Edge computing research, standardization and roll-out practices in vertical Area

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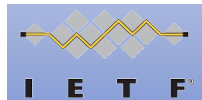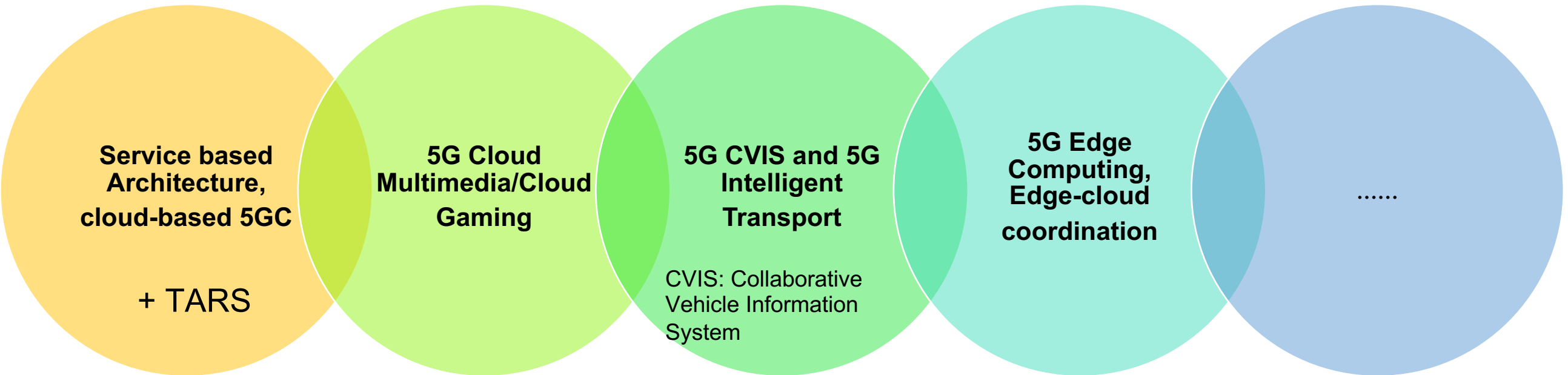# Outline

Tencent standardization Activities on 5G, Edge computing & V2X

Tencent MEC Solutions & Roll-Out Practices

Linux Foundation CVB

Technical Areas of Global/Domestic standardization & open-source activities

Tencent has been actively contributing to 3GPP standardization in edge computing, V2X and service-based architecture topics since 2018.
Tencent MEC/V2X/SBA standard contributions ranks Top 10 in 2020 in 3GPP Release 16.
Tencent acts as 3GPP Release 17 WID rapporteur in 3GPP SA2 (who is in charge of 5G architecture and key group for edge computing/MEC.)

Service based Architecture, cloud-based 5GC

+ TARS

5G Cloud Multimedia/Cloud Gaming

5G CVIS and 5G Intelligent Transport

CVIS: Collaborative Vehicle Information System

5G Edge Computing, Edge-cloud coordination

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Tencent Standard Activities on 5G, V2X & MEC

| Technical Area	Key Topics	SDO	
5G Service based Architecture, cloud-based 5GC	• **3GPP R16 5G eSBA** • **TARS open-source roll out with eSBA**	**3GPP SA2**	
5G Cloud Multimedia/Cloud Gaming	• **SA1 req, SA2 arch & SA4 multimedia for cloud gaming and XR, rapporteur of SA2 Rel-17 WID 5G-AIS.** • **Application and network interaction and integration**	**3GPP SA1，SA2，SA4,** **IETF,** **IMT2020**	
5G CVIS and Intelligent Transport	• **3GPP: ICV related SA1 req and SA2 architecture** • **5GAA:Tele-operated Driving and Precise Positioning XWI** • **CCSA TC10/CSAE/C-ITS V2X application layer message set** • **Co-lead CCSA TC10 5G ToD，ST9 high accuracy positioning** • **Lead C-ITS V2X-based AD testing standard** • **NTCAS, lead research project: Interaction between ICV and Smart Phone**	**3GPP SA1,SA2, 5GAA,** **IMT2020/C-V2X** **working group,** **CCSA TC10，TC5，** **ST9,** **China SAE,** **C-ITS,** **NTCAS SC34**	
5G Edge-Cloud Collaboration，Edge Computing	• **Edge computing related standards, key issues and solutions** • **CCSA TC5WG 12, domestic/industrial standards**	**3GPP SA2，SA6，** **SA1,** **CCSA TC5 WG12**	

