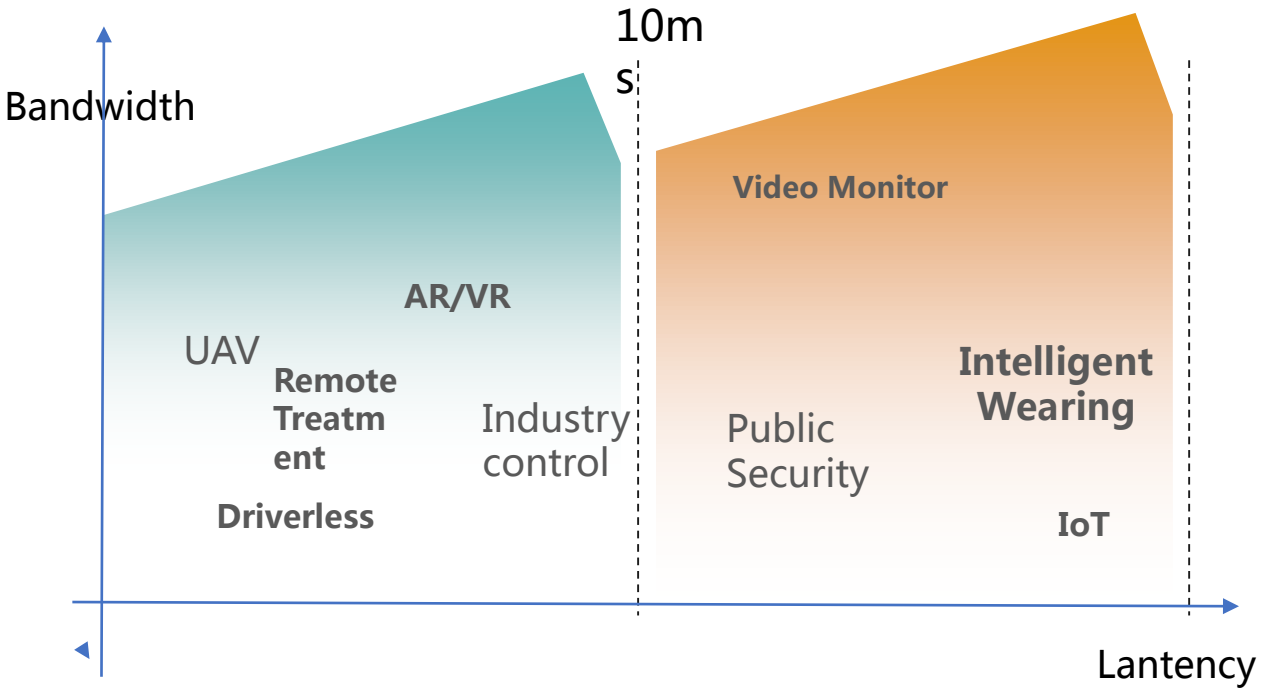
Edge Cloud Discussion

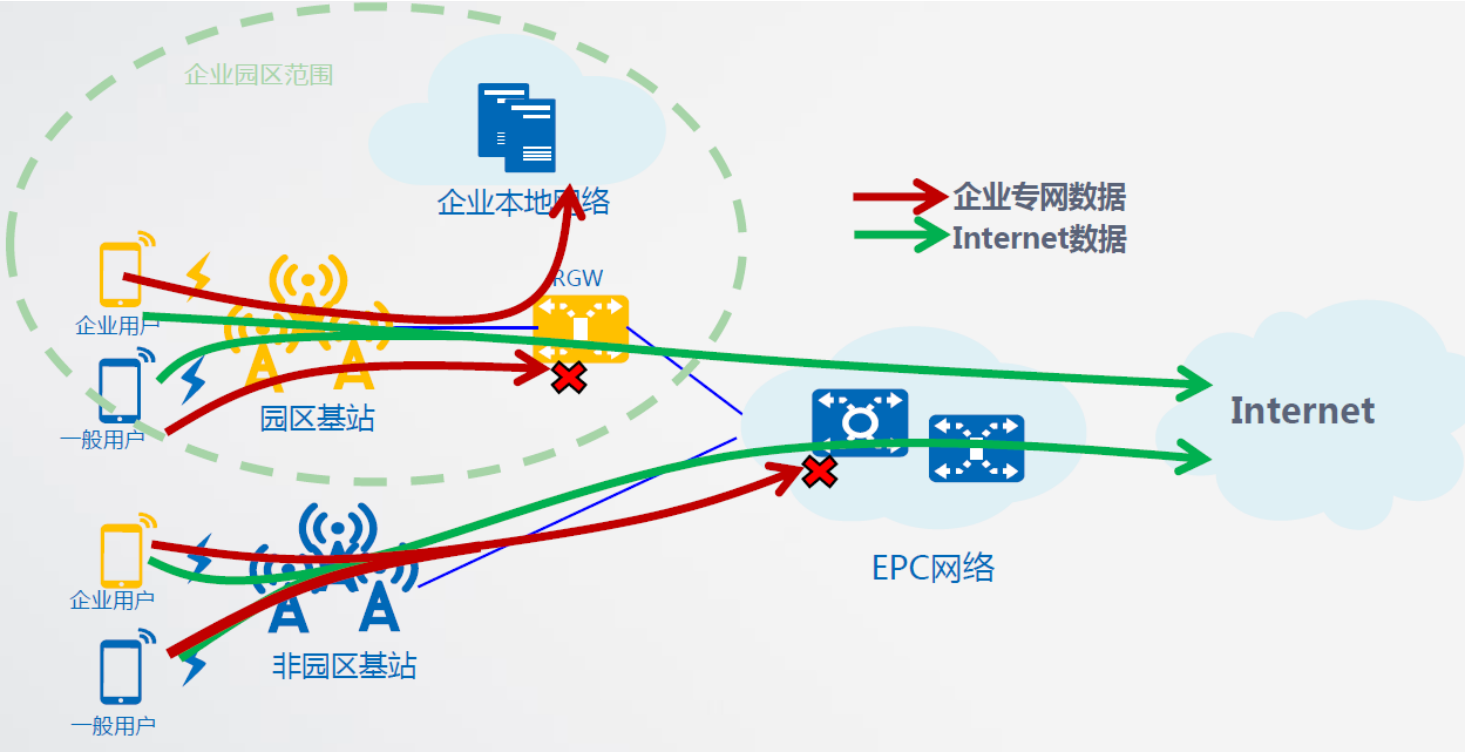
Service Requirement for Edge

Service for Edge:

- User plane services: SAE-GW, UPF
- Low Latency Services: VR, automatic driving
- High Throughput services: AR, Video surveillance
- Services with huge requirement for multicast: IPTV
- High Speed Mobile Services: UAV

