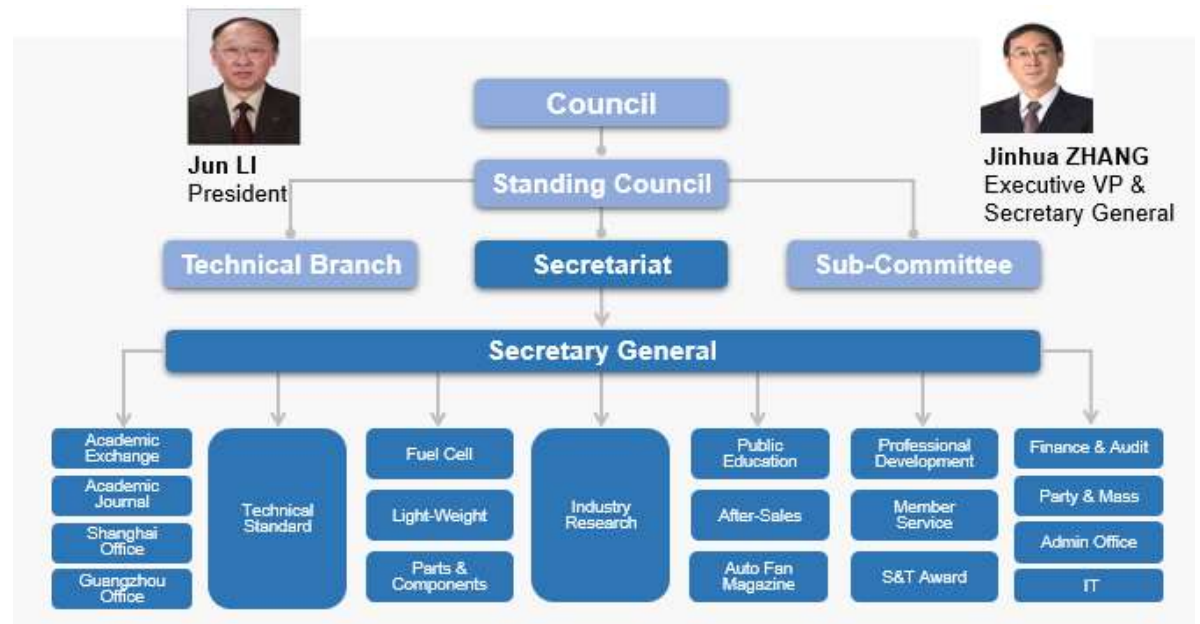
# CSAE

❑ China Society of Automotive Engineers (China-SAE or CSAE), a national academic organization, was founded in 1963, the secretariat is set up in Beijing.

❑ CSAE has more than 70, 000 individual members, mainly for automotive science and technology engineers.

❑ CSAE's main services include academic exchange, automotive policy research, collaborative innovation, talent training, technical standards.

