Application-Driven 5G Network

-From OTT's Perspective

Yunfei Zhang

2018.10.18@CyberC

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- Background
- Tencent 5G Tech. Layout
- Tencent 5G New Services
- 5G Trial NW & Service Testing

5G New Trends & Huge Potential

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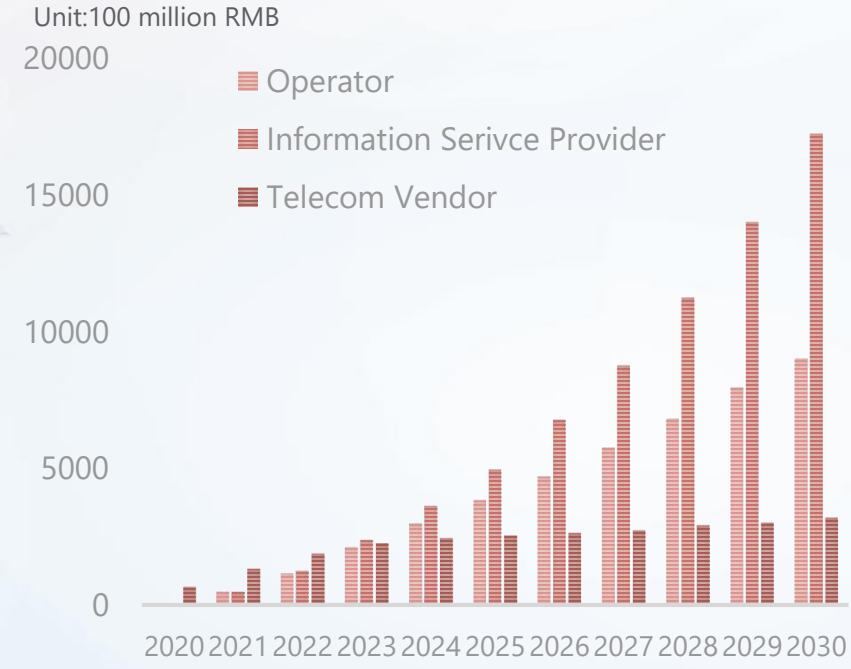
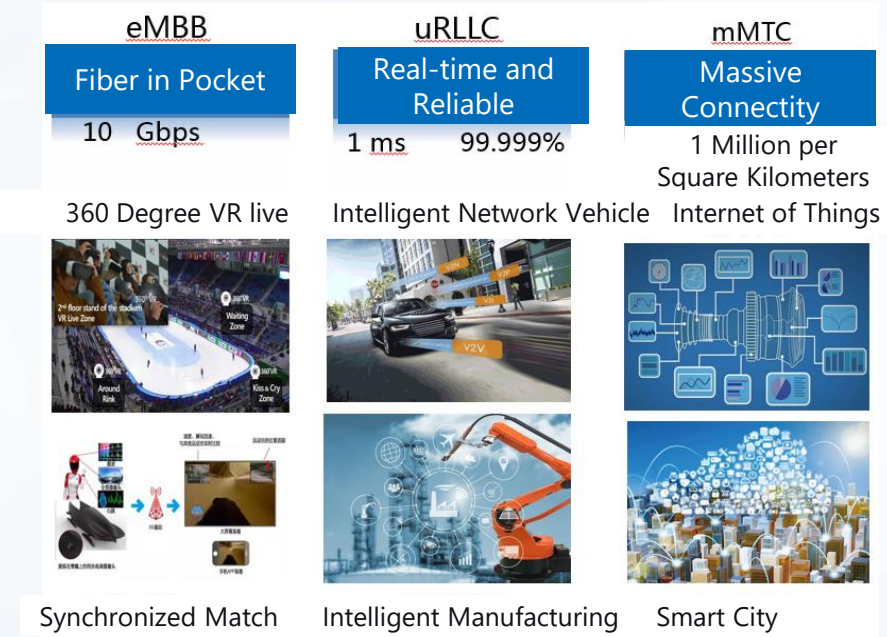
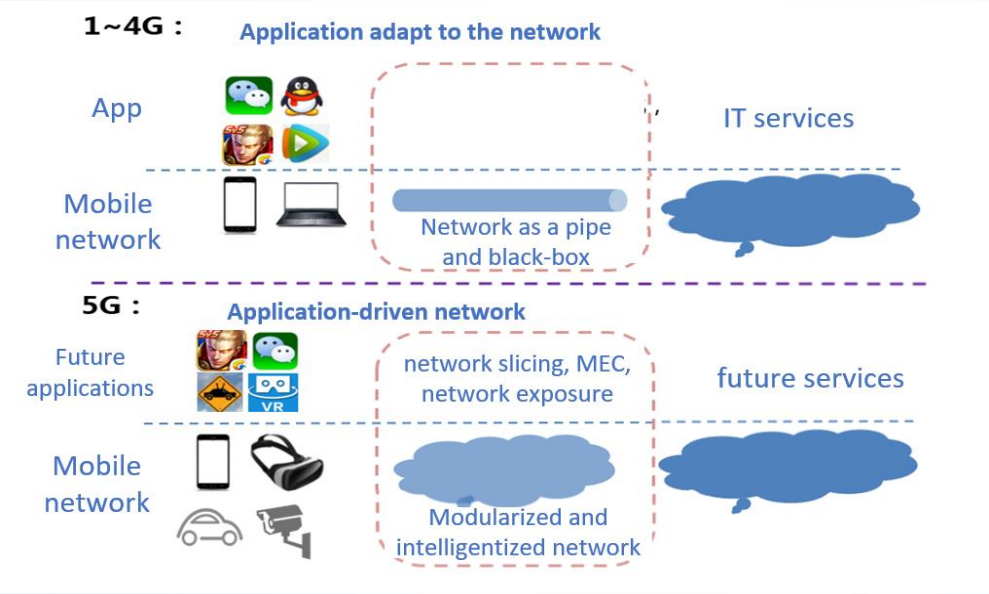
- Qualcomm forecasting, 5G industries has $12T market potential in 2020-2035;
- CIIT (China Institute of Information and Telecom) estimated the economic contributions from operators, information service provider and telecom vendors.