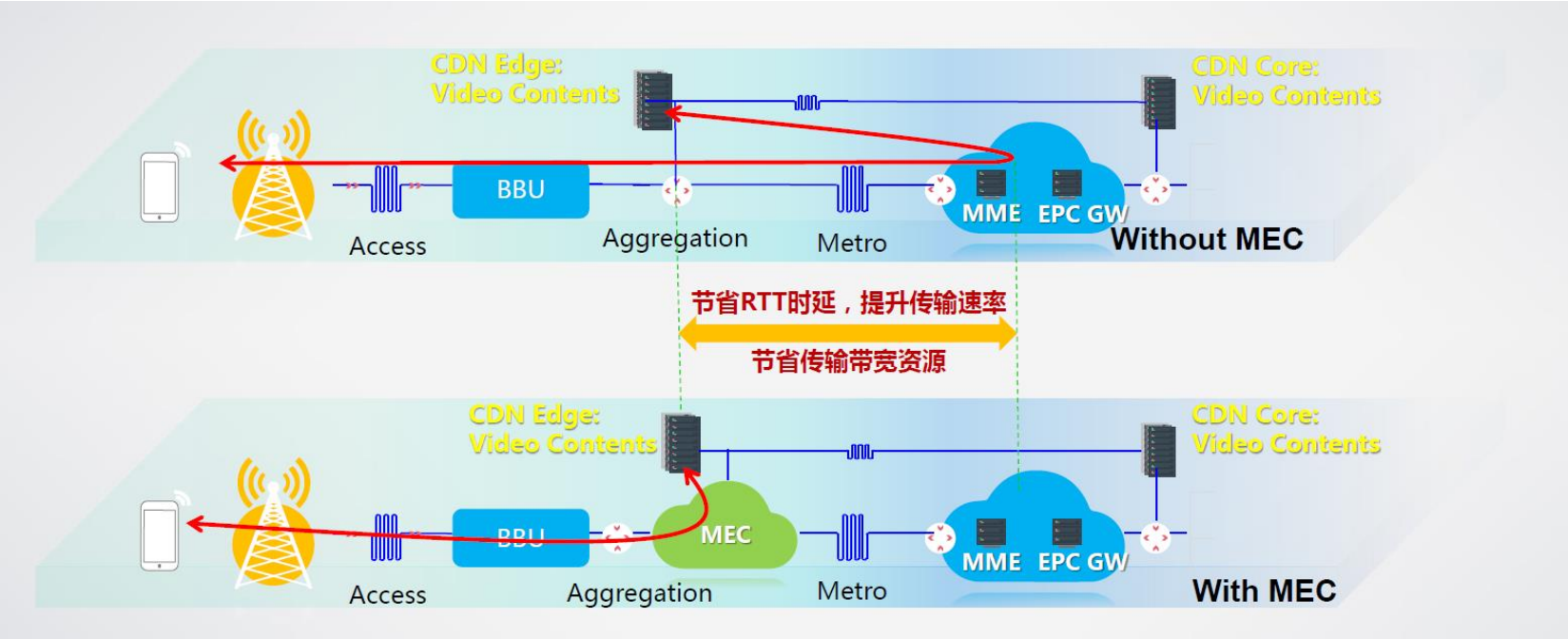


Usecase 1:Enterprise Private Network



- Related Technology
  - Edge DC deployment
  - Local Traffic Offloading
  - Distinguish Local Network Access
- Target
  - Inform local private network service
  - Reduce the access latency

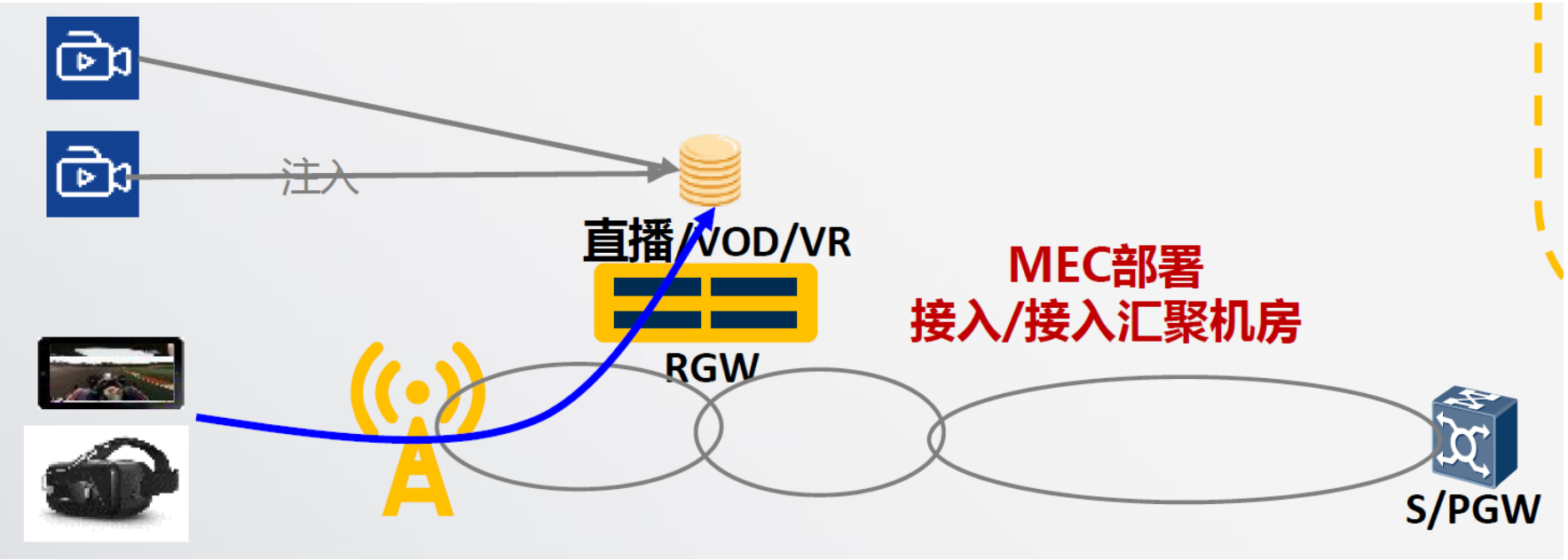
Usecase 2: CDN deployment



- Without edge cloud
  - Waste more transmission bandwitdth
  - Increase Core Network workload

- With edge cloud
  - Reduce the access latency
  - Reduce the resource consumption in transmission