ETSI ISG – Mobile Edge Computing

- **Initiated in Oct. 2014**
  - Huawei, IBM, Intel, Nokia, NTT DoCoMo, Vodafone
- **Defining**
  - Use cases
  - Deployment scenarios
  - Infrastructure
    - APIs in June, 2017
    - Whitepaper in June, 2018
- **ETSI MEC covers many verticals like automotive, as well as other industrial use cases.**
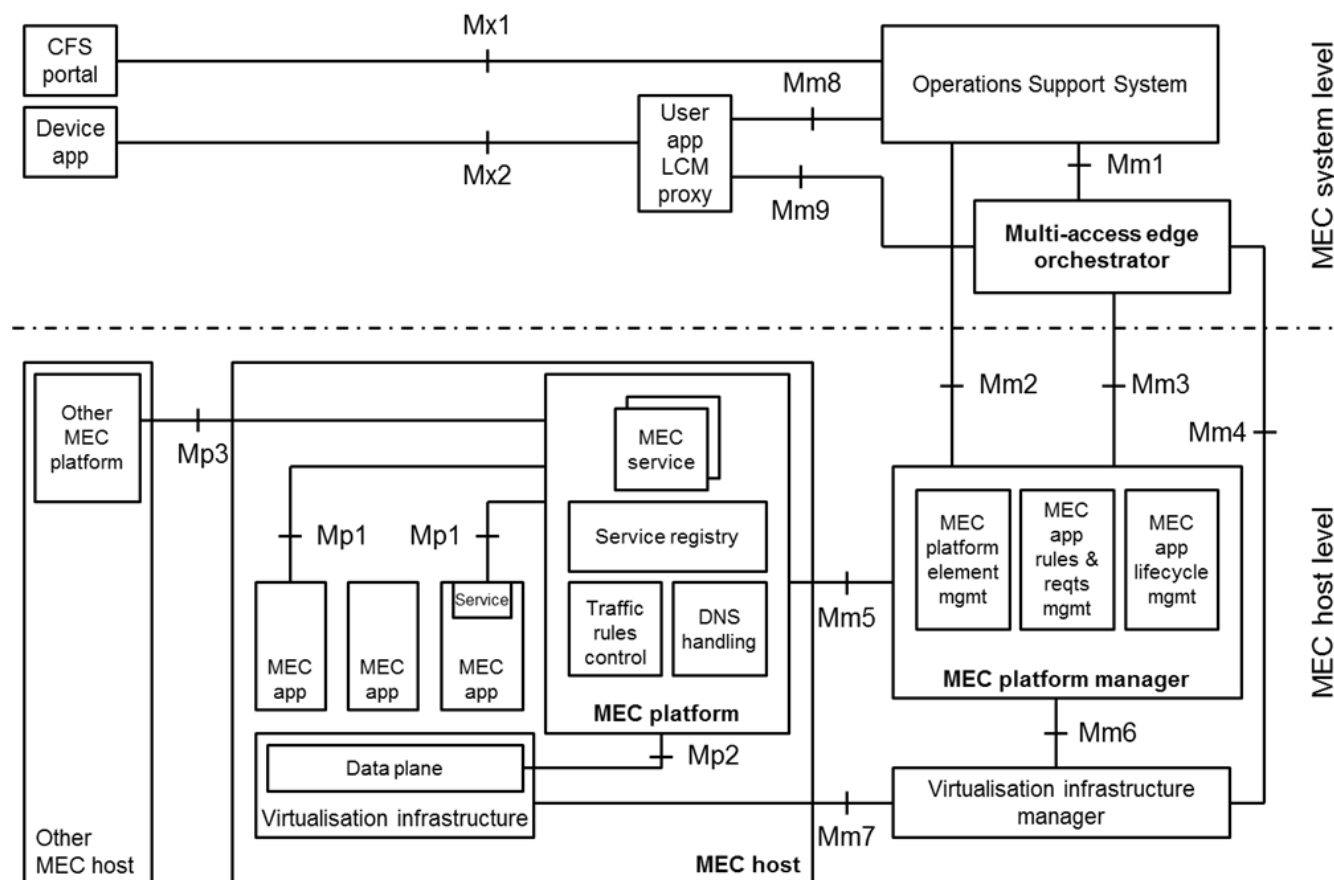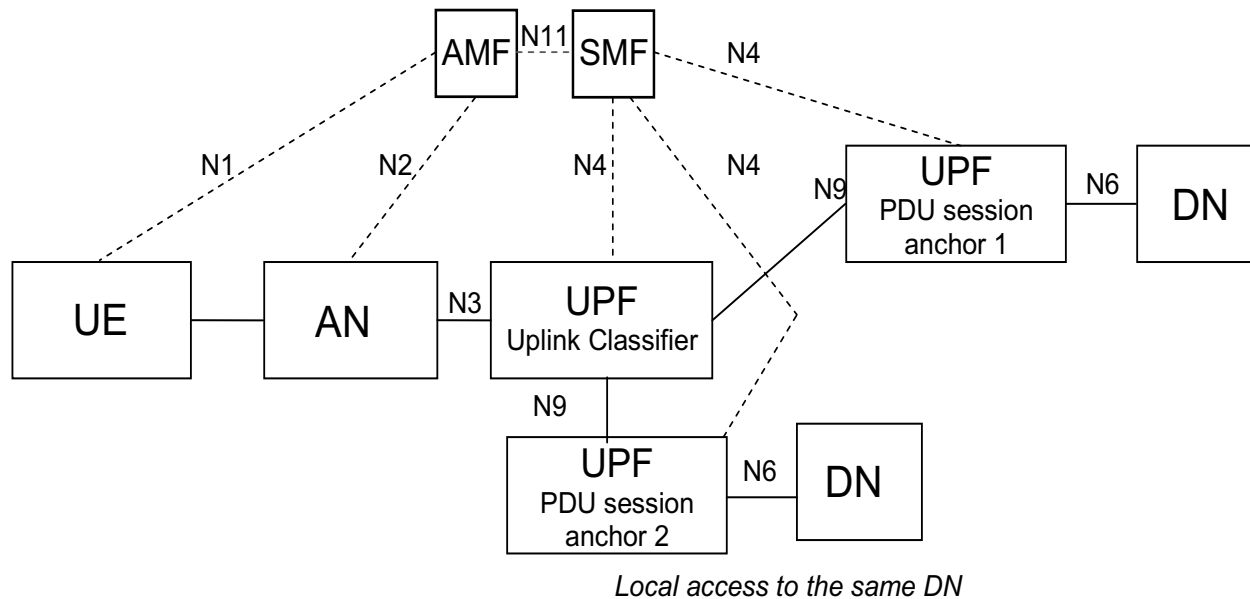

Multi-access edge system reference architecture

In ETSI, MEC is changed from mobile Edge Computing to multi-access Edge Computing from 2015.

3GPP Edge Computing – Release 15

- *Documented in Clause 5.13 of TS 23.501 Release 15.*
- *Native function of the 5G and is commonly recognized as an important technology for 5G.*

3GPP Key Enablers for Edge Computing

Local routing and traffic steering
- A PDU session may have multiple N6 interfaces

Application function to influence UPF (re)selection
- By Policy Control Function
- Indirectly by Network Exposure Function

Session and Service Continuity (SSC)
- Mobile scenarios

Support of Local Area Data Network
- Serving PLMN providing services to UEs by Tracking Area

AMF —N11— SMF —N4—

N1   N2   N4   N4   N9   UPF PDU session anchor 1 —N6— DN

UE — AN —N3— UPF Uplink Classifier

N9

UPF PDU session anchor 2 —N6— DN
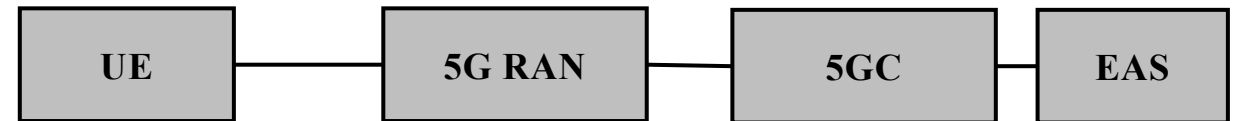
Local access to the same DN