Individual members:	70,000+
Registered members:	110,000+
Unit members:	1,900+

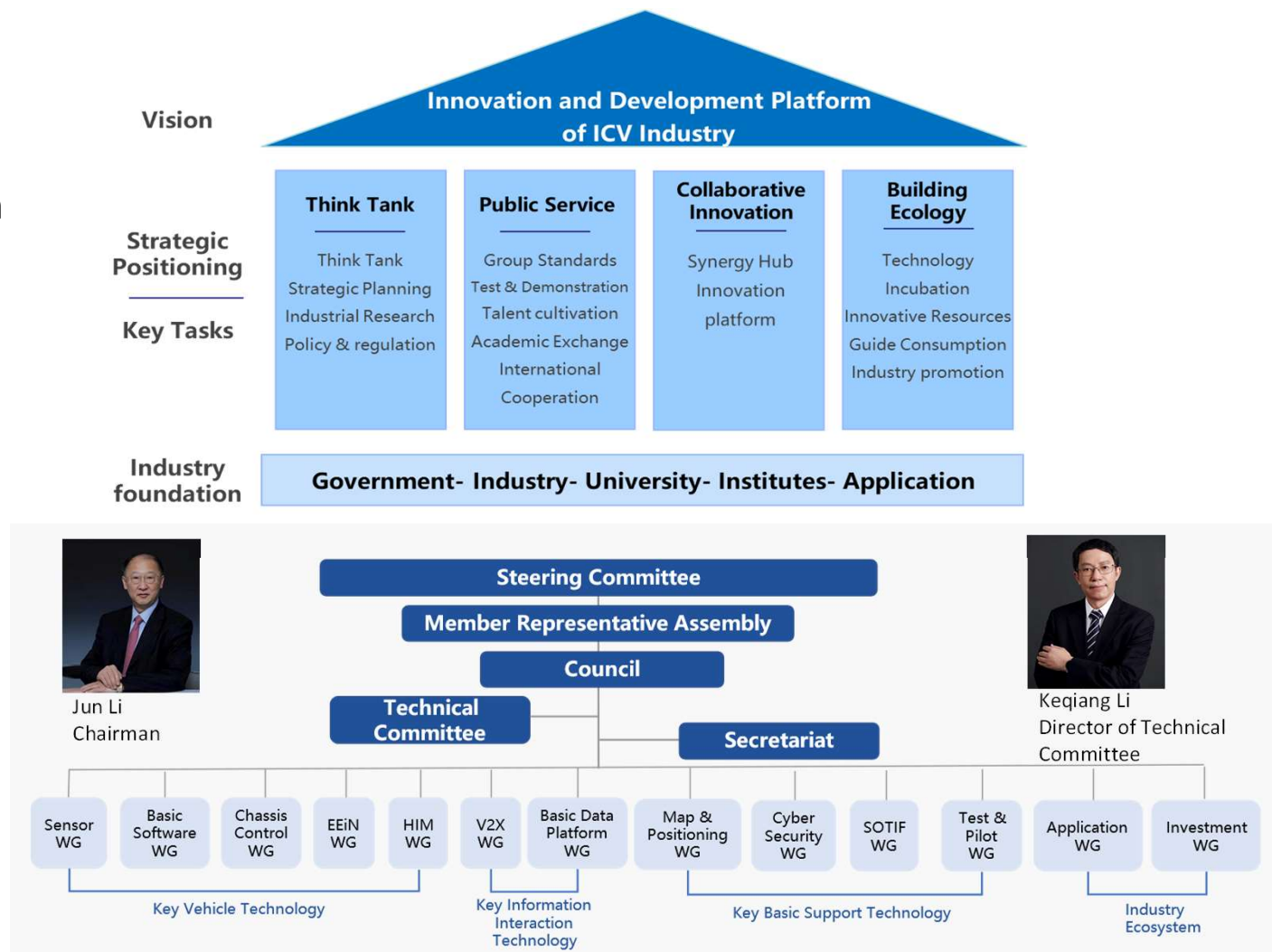


# CAICV

□ China Industry Innovation Alliance for the Intelligent and Connected Vehicles (CAICV) was initiated by China SAE and the China Association of Automobile Manufacturers (CAAM), with the support of MIIT on June 12, 2017.

□ CAICV has more than 500 members, including companies, universities, and institutes from the automotive, telecommunication, transportation, and internet industries.

□ CAICV has 13 working groups for different technical fields.



# Vision & Mission

**Build an important innovation and development platform for China's ICV industry**

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## **Industry lead**

World-renowned  
professional  
think tank



## **Public Service**

World-renowned  
group standard body



## **Collaborative Innovation**

World-renowned ICV  
Innovation Center



## **Industry Ecosystem**

Build  
ICV ecosystem



# Visions of ICVs

- China will achieve the grand goal of building an automobile power, to drive the mobility of society towards a direction of sustainability, and to meet the people's expectation for a better life.
- This is demonstrated by safety, efficiency, energy conservation, emission reduction, comfort and convenience and user-friendliness.