New Philosophy of 5G – Application Driven



Mobile & Edge Computing

Open and Customizable

Cloud and Network Convergence

Application-driven Network

Network follows with Cloud

Open platform= New entrance

- Open platform is the key of 5G business model
  - **data everywhere**
  - **access everywhere**
  - **connect everything**
  - **New business model**
- The type of devices will be overwhelming in 5G, so the platform will become the new entrance instead of the mobile phone.

5G in Tencent

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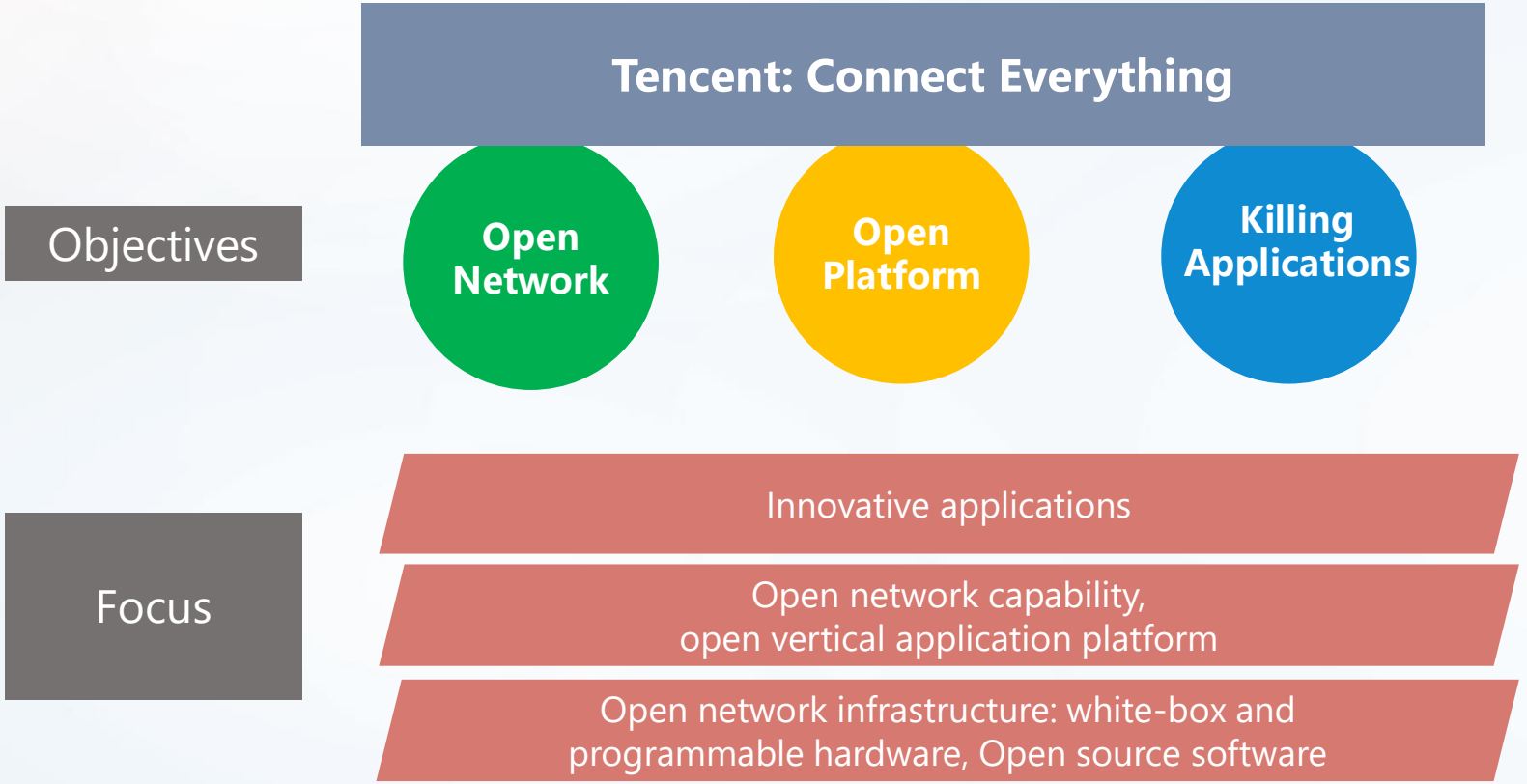

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Tencent 5G technology layout

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Open Network

CAPEX ↓ 50%

White-box network | Optimized network | Optimized protocol | Self organized network

