

New characters to autonomous vehicle introduced by Connectivity

Chongqing Changan Automobile Corp.

Fan Ren



长安汽车
CHANGAN AUTO

科技长安
智慧伙伴

Connectivity introduces new characters to autonomous vehicle

A. Growth

Data Collection

- EDR
- Work status
- Driving habits
- Sensor Data
- ...

Software update

- FOTA
- Map
- Configuration
-

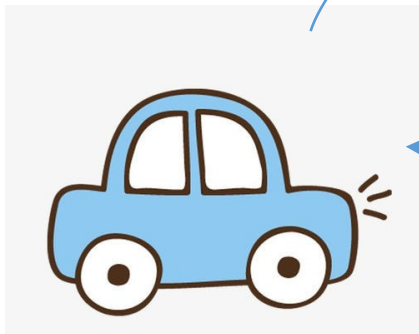
Cellular



C. Enhanced Safety by Cooperation

C-V2X
DSRC

Collision Avoidance
Assistance



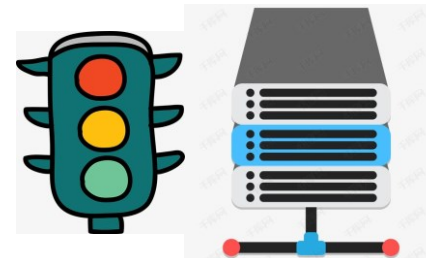
B. Service Extension

Reservation

Cellular
C-V2X

Traffic Service

- Traffic lights
- Parking status
- ...



A. Growth

Connectivity improves automotive user satisfaction, ROI and profit, especially for autonomous vehicle

- Users expect same continuous user experience as smart phone, and automated features are included
- Cost of L2++ automated system is high, so **have to** make same hardware create more value
- New business model to earn money
- High level autonomous technology takes data and time to be mature

Software Update

- Post-purchase feature enhancement
- Cross-domain functions requires associated-components update
- Purchase/Subscription management