# General Objectives of ICVs

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## □ By 2025,

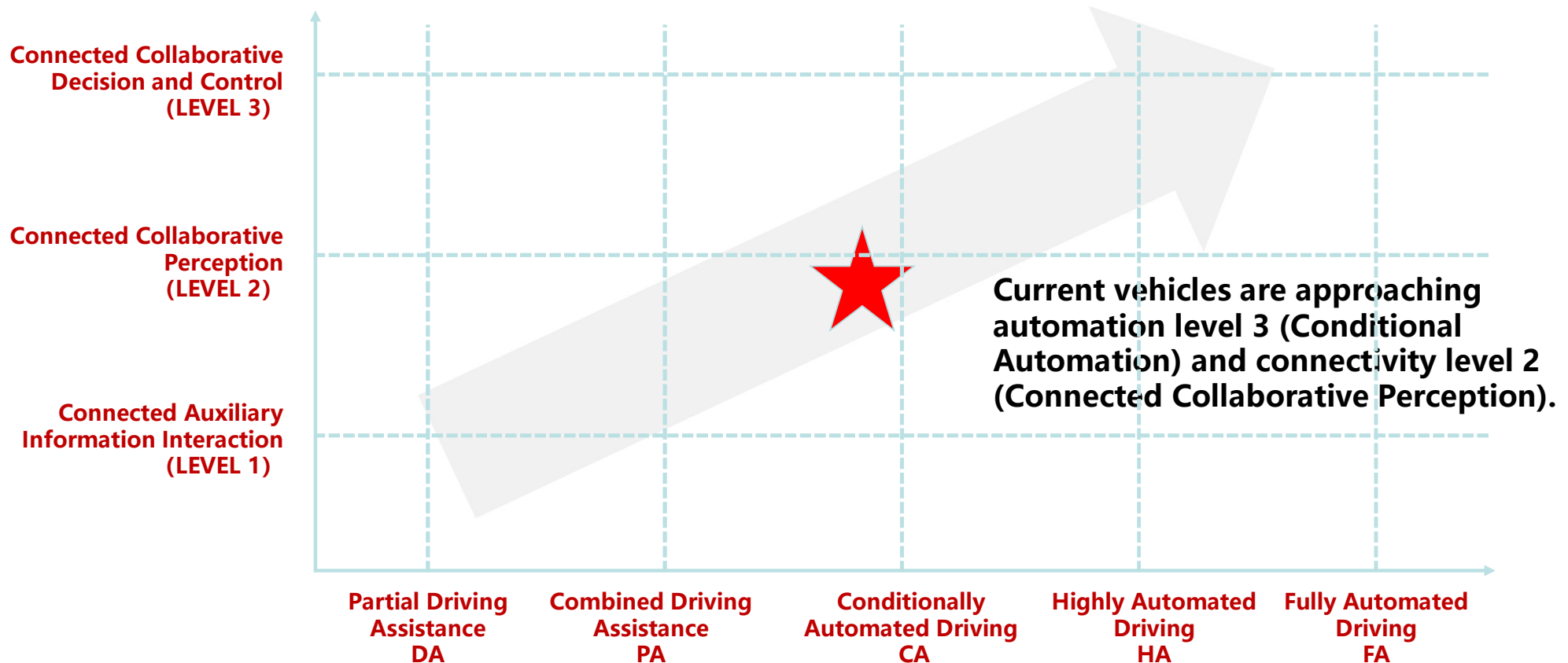
- level 2 & level 3 ICVs account for more than 50% of the new cars.
- level 4 ICVs begin to enter the market.
- The C-V2X terminal equipment rate for new vehicles reaches 50%.
- The connected collaborative perception technology is to be applied in some scenarios incl. highways, some urban roads and closed areas

## □ By 2030,

- level 2 & 3 ICVs account for more than 70% of the new cars.
- level 4 ICVs is 20%.
- new vehicle equipped with C-V2X terminal is popularized
- vehicle-road-cloud integrated ICV with the collaborative decision-making will enter the market.

# Levels of Automation and Connectivity

- The classification method of integrating automation and connectivity is proposed, with 5 levels of automation and 3 levels of connectivity. The fully autonomous Driving will be realized by the convergence of automation and connectivity.





# China C-V2X Industry Developments

## C-V2X Infrastructure Takes Shape



## Vehicles Announced Equipped with C-V2X

				
上汽Marvel R	红旗E-HS9	别克GL8	奥迪A7L	蔚来ET7
				
广汽埃安 V	长城WEY	福特锐界 PLUS	高合HiPhi X	北汽极狐 ARCFOX
				
上汽通用 GL8Avenir	威马W6	福特探险者	吉利星越L	

Test & Verification Activity

17 National ICV Demonstration Areas

4 National IoV Pilot Areas

16 Smart Infrastructure & Smart Vehicle Pilot Cities

## Obstacles Impeding Industry

### Infrastructure side

- Roadside infrastructure need time & money to build or upgrade
- C-V2X deployments need to be improved, RSU coverage especially for intersections and important sites
- Reliable information can be accessed , for example Traffic light, dynamic road info...