RAN | TN | CORE

Innovation ↑

P4 programmable interface

Network equipment as white-box

Tblock modularized data model

Communication + computing

Service based architecture

flexibility ↑

Deployment time ↓

On-demand services
Dynamic deployment

Application driven
Fast onboard

High efficiency cooperation
Easy extension

New Platform

Local forwarding latency ↓

MEC

Local treatment privacy ↑

latency ↓ 50%

network+service cooperation

Network capability exposure

QOE ↑

APP | APP | APP

Capability registration, management, distribution

SLA management | Routing management

5GC | EPC

Open Source & Whitebox

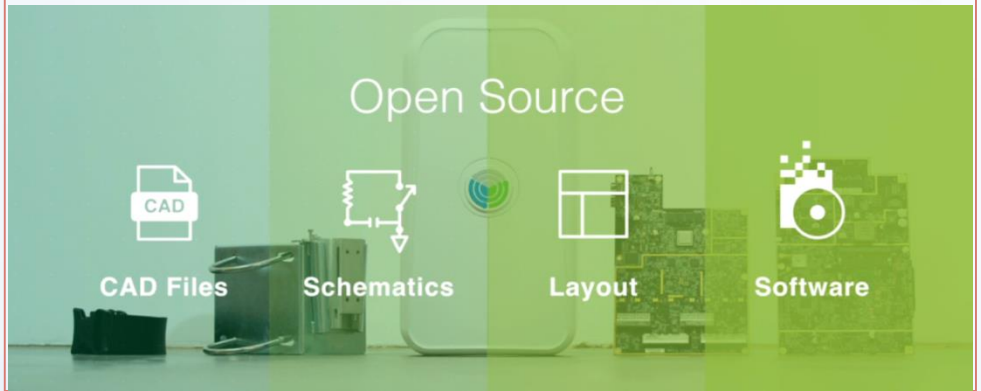
- Tencent is the board member of Linux Foundation to promote open source based 5G network.

THE LINUX FOUNDATION

OPEN Compute Project®

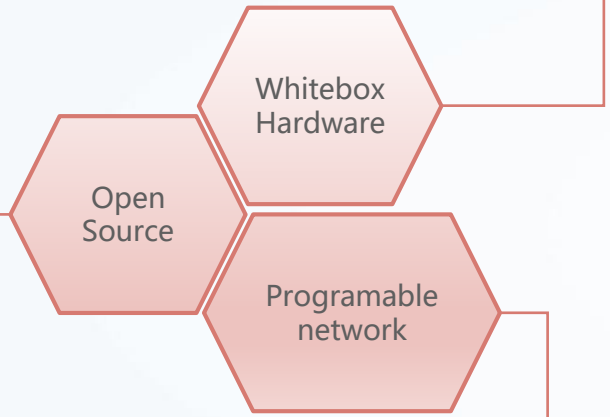
TELECOM INFRA PROJECT

Open Cellular- Open Source Whitebox based Hardware & Software for Access



Breaking the blackbox to realize application-driven open network

Lower on CAPEX and operator cost, adaptation platform for services

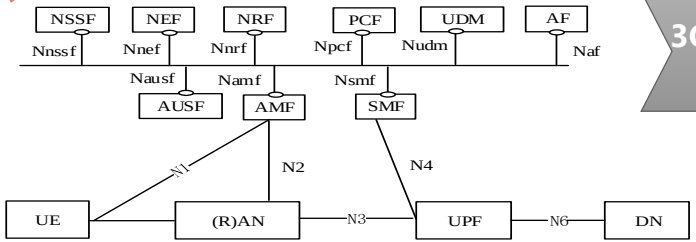


Avoid dedicated network for dedicate service, support disverse industrial scenarios

Service based architecture enhancement

2017 → 2018 → 2019 → 2020

R15 Service based architecture (SBA)



- Network functions within the 5GC Control Plane shall only use service-based interfaces.
- Service based interface don't include N1,N2,N3,N4,N6 interfaces
- A Network Function may expose one or more NF services.
- Each of the NF services shall be self-contained and reusable.
- System procedures can be described by a sequence of NF service invocations.

3GPP SA2 R16 SID FS_eSBA

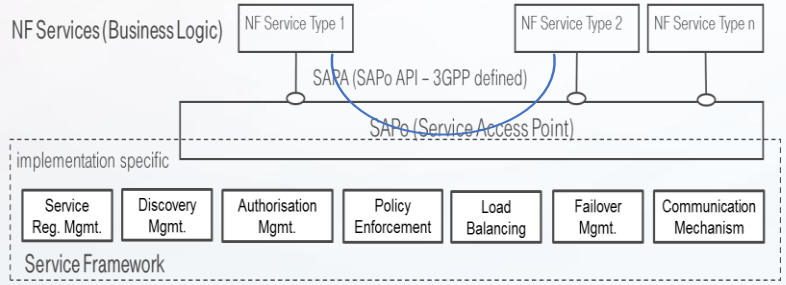
3GPP SA2 WID on eSBA and stage 3 work

- 3GPP SA2 SID on Enhancements to the Service-Based 5G System Architecture (FS_eSBA): (2018.3-2018.12)

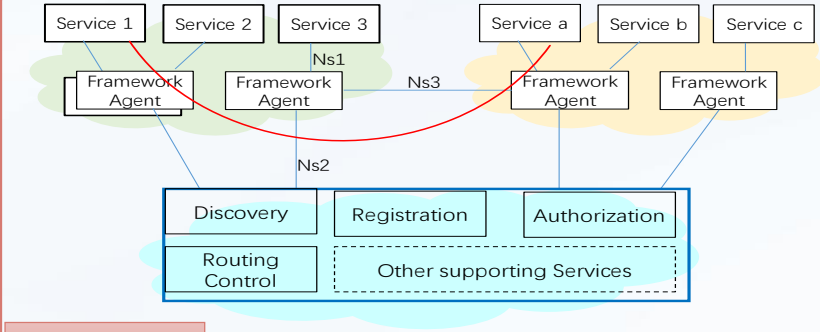
Main issues

- Whether the modularization needs further optimization?
- How to improve the service framework
- How to define UPF services
- How to realize stateless NF