TARS

3GPP Edge computing in Release 17
- Study Item phase

- Control-plane based solution
  - Acquire radio network information with localize NEF and interaction with OAM
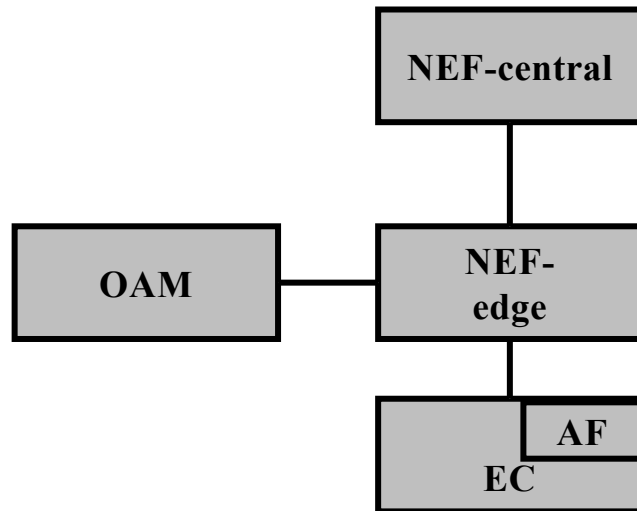
- User-plane based solution
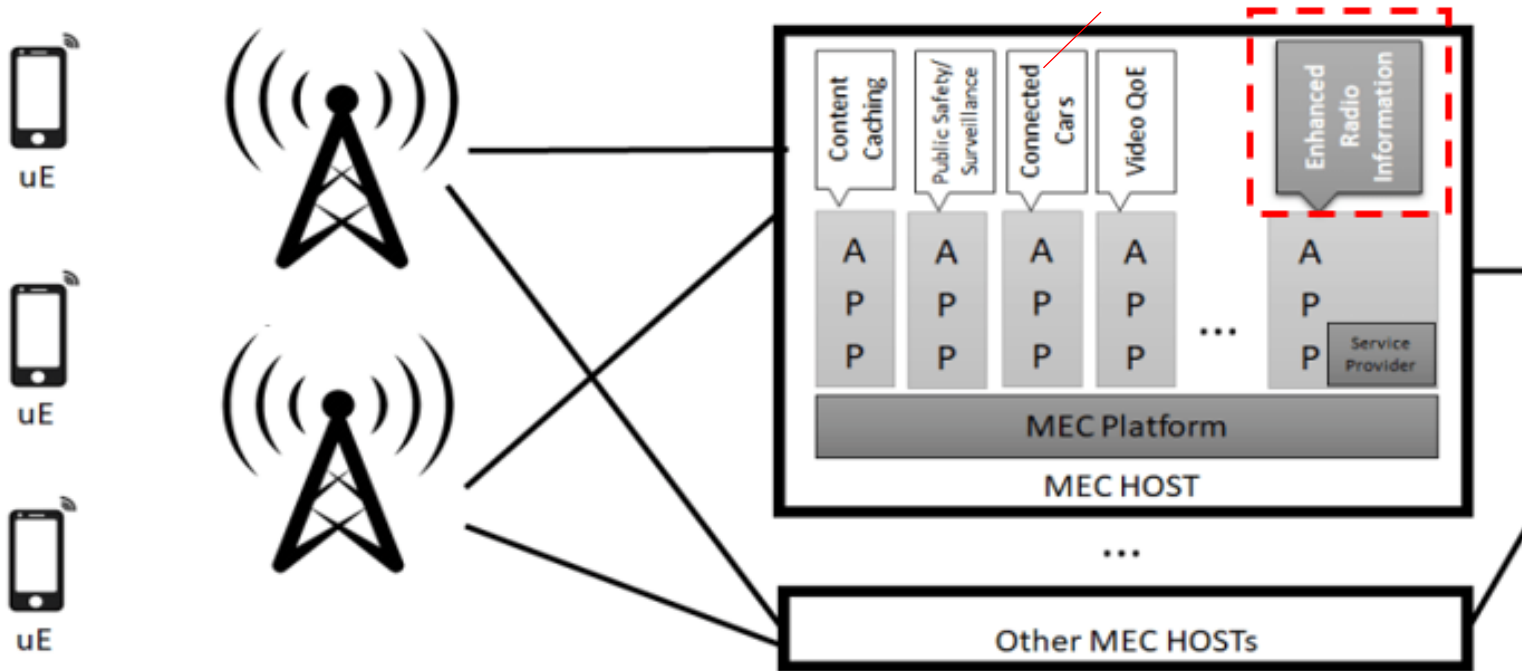 - Acquire radio network information via UPF