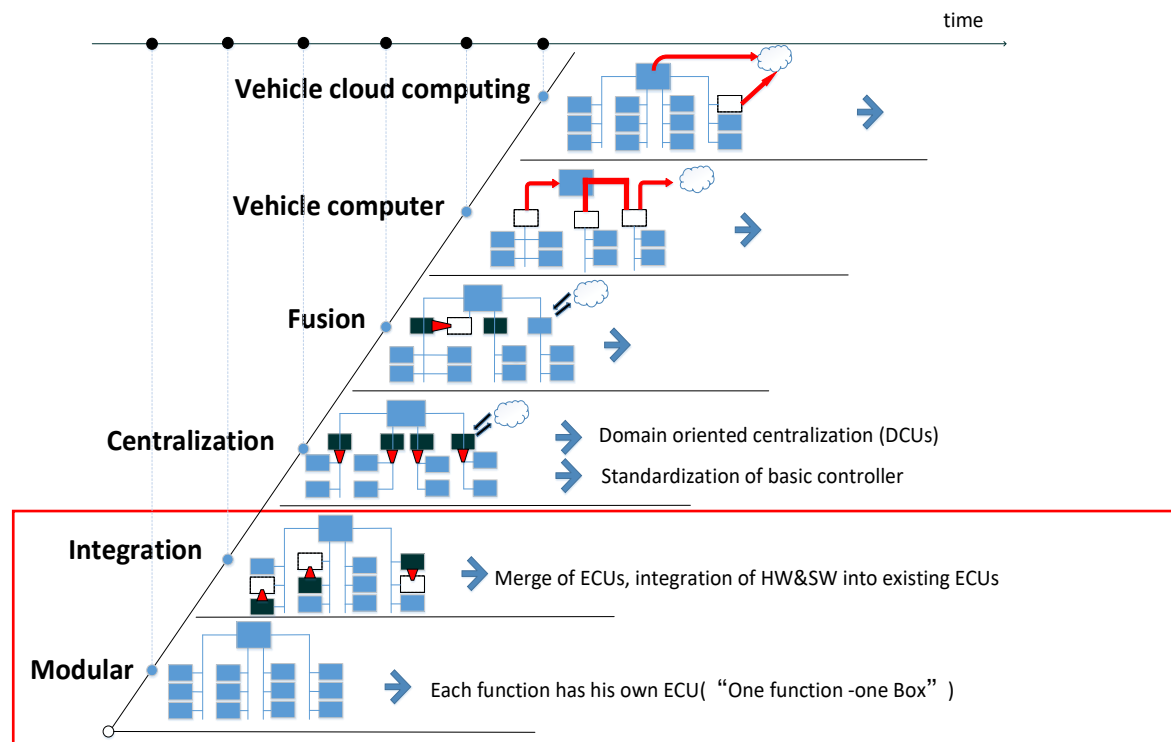
Data collection

- Close-looped data on end-cloud system
 - New feature development
 - Performance improvement
 - Validation
- EDR

**Low latency, High bandwidth cellular communication is the foundation;
Amazing data volume should be supported by new business model.**

A. Growth——Changan's Practice

- By 2020, No longer produce non-connected vehicles, All vehicles are 100% networked
- The internal network is the bottleneck instead of external network; Changan is now deploying new generation of EEA ;
- Vehicle-wide software update is supported, and Powertrain, Chassis, Body, Cockpit, ADAS/Autonomous domains are included

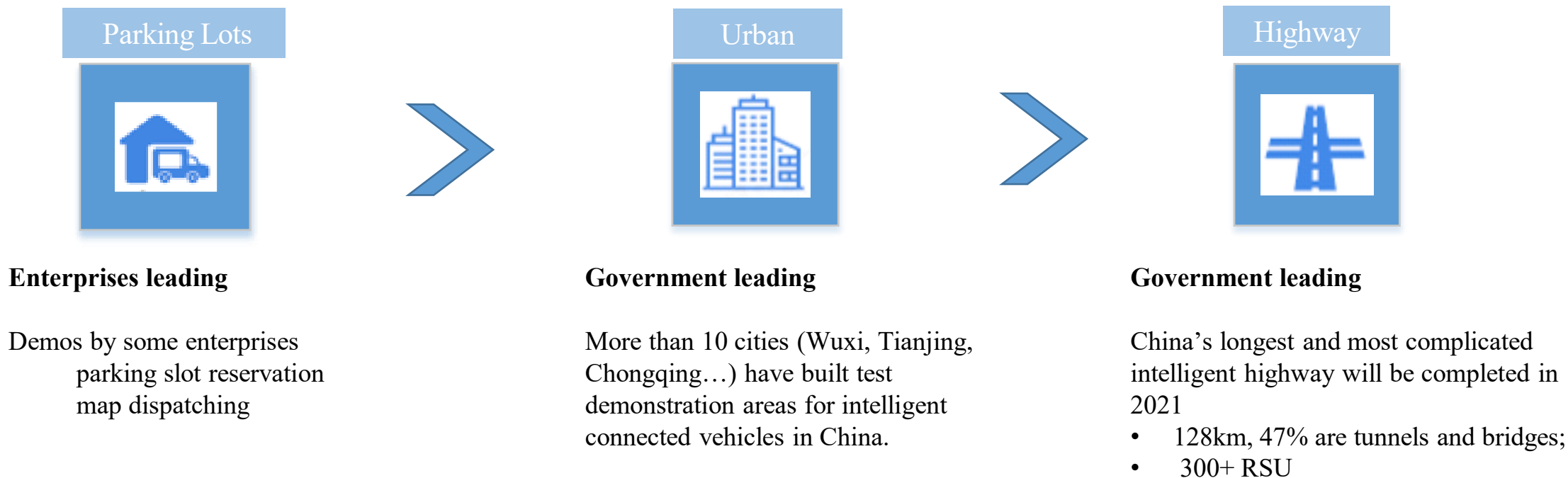


Source: Bosch

Evolution of EEA

B. Service Extension

- The more complicated the road conditions are, the more V2I based service is needed.
- Chinese government are promoting “new infrastructure construction” in the transport sector to advance its transformation to digitalization and the use of artificial intelligence.
- Some enterprises are exploring the field based autonomous parking solution



B. Service Extension——Changan's Practice

Parking



Smart campus & smart parking lots in Changan Global R&D Center



APA6.0 production is publicly released in March 2021, unlimited-distance remotely remove the vehicle, and automatically search the available parking slot

Urban



2019 & 2020 C-V2X “4-Cross”& Large-scale Pilot Plugfest

Highway



10.5km Intelligent Highway from Chengdu to Jianyang

C. Enhanced Safety by Cooperation

- Communication based cooperation is indispensable for autonomous driving in all condition.