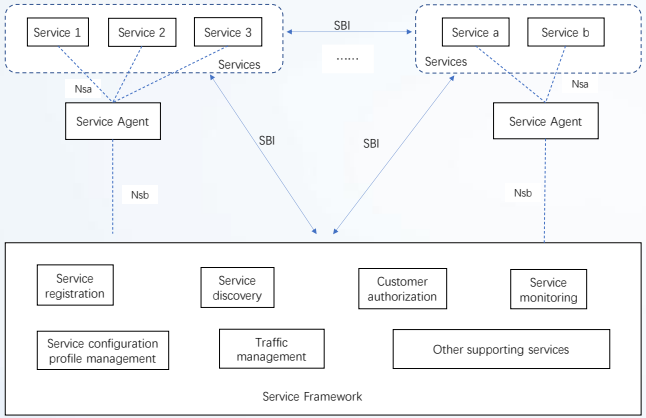
3GPP R16 eSBA-potential enhancement to service framework



Option 1 Indirect communication through service framework



Option 2 Indirect communication through agent



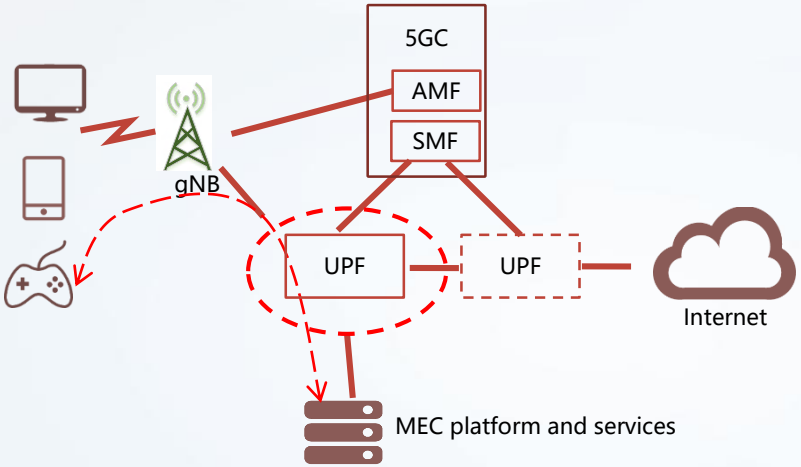
Option 3: Tencent solution

- Service Framework is responsible for service registration, customer authorization, service discovery, service monitoring, service configuration profile management, traffic management, etc.
- Service Agent is responsible for the management of the service instances within the same host.
- Stateless services
- **Direct service communication to reduce the communication latency and avoid the bottleneck for the service invoking**

Edge computing for 5G: standards progress

- MEC enables servicers to be closer to the user, so that the service delivery could be more efficient, the latency and network load could be reduced.
- Tencent promote edge computing standardization and real network deployment for various scenarios including, e.g., cloud gaming, V2X. Tencent contribute actively to 3GPP SA1 & SA2 on edge computing related issues.

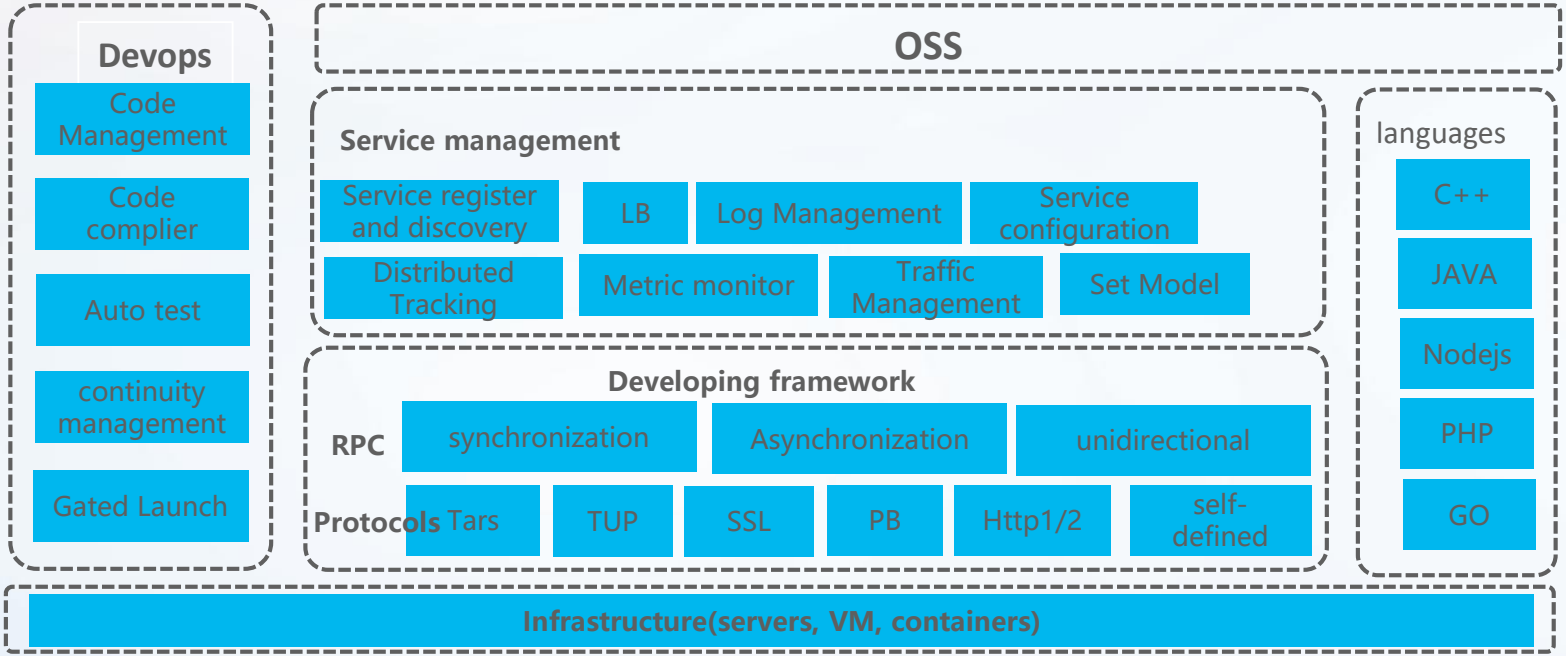
5G NW architecture enabled edge computing