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                    ┌──────────────┐
                    │  NEF-central │
                    └──────┬───────┘
                           │
┌──────────┐        ┌──────┴───────┐
│   OAM    │────────│    NEF-      │
└──────────┘        │    edge      │
                    └──────┬───────┘
                           │
                    ┌──────┴───────┐
                    │          ┌───┤
                    │          │ AF│
                    │   EC     └───┤
                    └──────────────┘
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┌────────┐   ┌──────────┐   ┌──────────┐   ┌────────┐
│   UE   │───│  5G RAN  │───│   5GC    │───│  EAS   │
└────────┘   └──────────┘   └──────────┘   └────────┘
```

AF: application function
EAS: edge application server
NEF: Network Exposure Function

Tencent is contributing to MEC standardization in 3GPP since Y2018. In 3GPP Rel-17, Tencent proposed two solutions to 3GPP SA2#139 meeting about control-plane and user-plane based solutions which are captured by 3GPP TR 23.748.
www.3gpp.org/dynareport/23748.htm

Tencent promotes MoWIE based on MEC in IETF

MoWIE for Network Aware Application
draft-huang-alto-mowie-for-network-aware-app-02

MoWIE与RNIS融合

- RNIS： Radio Netwokr Information Service,
  - Cell capacity
  - User location
  - Cell id
  - User bearer id
  - Handover status
  - QoS flow release indication
  - Uu delay

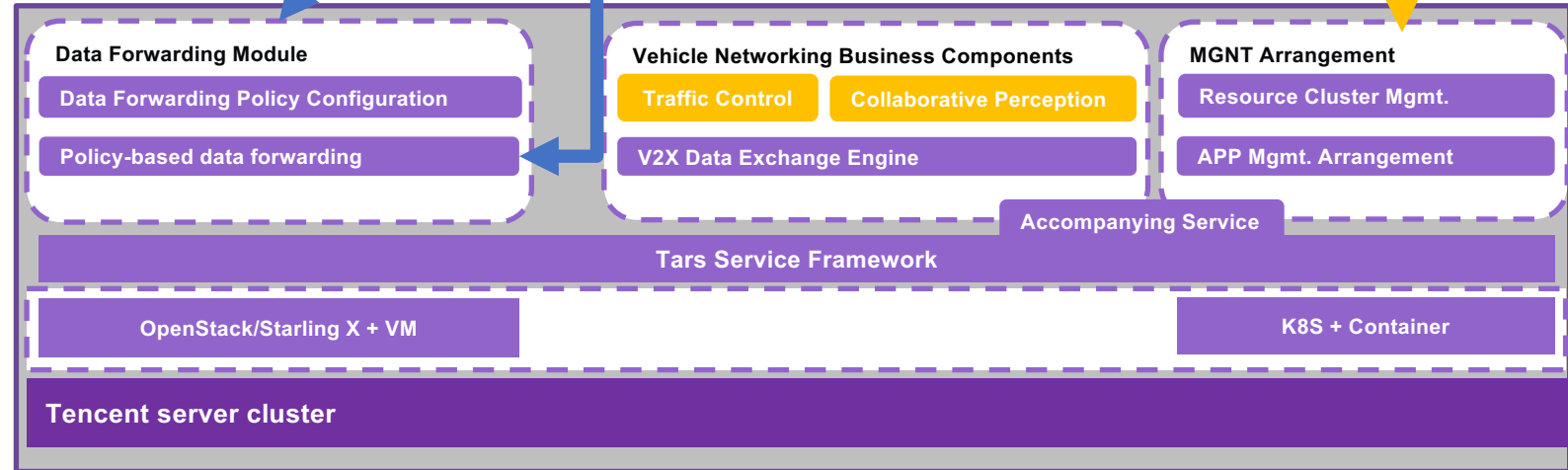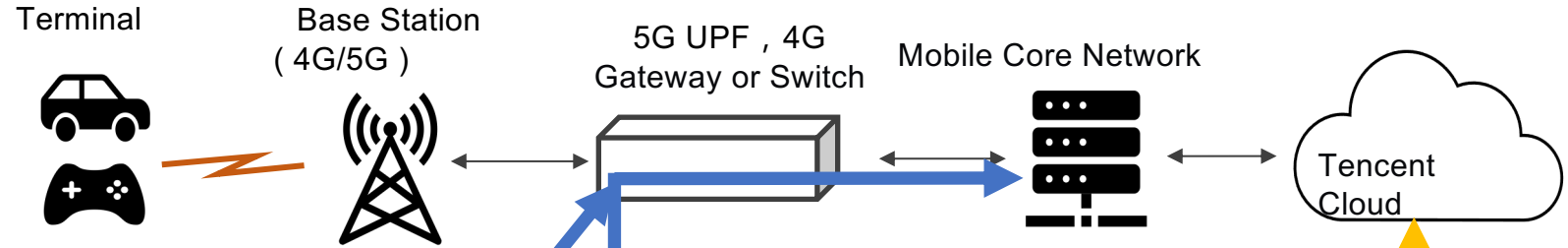MoWIE: Mobile and Wireless Network Information Exposure