Usecase 3: Live Sporting Event



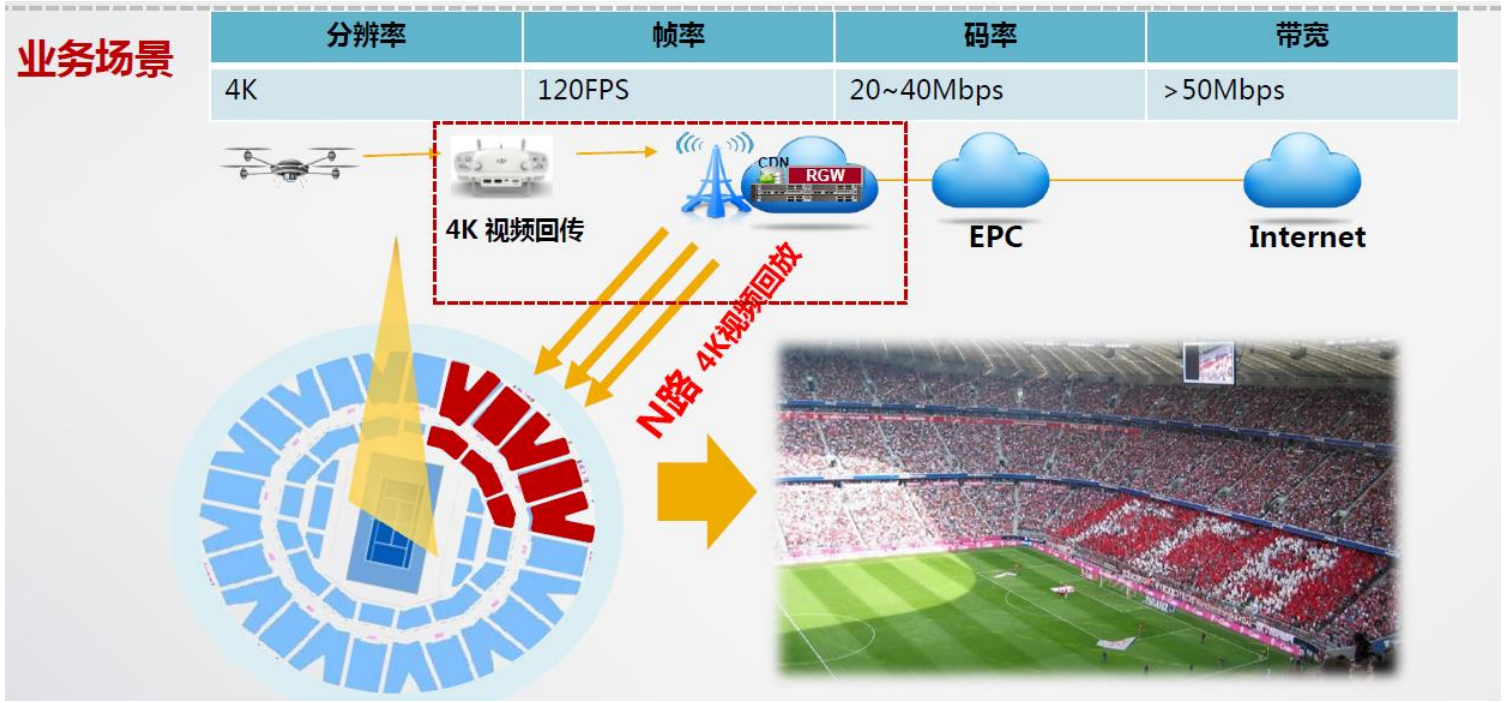
- Target
  - More comfortable user experience
- MEC
  - Processed at local application servers
  - Video back to end users with service distribution

Usecase 4: Scenic Area with AR/VR

- Disadvantage & Problem
  - Lack of innovation
  - Few items for sightseeing
  - Flow charge is too expensive

- Target
  - Reduce the charge with providing the scenic area more economic larger package
  - Enrich the experience of travelers