- Edge computing platform
- Session and service continuity：SSC mode
- User plane selection, LADN
- AF impacts the UPF selection and traffic routing
- Network capability exposure to MEC
- QOS and charging support

Edge computing for 5G: Outlook and Issues

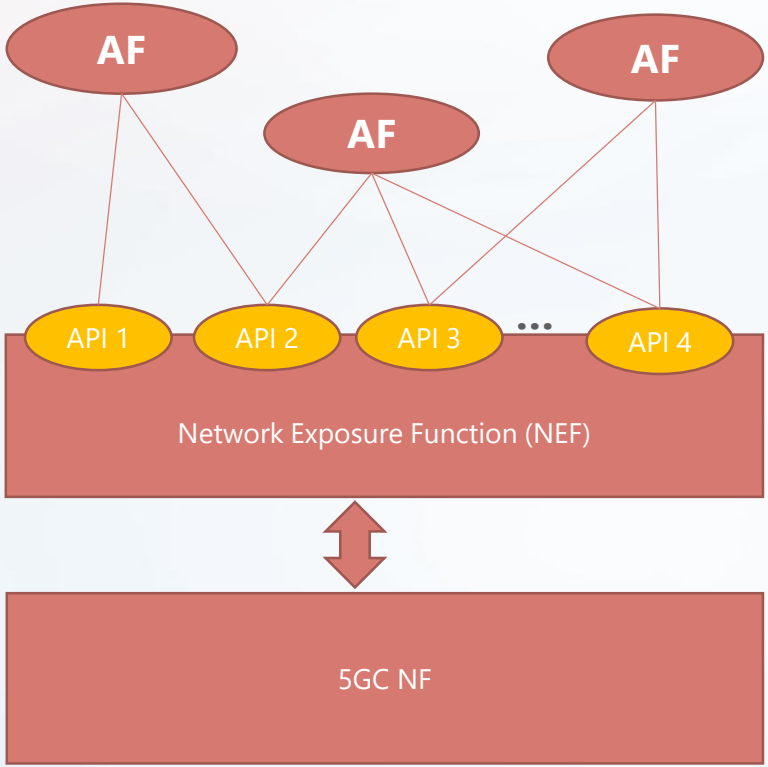
- Tencent cooperates with operators to build total solution of edge computing to enable vertical application, including 5G network, edge computing platform
- Tencent TARS is a good practice of a micro-service framework supporting multiple languages, service management, devops. TARS can be a developing framework of edge computing platform



Issue

- How to meet APP flexible local traffic routing policy coordinated with APP scheduling? scenarios?
- What is main business model for MEC?

Network Capability Exposure: Standard Progress



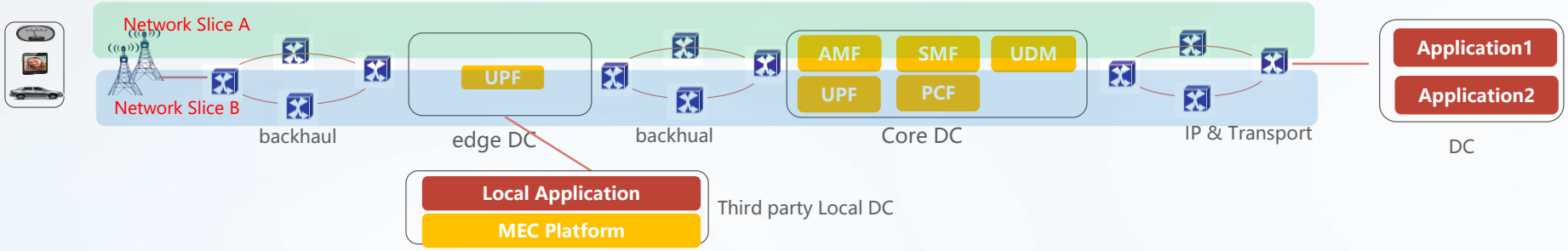
- NEF is responsible of the capability exposure of 5G network to the AF(may located in third party)
  - ✓ NF capabilities and events may be securely exposed by NEF for e.g. 3rd party, Edge Computing
  - ✓ Secure provision of information from external application to 3GPP network

Monitoring capability 5GC->AF	• UE location, reachability, roaming status, and loss of connectivity
Provisioning capability AF->5GC	• Expected UE Behaviour (e.g., a planned path of UE movement)
Policy/Charging capability AF->5GC	• QOS • Charging policy

Network Capability Exposure: Outlook and Issues

Tencent Expectations

- **Exposed API interfaces on important 5G capabilities (e.g., Network slicing, edge computing) can clearly be defined and friendly used by 5G applications**
- **Exposed capabilities brings Less influence to 5G applications**



Issue

How to support E2E network slicing from UE to App in DC?
It is not clear for slicing exposed interfaces and business model?
Application provider need complex cooperation to use MEC feature, e.g., need to cooperate with operator and MEC platform vendor to deploy MEC app and realize local traffic routing?