- MoWIE+ MEC+ RNIS provide generic network capability exposure.
- Supports various apps on MEC platform and improves user experiences.

Open Source & Standardization : Two-Wheels to drive EC roll-out

THE LINUX FOUNDATION

5G-V2X Edge Computing platform

Tencent 腾讯   intel   NOKIA   ARM

Terminal

Base Station （4G/5G）

5G UPF，4G Gateway or Switch

Mobile Core Network

Tencent Cloud

Data Forwarding Module

Data Forwarding Policy Configuration

Policy-based data forwarding

Vehicle Networking Business Components

Traffic Control   Collaborative Perception

V2X Data Exchange Engine

MGNT Arrangement

Resource Cluster Mgmt.

APP Mgmt. Arrangement

Accompanying Service

Tars Service Framework

OpenStack/Starling X + VM

K8S + Container

Tencent server cluster

Tencent CVIS/EC Platform

Outline

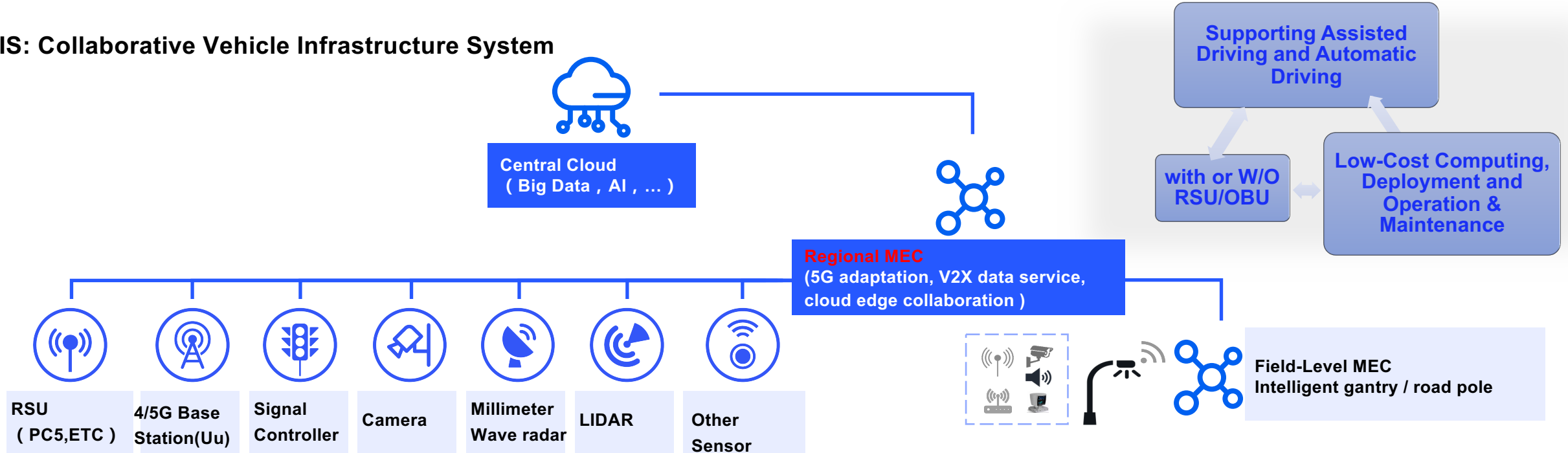Tencent standardization Activities on 5G, MEC & V2X

Tencent MEC Solutions & Roll-Out Practices
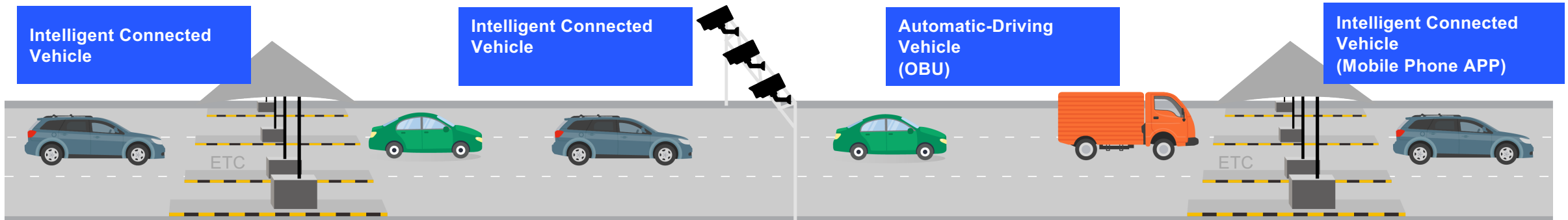
Linux Foundation Connected Vehicle Blueprint

Tencent CVIS

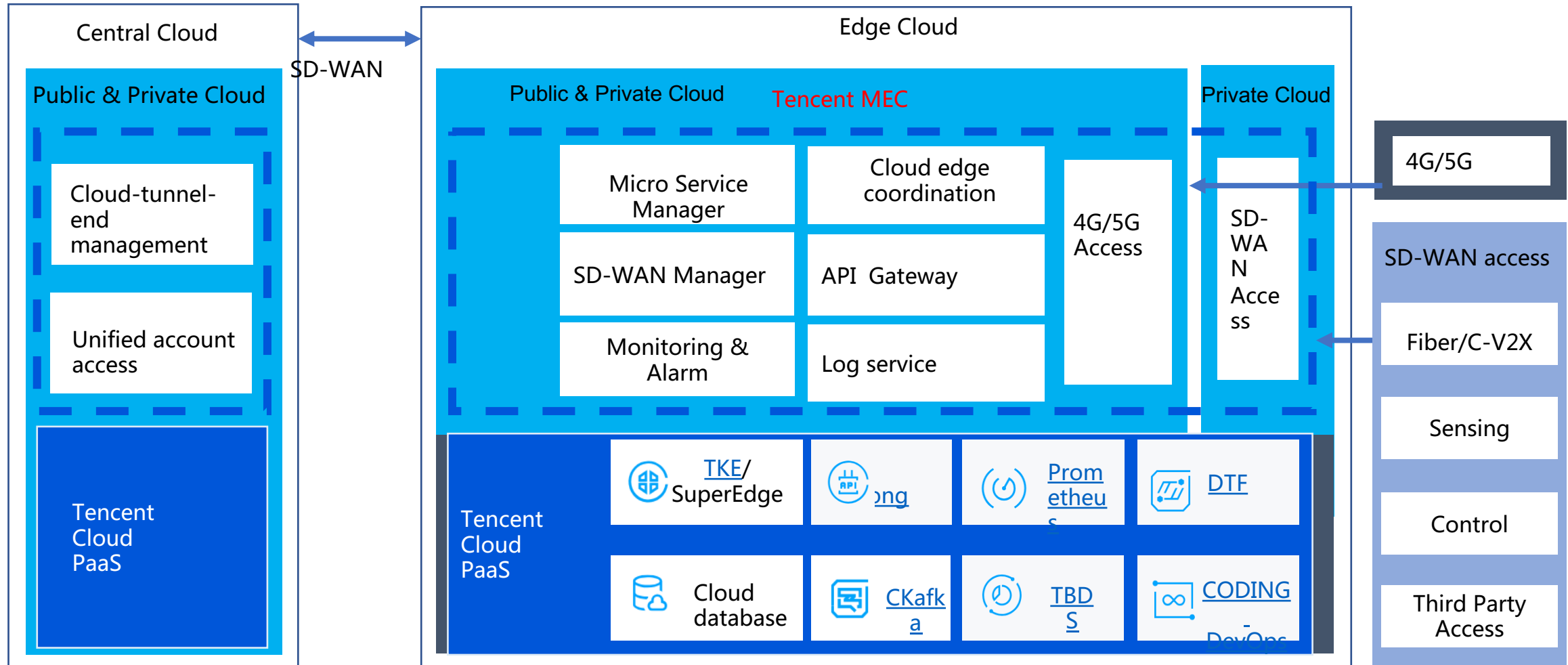## —Loop of information among people, vehicles, roads, networks and clouds

CVIS: Collaborative Vehicle Infrastructure System

Central Cloud
(Big Data , AI , …)

Supporting Assisted Driving and Automatic Driving

with or W/O RSU/OBU

Low-Cost Computing, Deployment and Operation & Maintenance

Regional MEC
(5G adaptation, V2X data service, cloud edge collaboration)

Field-Level MEC Intelligent gantry / road pole