### Vehicle side

- Long lifecycle , need more time to introduce new feature
- OBU penetration need to be improved
- Killer application ?
- Evaluation system for communication component

Business model need to be explored  
and need more collaboration across different stakeholders

# ICV Application Evolving : C-V2X Day 1 & Day 2 Applications

T/CSAE 53-2020 Cooperative intelligent transportation system-Vehicular Communication application layer specification and data exchange standard(Phase I)

No.	Application name
1	Forward Collision Warning
2	Intersection Collision Warning
3	Left Turn Assistant
4	Blind Spot Warning / Lane Change Assist
5	Do Not Pass Warning
6	Emergency Brake Warning
7	Abnormal Vehicle Warning
8	Control Lost Warning
9	Hazardous Location Warning
10	Speed Limit Warning
11	Signal Violation Warning
12	Vulnerable Road User Collision Warning
13	Green Light Optimal Speed Advisory
14	In-vehicle Signage
15	Traffic Jam Warning
16	Emergency Vehicle Warning
17	Vehicle Near-field Payment

YD/T 3977-2021 The requirements standard for enhanced V2X application layer data interaction

T/CSAE 157-2020 Cooperative intelligent transportation system-Vehicular Communication application layer specification and data exchange standard(Phase II)

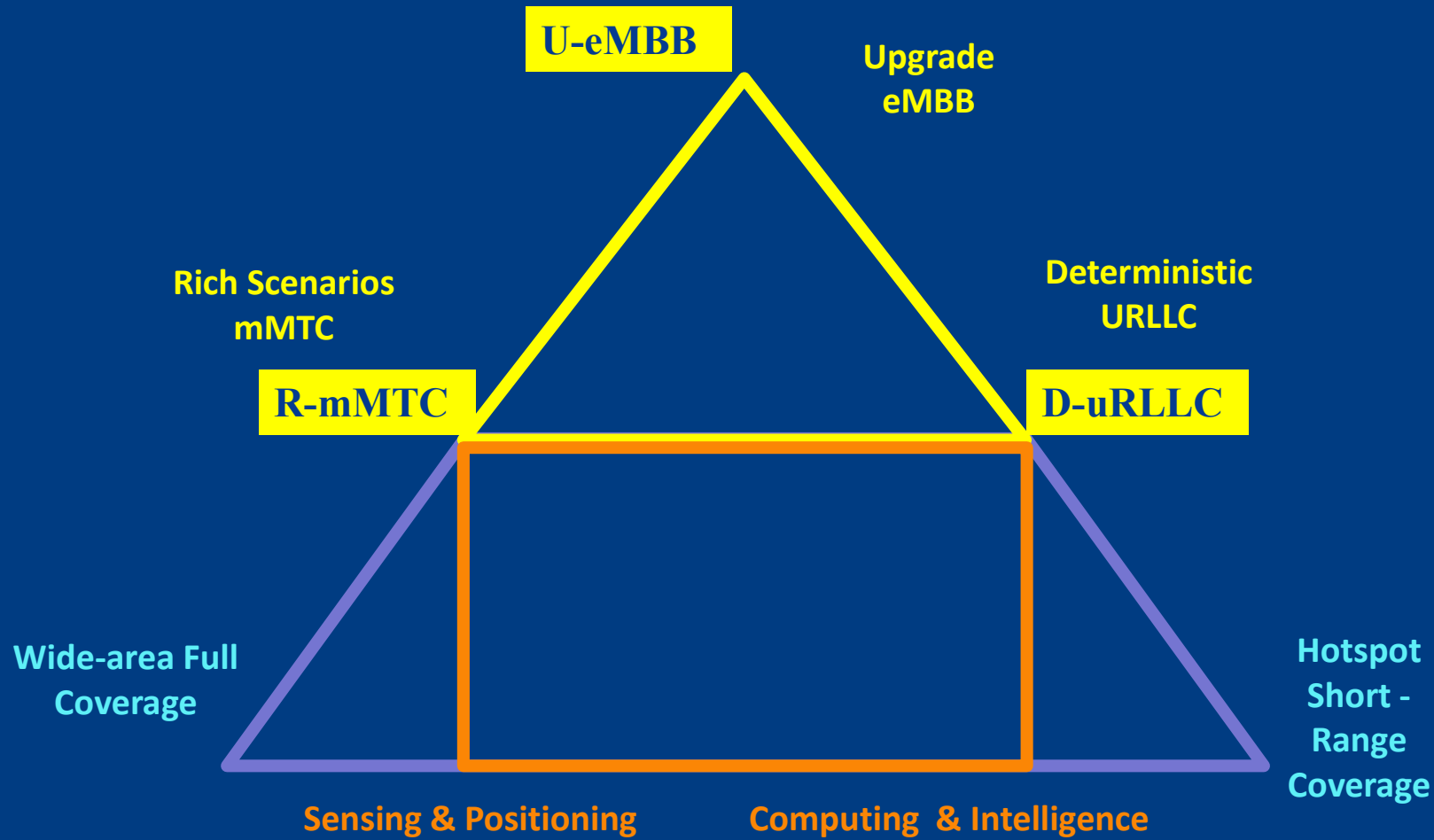
No.	Application name
1	Vehicle Merging
2	Vulnerable Road User Recognition
3	Intersection Crossing based on Vehicle-infrastructure Cooperation
4	Vehicle Route Guidance
5	Dynamic Lane Management at Intersection
6	Dynamic Optimization of Traffic Signal Timing based on Real-time Connected Data
7	Intelligent Parking Guidance
8	Vehicle Platooning Driving
9	Cooperative Platooning Management
10	Flexible Management of Expressway Dedicated Lane
11	Active and Passive Tolling based on Vehicle-infrastructure Cooperation
12	Dynamic Path Planning of Electric Vehicle
13	Remote Software Upgrade based on Vehicle-infrastructure Cooperation
14	Hardware In-the-loop Simulating of Automated Vehicle based on Vehicle - Infrastructure Cooperation