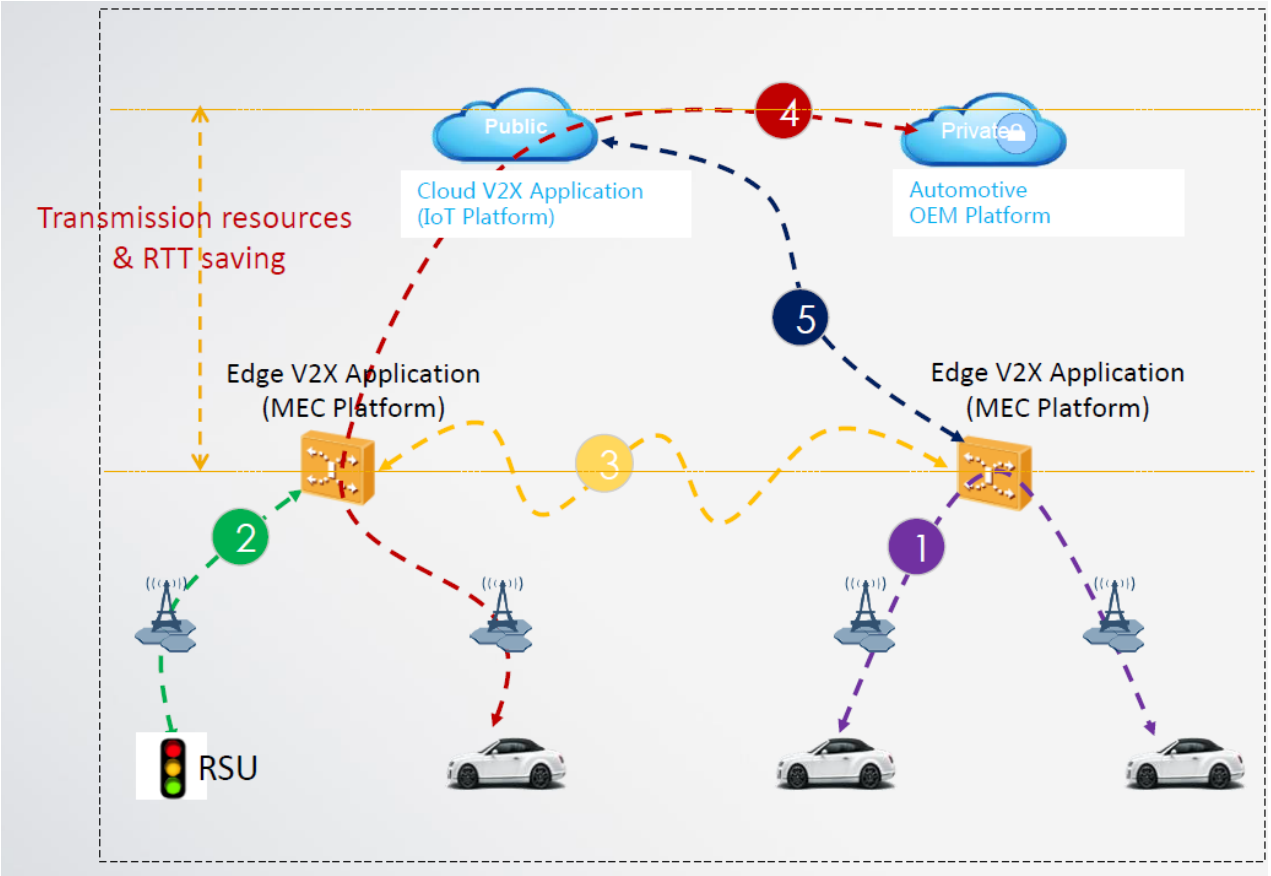
Usecase 5: Real time data backhaul of Unmanned Aerial Vehicle(UAV)



- Disadvantage & Problem
  - Using UAV's local storage
  - Long backhaul route
  - Bandwidth demand