Collision and minor contact events in automated driving test published by Waymo

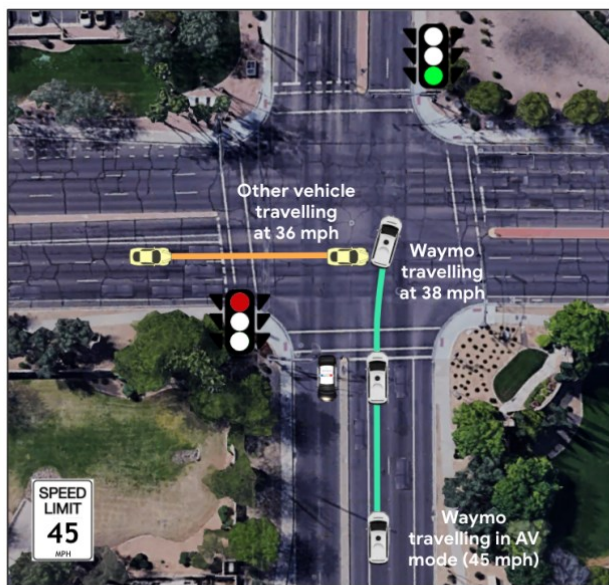


Figure 6. Event E - A collision in which the other vehicle passed through a red stop light

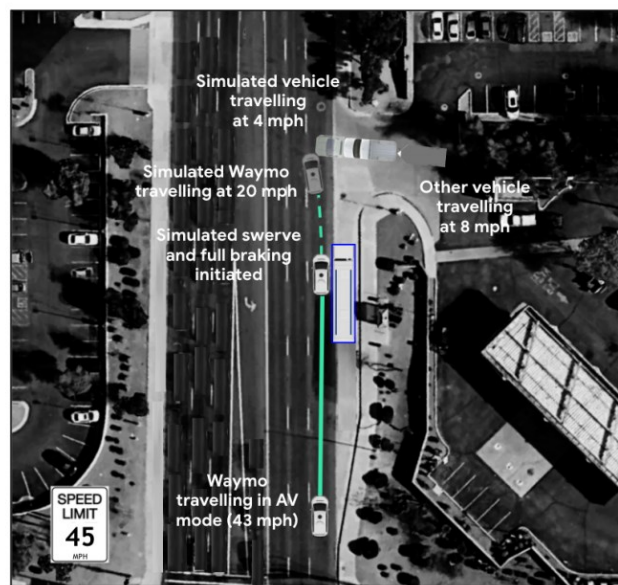


Figure 7. Event F - Simulated collision involving crossing vehicle behind occlusion

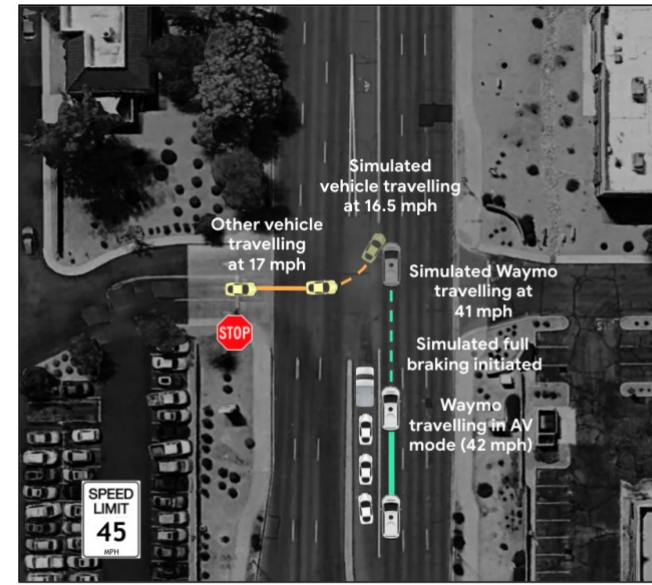


Figure 8. Event G - Simulated collision involving crossing vehicle behind occlusion

C. Enhanced Safety by Cooperation——Changan's Practice

Government-funded Projects

Lead 15 projects in connected automated vehicle area since 2010.