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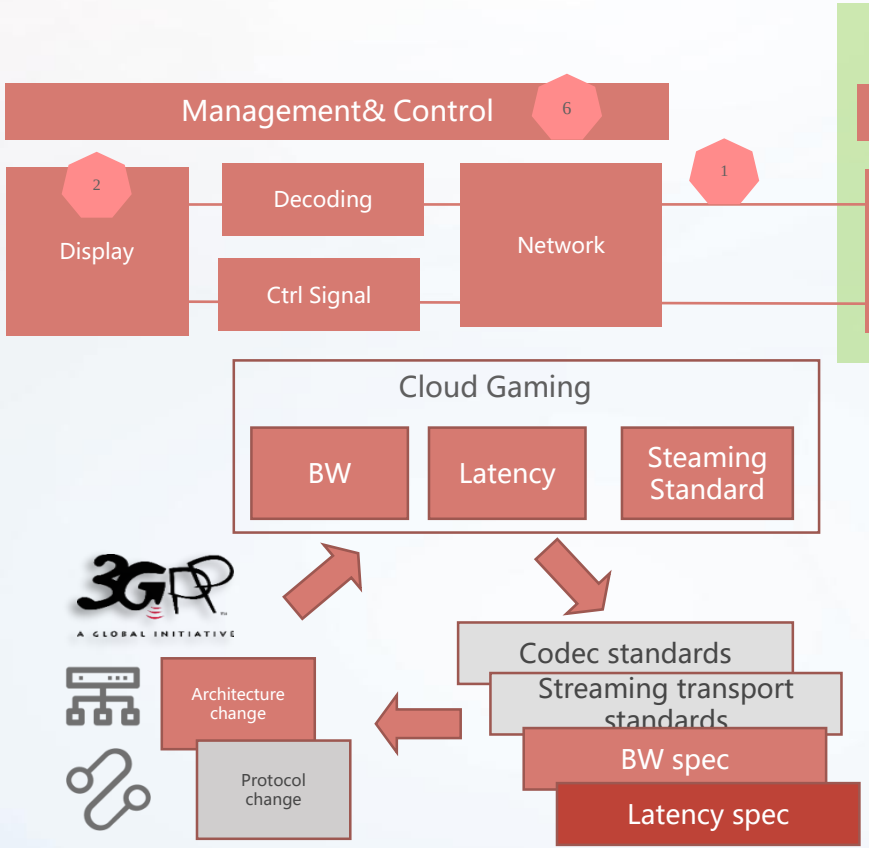
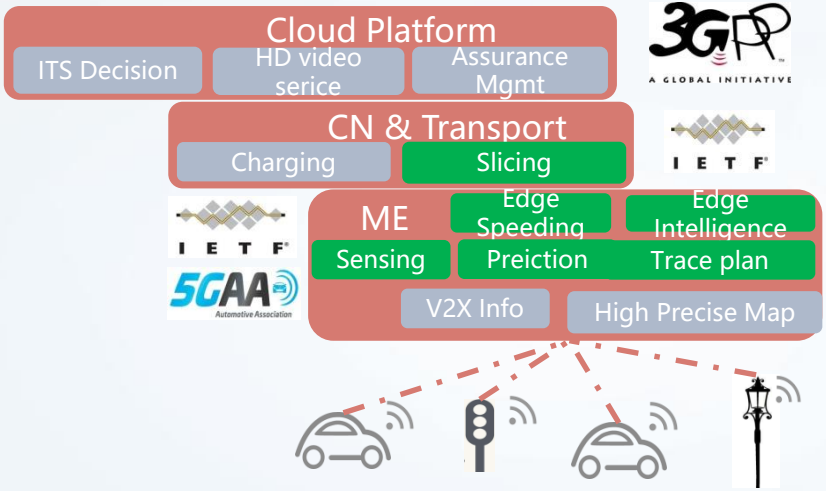
5G Cloud Gaming Services



- *Large network dependency on 5G network which demonstrate application-driven network*
- *Support complex rendering for popular games without high-end dedicated gaming devices;*
- *No need for downloading and pre-installation, prompt trial;*
- *Facilitate gaming version update and avoid tag-on service/ cheating program;*
- *Lower down development barriers.*