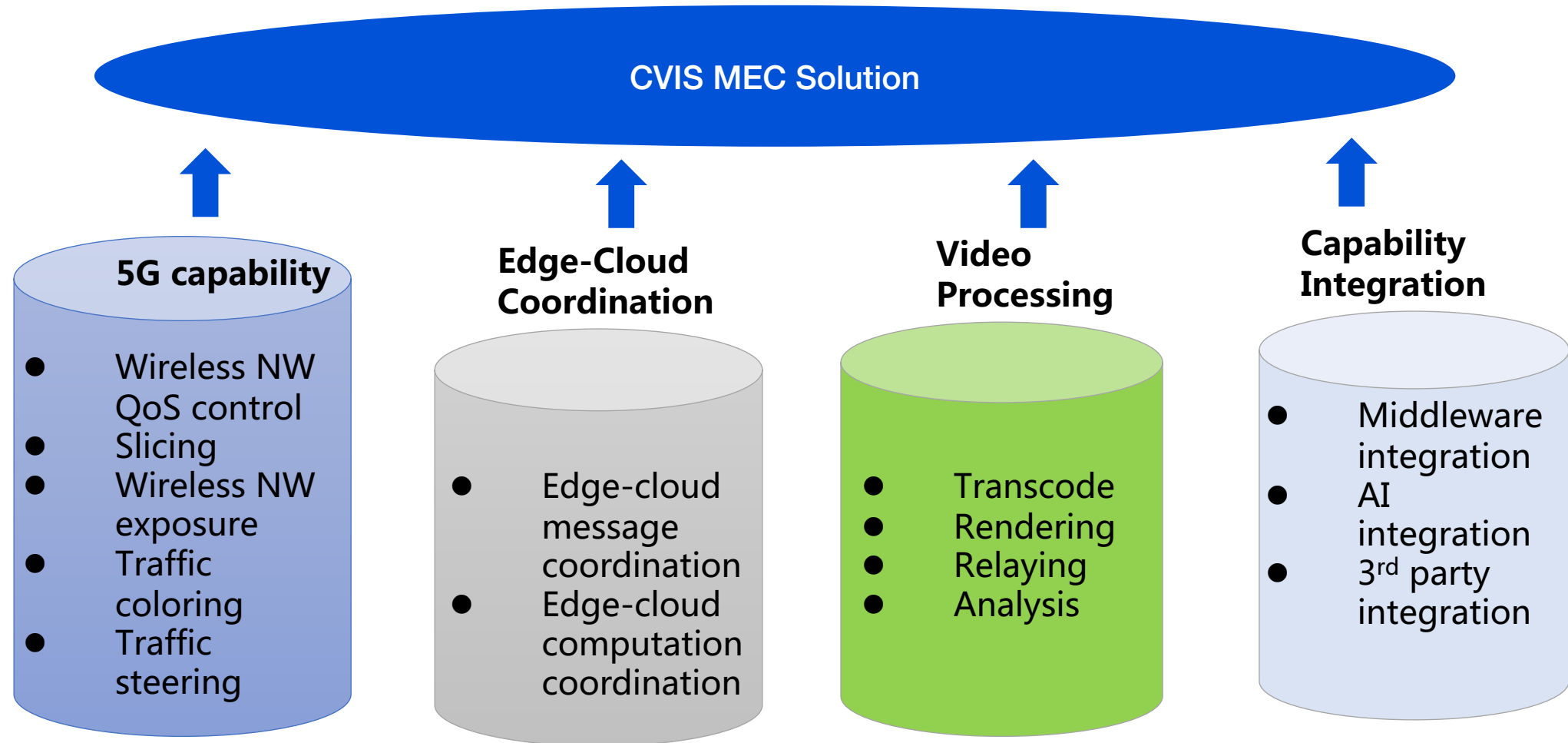|						
RSU (PC5,ETC)	**4/5G Base Station(Uu)**	**Signal Controller**	**Camera**	**Millimeter Wave radar**	**LIDAR**	**Other Sensor**

- Open ecosystem, verified with 3rd party DP and on-board unit vendors

- V2X data service engine with information cleaning, modeling and reuse
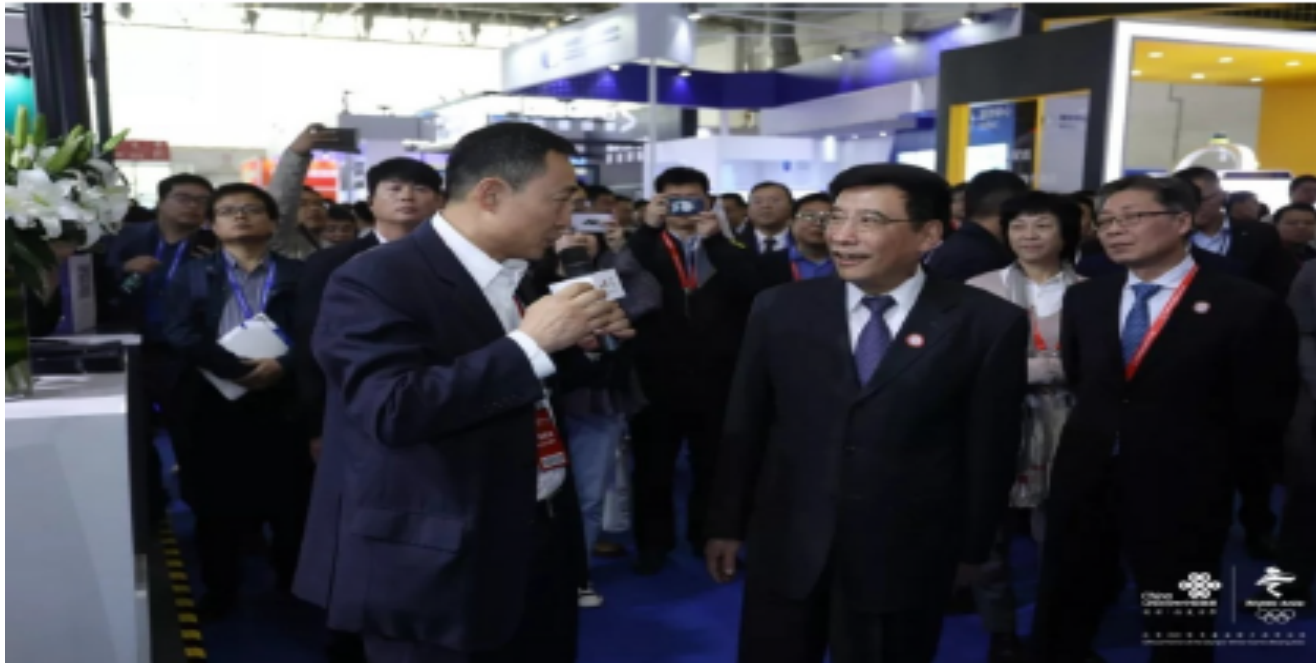- Distribution V2X with/without RSU/OBU

Intelligent Connected Vehicle

Intelligent Connected Vehicle

Automatic-Driving Vehicle (OBU)

Intelligent Connected Vehicle (Mobile Phone APP)

ETC

ETC

Tencent MEC platform for CVIS & Intelligent Transportation System

Tencent MEC Solutions for CVIS

CVIS MEC Solution

5G capability

- Wireless NW QoS control
- Slicing
- Wireless NW exposure
- Traffic coloring
- Traffic steering

Edge-Cloud Coordination

- Edge-cloud message coordination
- Edge-cloud computation coordination

Video Processing

- Transcode
- Rendering
- Relaying
- Analysis

Capability Integration

- Middleware integration
- AI integration
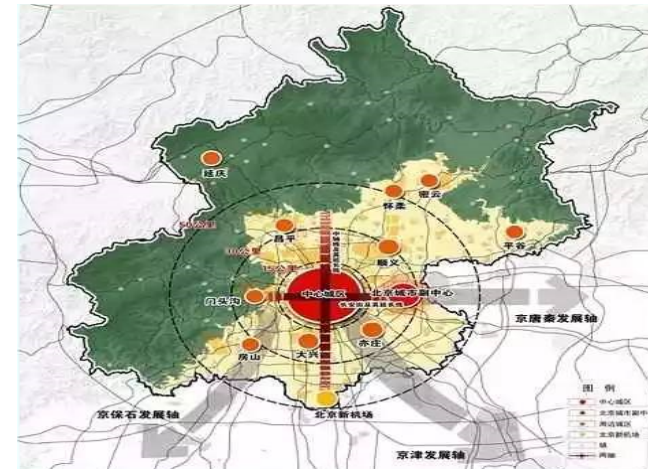- 3rd party integration

TARS

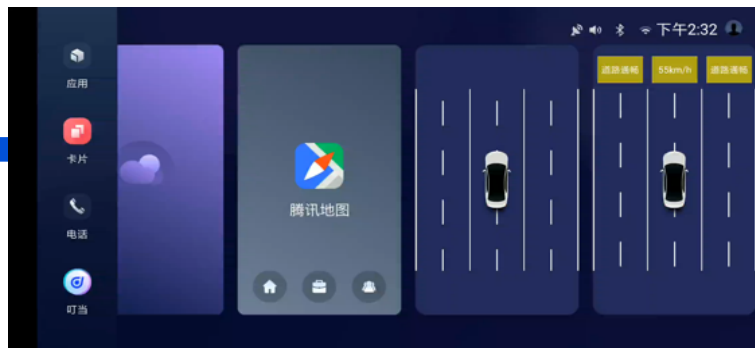# Rull-out Case : 5G Shougang Park @ Beijing Winter Olympic 2022

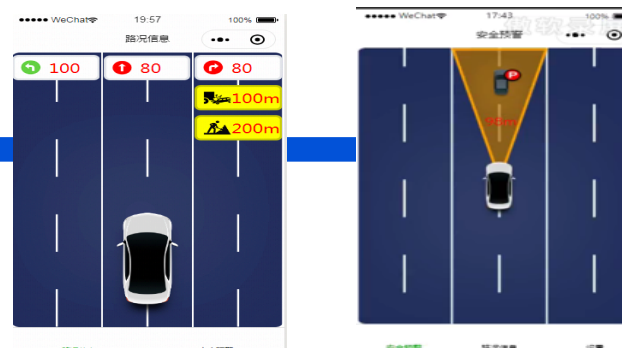**2019 World Intelligent Connected Vehicle Congress**

- 1st launched vehicle-road collaboration platform based on **commercial 5G networks**
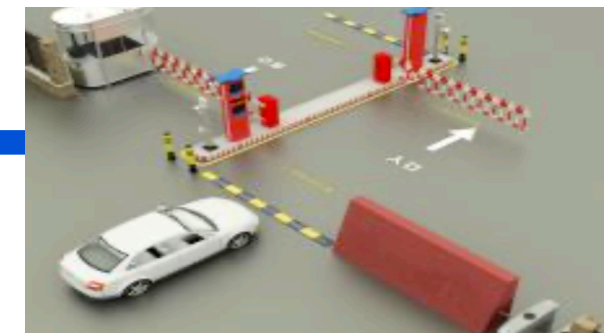- Supports full cycle of traveling services such as Driving Assistance (18 types of alerting services) and AVP