Ex: Changan lead the first connected vehicle project in national 863 program



Participated in 37 projects

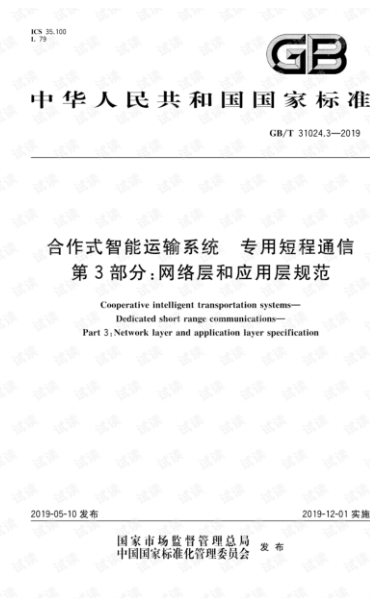
Ex: Intelligent Vehicle-Infrastructure Cooperation Systems(i-VICS)



Standards Establishment

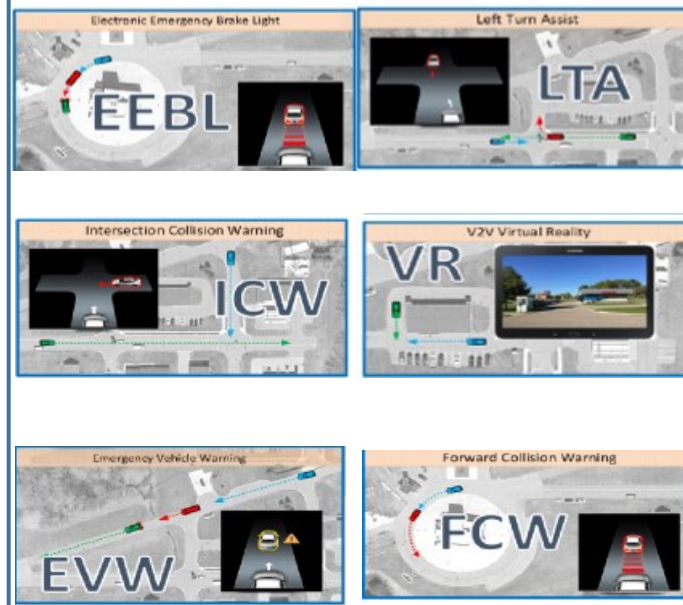
Lead establishing 4 national/industry standards

1 released;
 2 pre-release;
 1 in progress;



Application & development

13 V2X applications have been developed, and some will be production launched soon.



Outlook

A. Growth

Data Collection

- EDR
- Work
- Drive
- Se
- ...

OEM
~2022

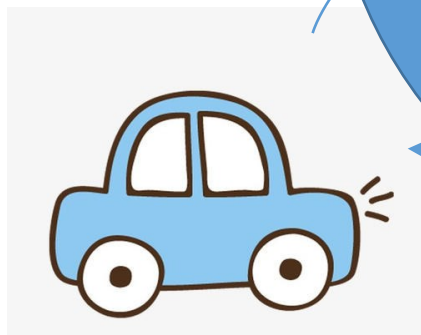
Cellular

update

uration



C. Enhanced Safety by Coopera



Industry
(After 2025)

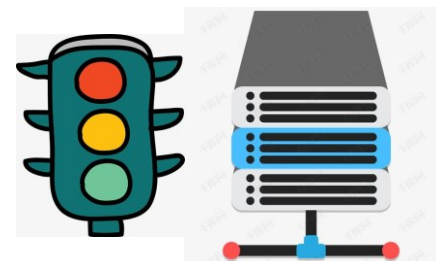
Co
Assista

B. Traffic Service

Reservation

Government/
Enterprises
(2023-2025)

mic lights
Parking status
...





长安汽车
CHANGAN AUTO

科技长安
智慧伙伴