No.	Application name
1	Sensor Data Sharing
2	Cooperative Lane Change
3	Cooperative Vehicle Merge
4	Cooperative Intersection Crossing
5	Differential Data Service
6	Dynamic Lane Management
7	Cooperative High Priority Vehicle Passing
8	Guidance Service In Parking Area
9	Probe Data Collection
10	Vulnerable Road User Safe Passing
11	Cooperative Platooning Management
12	Road Tolling Service

T/CSAE 158-2020 (YD/T 3978-2021) Data exchange standard for high level automated driving vehicle based on cooperative intelligent transportation system

No.	Application name
1	Cooperative Perception
2	Non-signalized Intersection Crossing based on Roadside Cooperation
3	Cooperative driving for Automated vehicle out of stuck
4	High-precision Map Version Alignment and Dynamic Update
5	Cooperative Automated Valet Parking
6	Cooperative detection of "Zombie car"
7	Cooperative detection of traffic situation
8	Cooperative detection of abnormal driving behavior

# Communication Evolution from 5G to 6G



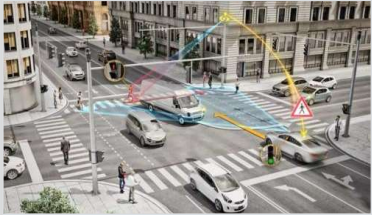
1) 、 More powerful network capability

2) 、 New service capability

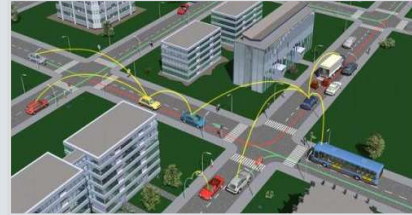
3) 、 New coverage Scenarios

# ICV Applications Specific Requirements

## Road Safety



## Traffic Efficiency



## Automated Driving



## Infotainment



### Stringent

- Safety related
- ms level Reaction time

### Fast Change

- Relative speed up to 500Km/h
- Burst Comm
- Topology
- Varying wireless channel

### High Frequency

- BSM, 10Hz
- BSM extension, PCM  $\geq 20$ Hz
- Multi to multi Comm

### Complex Scenarios

- Highway, Urban, Suburban, Tunnel
- LOS, NLOS
- Out of coverage

# Potential Connectivity Evolution for ICV

**Robust and ubiquitous connectivity, high data rate and low-latency V2X capability are key to realize full automated driving**

V2X Direct Communication enhancement

Native requirements of high precise positioning

Vehicular environment specific consideration ,such as antenna deployment

Joint communication and sensing

- Vehicular sensors to help communication
- Communication waveform help sensing

AI introduced in V2X communication

# Thanks for Your Attention



CSAE

<http://www.sae-china.org/>



CAICV

<http://www.caicv.org.cn/>



CATT

<https://www.gohigh.com.cn/>