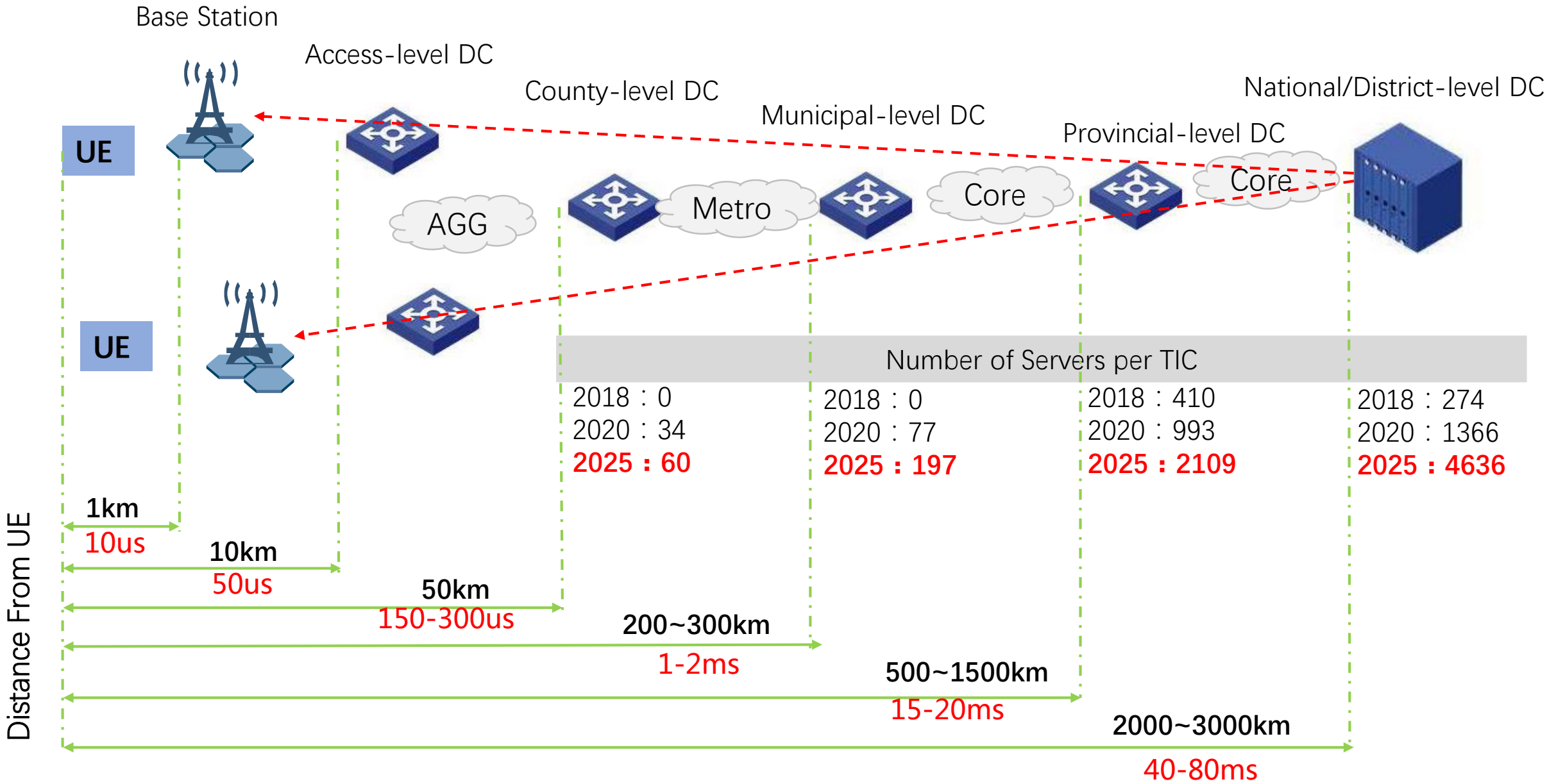
- Using MEC
  - Use the venue's prepared storage or some others
  - Shorten backhaul route
  - Reduce workload of both core network and backhaul network

Usecase 6: V2X service



- Application Scenario:
  - Driverless
  - Intelligent parking
  - Intelligent traffic and weather reminding
  - Communication between cars
  - V2N V2X V2I V2V V2P
- Difficulties:
  - Very strictly low latency for driverless scenario

Network Structure of China Mobile



Features of Edge Cloud

Edge TIC is quite different from core TIC, especially county-level and Access-levy edge TIC.

Features of Edge TIC:

- **Limited space and power resource**
- **Lightweight management**
  - Small scale of edge TIC nodes (less then 10 in AP)
  - No need to fully install management component
- **Unattended**
  - Remote & scattered location of edge TIC nodes
  - Remote orchestration & management are needed
- **Resource Heterogeneity**
  - Various services: MEC, CDN, 5G-UPF
  - Various infrastructure: VM, container, bare metal
- **Acceleration**
  - Low-delay, high-bandwidth services
  - FPGA, GPU, TPU

Open Questions for Edge(1/2)

- **Hardware:**
  - Do we need a specific design of hardware for edge?
  - Central offices for operations varies a lot. For central offices in AP, specifically designed hardware should be necessary due to limited space and power resources
- **OpenStack:**
  - **Light weight OpenStack is important for Edge**
  - **Remote provisioning (cell, Multi-region, or remote compute). For each solution, lots of detailed questions will be raised for integration.**
- **SDN**
  - Do we need SDN at Edge?
  - Light weight SDN controller should be necessary for edge
  - How should SDN work with OpenStack in edge, when OpenStack may in a remote mode

Open Questions for Edge(2/2)

- **Network**
  - Does Edge still need spine-leaf?
- **Storage**
  - Do we need distributed storage or disk array necessary for edge? Or we just use local disk
- **Container**
  - Heterogeneous resources at edge, including VM, container and bare metal
  - How should we manage these resources? Using OpenStack or K8S or both?
- **Acceleration**
  - Lots of acceleration requirements for service at edge, including GPU, FPGA, smart NIC
  - A unified API for all different acceleration resources is necessary so that we can still have the agility feature for virtualization
- **Provisioning and operation**
  - Remote provisioning is a must for edge, therefore reliability and disaster recovery is important