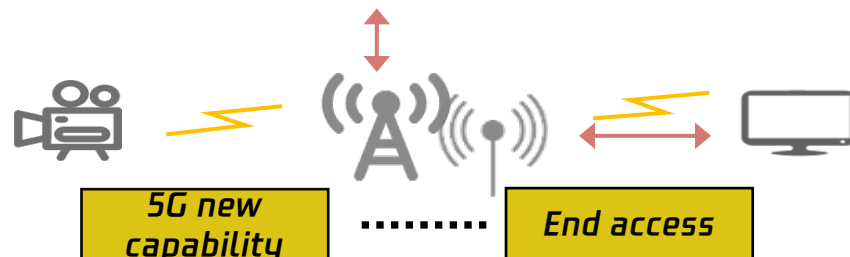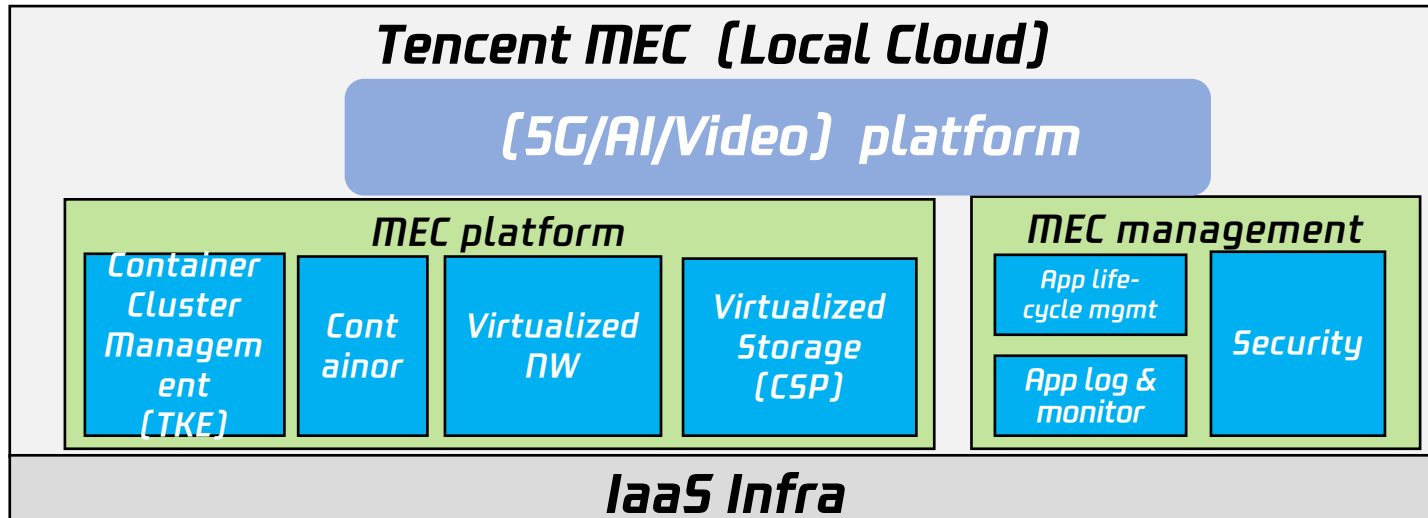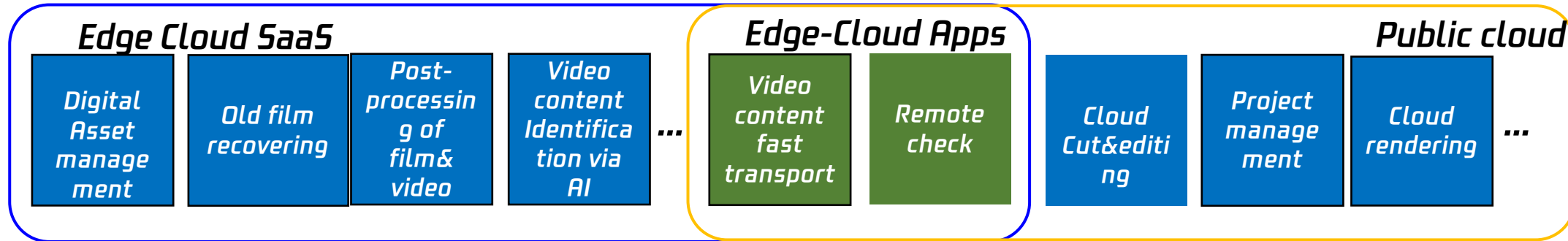

Head Unit

WeChat Mini Program

AVP

TARS

Roll-out case, Smart Picture & Video Production

5G smart picture tool chain

Edge Cloud SaaS

| Digital Asset management | Old film recovering | Post-processing of film& video | Video content Identification via AI | ... |

Edge-Cloud Apps

| Video content fast transport | Remote check |

Public cloud

| Cloud Cut&editing | Project management | Cloud rendering | ... |

Tencent MEC (Local Cloud)

(5G/AI/Video) platform

MEC platform

| Container Cluster Management (TKE) | Cont ainor | Virtualized NW | Virtualized Storage (CSP) |

MEC management

| App life-cycle mgmt | Security |
| App log & monitor | |

IaaS Infra

5G new capability   ·········   End access

- **Functions:**
  - 5G smart picture total solution
  - Can be deployed via public plus private/local cloud via MEC platform

- **Application scenario:**
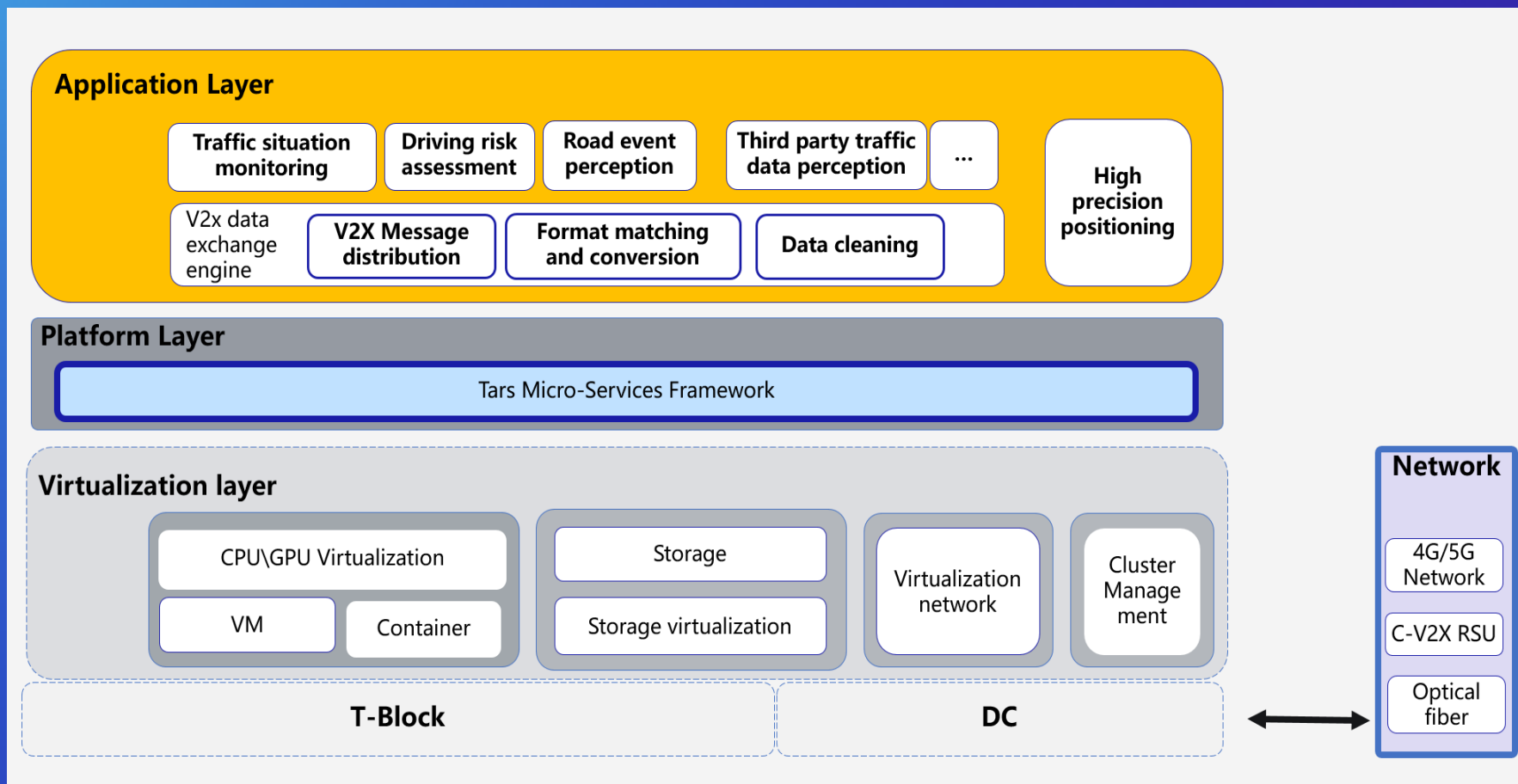 - Picture&video production

TARS

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Tencent standardization Activities on 5G, MEC & V2X

Tencent MEC Solutions & Roll-Out Practices

Linux Foundation Connected Vehicle Blueprint

CVB application architecture

The Connected Vehicle Blueprint (CVB) focuses on establishing an open source MEC platform, which is the backbone for V2X application.

The application architecture of the CVB consists of the following key components:
- ✓ Commodity Hardware, Arm/X86 Physical Server.
- ✓ Virtualization Layer.