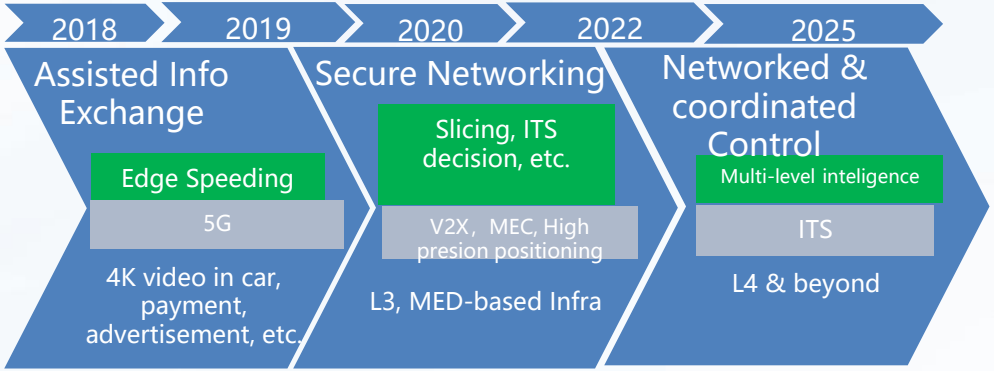
5G V2X Services

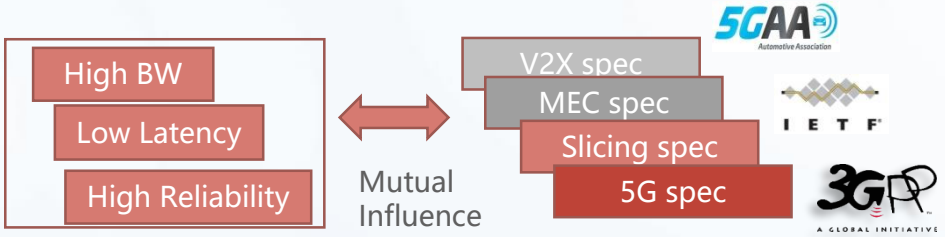
- Compared with single-car sensing, 5G V2X can achieve beyond Line-of-Sight transmission and improve safety by 80%.
- MEC + V2X support L3 AD and improve traffic efficiency by 30%.



MEC-based V2X as mandatory component to support Autonomous driving

Road map of Intelligent networked vehicles

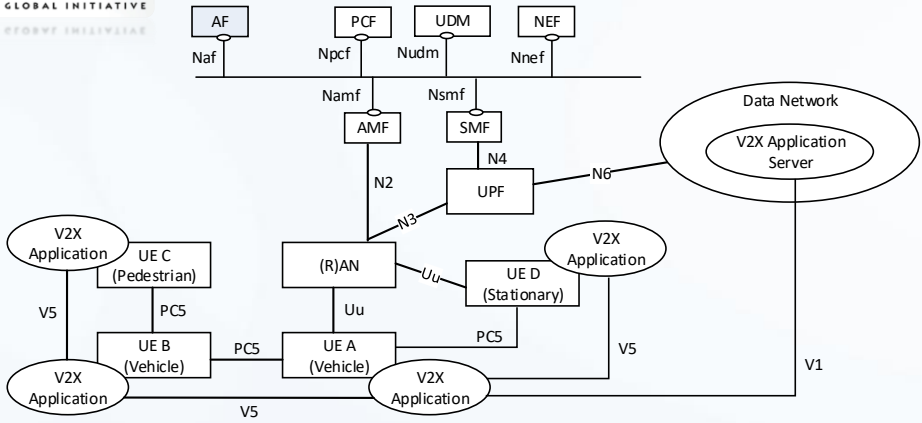




5G V2X Services
– Standard Activities

- 3GPP specified LTE-V Phase I standards in Y2014-2016 and Phase II standards in Y2017, all based on LTE;
- 3GPP is specifying NR-based V2X standards in Rel-16.
- Tencent attended 3GPP SA1#83 in Aug. 2018 and SA2#129 in Oct. 2018 and submit contributions for 5G V2X topic.

SA1	• 5G V2X requirements
SA2/3	• 5G V2X CN architecture, E2E procedure and security issues
RAN1/2/3/4	• 5G V2X radio access architecture & protocols, radio resource management and RF issues



Example Architecture Option for 5G eV2X being discussed in SA2

5G V2X Services
– High Accuracy Positioning as Enabler

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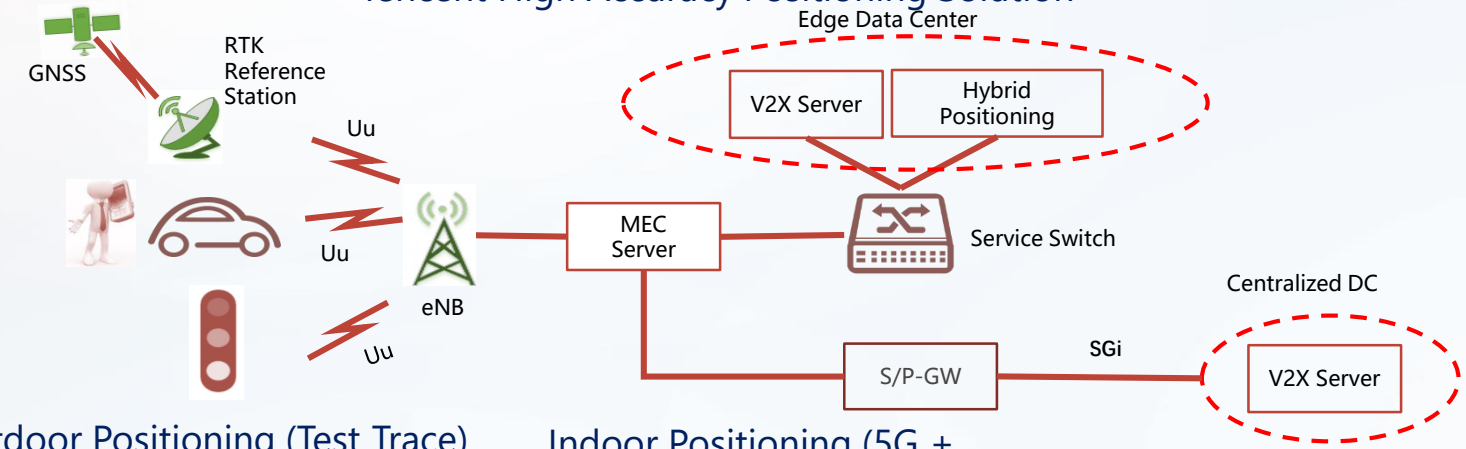
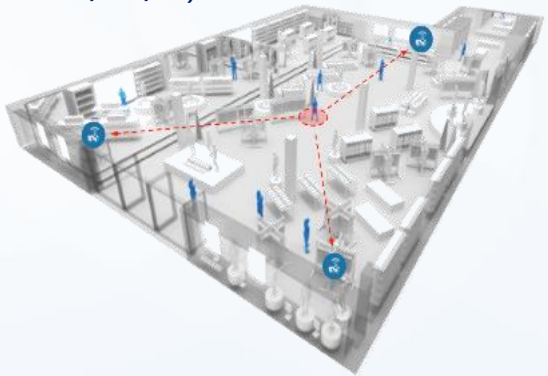
Tencent High Accuracy Positioning Solution