Progress in Upstreams

- ETSI MEC ISG
  - Requirement analysis
  - Framework design
  - Deployment of MEC in NFV
  - (http://www.etsi.org/deliver/etsi_gr/MEC/001_099/017/01.01.01_60/gr_MEC017v010101p.pdf)
- OpenStack
  - FEMDC SIG https://wiki.openstack.org/wiki/Fog_Edge_Massively_Distributed_Clouds
  - Tricircle: https://wiki.openstack.org/wiki/Tricircle_before_splitting#Massive_distributed_edge_cloud
  - Cyborg: https://wiki.openstack.org/wiki/Cyborg
- Akraino:
  - code designed for carrier-scale edge computing applications running in virtual machines and containers
  - Code release in 2018Q2
  - https://www.akraino.org/
- ONAP
- K8S
- ODL
- ONOS
- Ceph

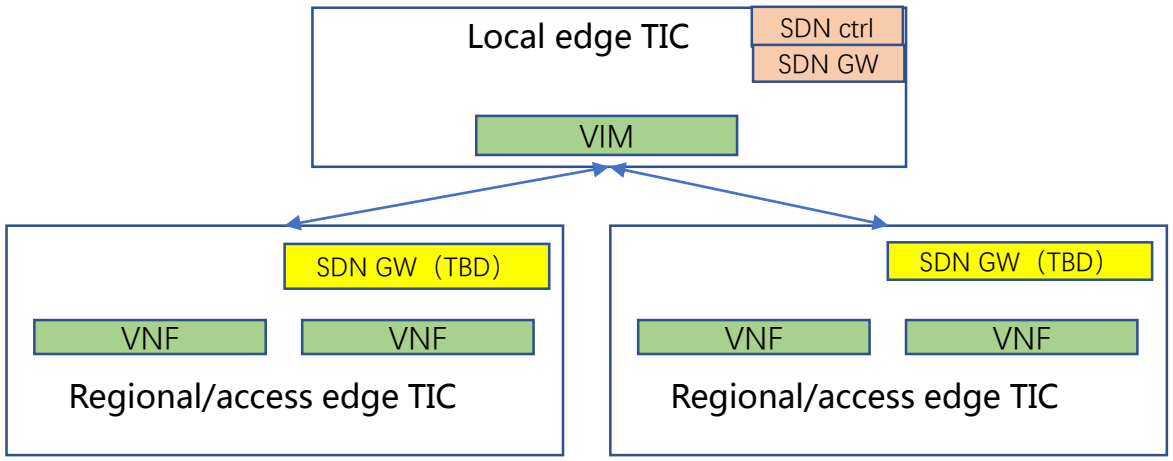
Edge cloud proposal for OPNFV

- **Purpose for this project:**
  - Focusing on the NFV Platform integration for Edge cloud.
  - Make sure we can have a platform for edge, which can stay homogeneous with core, so that unified orchestration and operation mechanism can be used
  - Better trimmed platform to meet the specific need for edge services
- **What we can do:**
  - Requirement Analysis
    - Analyze and conclude the requirement from multiple services (MEC, CRAN, vCPE, vOLT, vCDN, etc.)
    - Reflect the service requirements into allocation and detail requirement for edge
    - Reflect detail requirement of edge into component requirement (NFVO, VNFM, VIM, Hypervisor, VSW, HW, etc.)
  - Upstream integration
    - Engaged in upstreams
    - Transfer detailed requirement of component to upstreams
    - Promote the work in upstream, and integrate them back into OPNFV releases
    - Focusing on integration issues for edge scenario (e.g. how OpenStack should work with SDN controller in remote compute scenario?)
  - Several release scenarios for Edge
  - Specific testing for Edge

NFV Platform for Edge

Solution 1: Remote Hypervisor

(VxLAN Gateway is necessary)



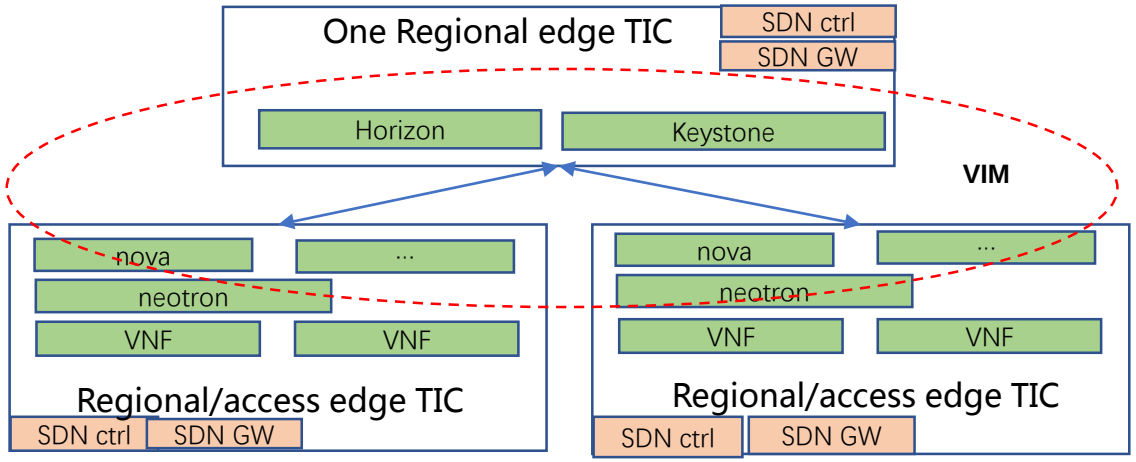
Advantage :