- ✓ Tars Microservice Platform layer.
- ✓ Connected Vehicle Applications layer.

Use Cases in CVB (1)

The following use cases have been tested within the community, with additional use cases to come:

- Transportation efficiency improvement:
    - Real-time traffic information updates;
    - figures out the most efficient route for drivers

- Safe Drive Improvement:
    - Figures out potential risks which cannot be seen by the driver.

- Reduces traffic violations:
    - Conveys traffic rules of some specific area.
    - For instance
        - change the lane prior to a narrow street
        - avoid opposite way driving on a one-way road
        - avoiding the carpool lane when single driver, etc

Use Cases in CVB (2)

- Cooperative vehicle and infrastructure system :
  - ✦ Roadside sensing system obtains and computes real-time traffic objects status ;
  - ✦ Based on the roadside sensing data, the host vehicle obtains the traffic warning and driving assistance informationwhich threatens itself。
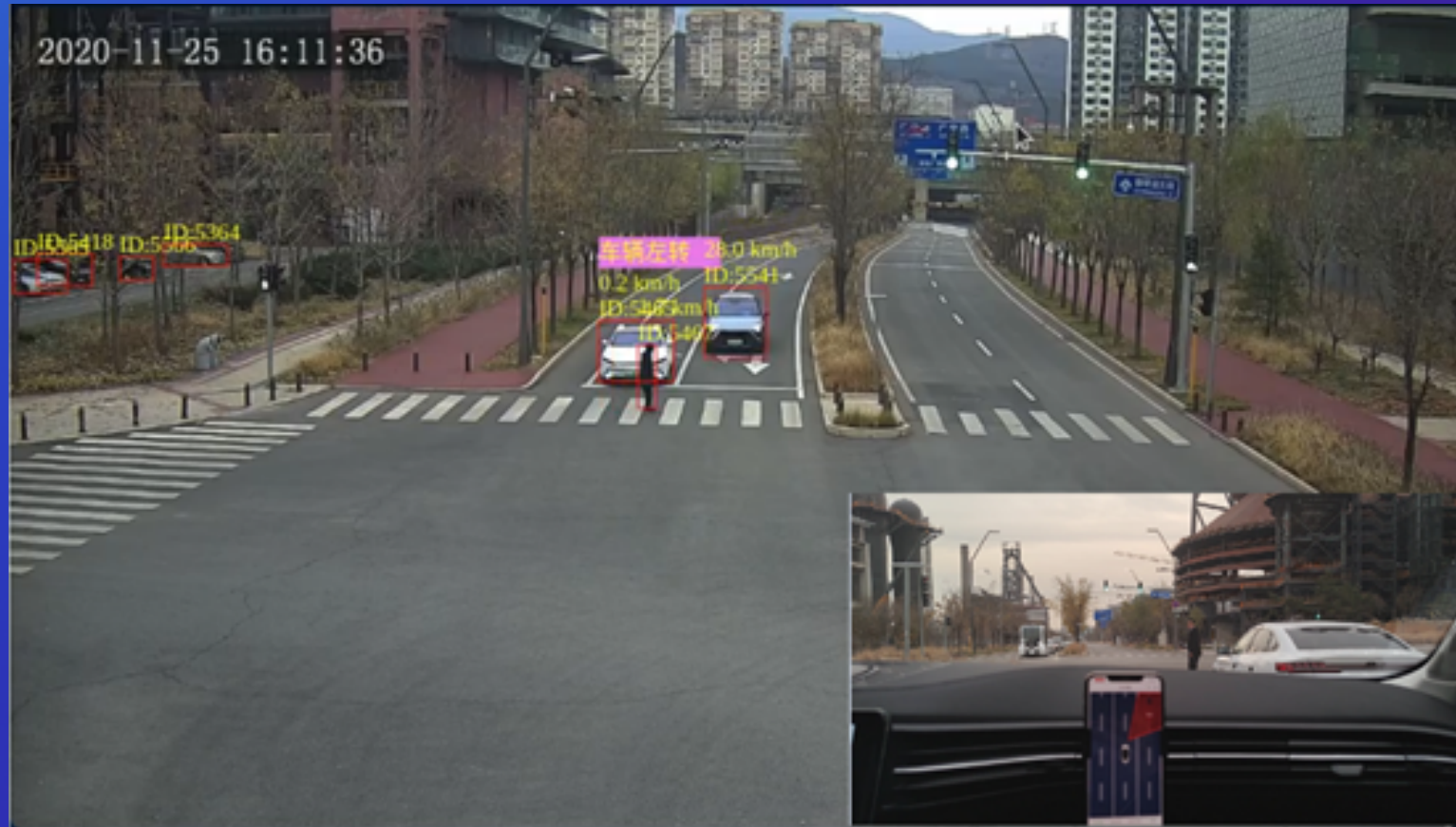
Summary of CVB R4

- Tars based micro-service platform is established as the MEC platform to deploy the Connected vichele application

  - ✓ High Performance RPC Call
  - ✓ Service Governance
  - ✓ Web Config/Monitor Platform
  - ✓ Multi Program Languages
  - ✓ Orchestration between Edge Nodes

- BluVal Testing and Lynis Testing are done to consolidate the softeware environment.

  - ✓ https://nexus.akraino.org/content/sites/logs/parserlabs/r4/jobs/cvb/

Thanks and Welcome to Join Akraino!