Outdoor Positioning (Test Trace)

GPS-enabled Phone in Car RTK Terminal in Car

Indoor Positioning (5G + WiFi/BT/…)

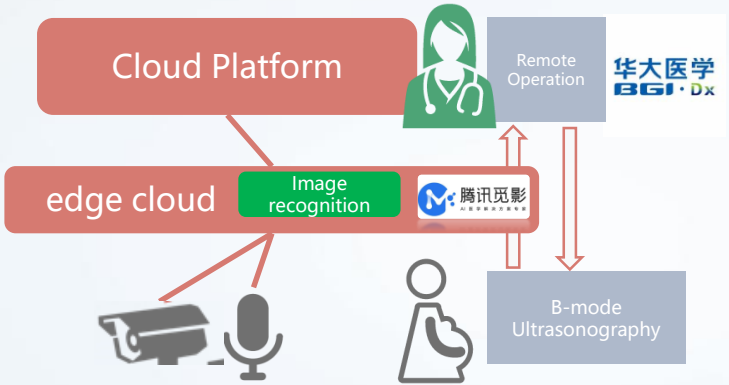


- **Tencent Testing Results**
  - *RTK-based positioning can achieve accuracy to lower than 0.1 m;*
  - *RTK-based positioning can support 5G V2X;*

5G New Services – IIoT

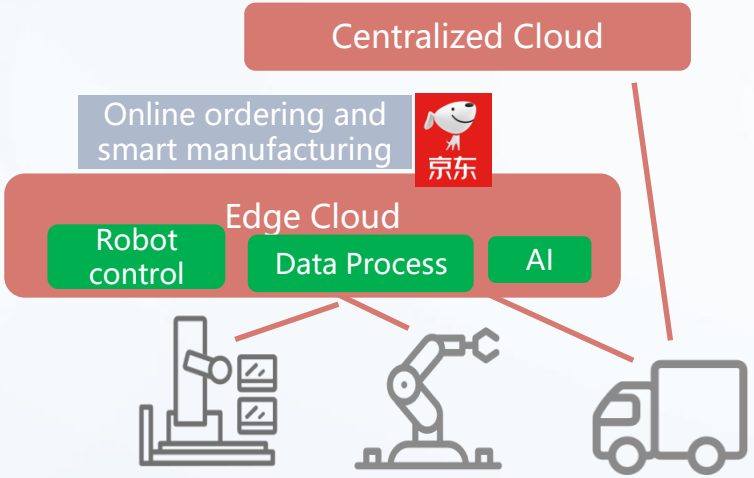
Medical Case

- medical image recognition，real-time image upload(high UL throughput) to cloud/MEC by 5G
- Remote Consultation
- Remote diagnosis for emergency ambulance case



Manufacturing Case

- Flexible production line: Robot arm manufacturing control in edge cloud(low latency) to improve efficiency
- Logistics info report, equip management and tracking
- Manufacturing equipment data analysis. E.g., the feasibility of screw driver



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E2E 5G Trial Network

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CPE

5G RRU

SW

BBU

CN Node

MEC

Cloud Gaming Server

Test of Tencent Existing Services over 5G Network

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QQ Voice& Video

Voice Quality ↑

5G Outdoor Testing in Guangzhou

1. Test of QQ voice&video services
2. QoE improved for voice and video
3. Caton eliminated

Tencent Video

Resolution ↑

5G Outdoor Testing in Guangzhou

1. Resolution higher than 4K
2. More stable steaming with better user experiences
3. Caton in 4G disappeared in 5G

Gaming

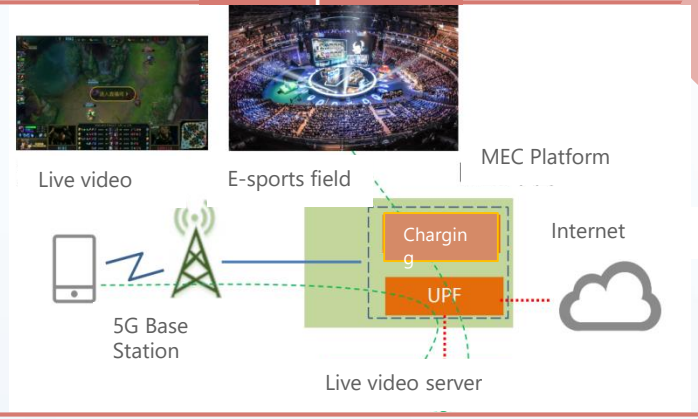
Experiences ↑

King glory experience guarantee with Operators

1. E2E gaming traffic marked as highest priority
2. Special treatment of gaming traffic by operators' network

E-Sports

Latency ↓



Thanks!