- For regional/access TIC, it is not so important to manage the resource
- Multi areas can share the resource

Disadvantage :

- Two layer network, low latency
- SDN GW is TBD

Solution 2: Multi-Region



Advantage :

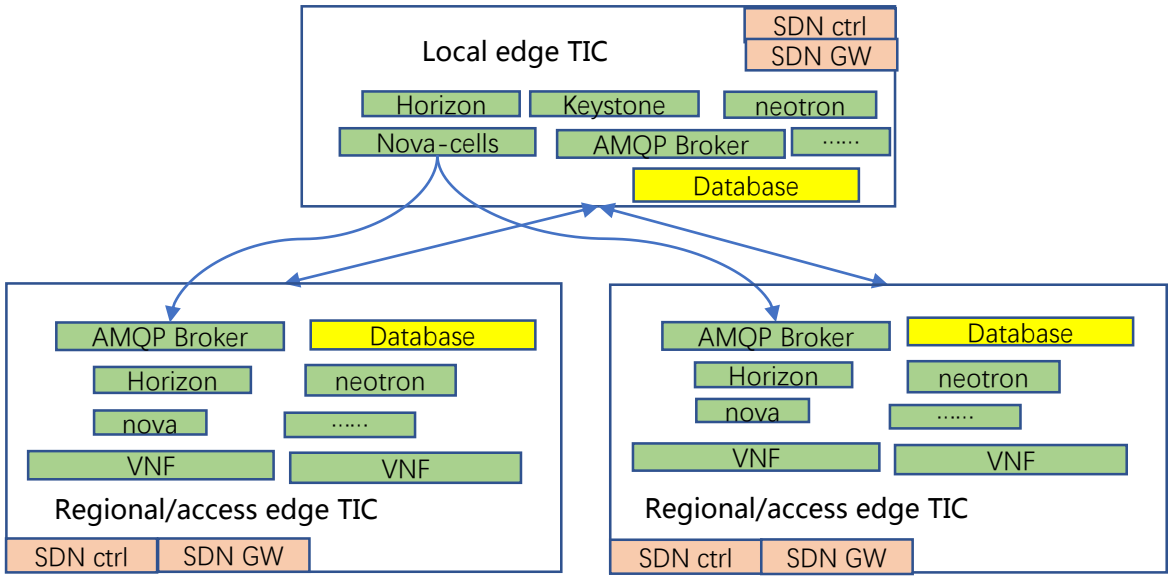
- Unified keystone for certification. Tenants management and resource overview can be done in the regional or local TIC.
- Not strict to the network and latency. IP network is OK.

Disadvantage :

- Regional/access edges will be deployed with unnecessary VIM part.
- Resource share is impossible

Edge Deployment strategy(2/2)

Solution 3: Cell



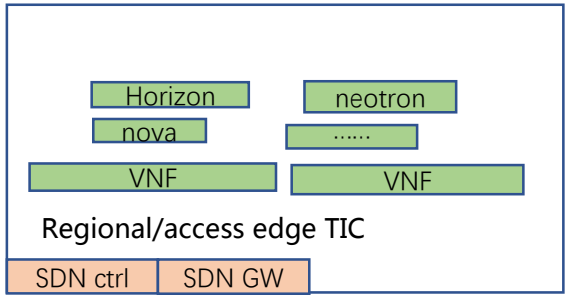
Advantage :

- Extend the resource pool to 2000+ or even more
- Not so strict to the network and latency. IP network is OK.
- Have some successful cases in IT industry.

Disadvantage :

- Regional/access edges will be deployed with unnecessary VIM part.
- Migration is impossible
- Solution 3 Can not meet the demand of lightweight edge TIC

Solution 4: Light weight OpenStack



Advantage :

- With light weight OpenStack services in 1-2 vCPU
- Other CPU resources could be shared with VNFs

Disadvantage :

- Impossible for physical separation of management network and service network
- Performance of light weight OpenStack need to reexamined.