CUPS White Paper

Control and User Plane Separation

As network traffic grows dramatically, all new investments in networks to meet throughput capacity requirements must be 5G ready to support New Radio(NR) and the Non-Standalone(NSA) infrastructure.

HUAWEI
Huawei Technologies Co.,Ltd.

Content

1. Network Strategy for Global Operators

Today, Mobile Communication form an indispensable part of the daily lives of millions of people in the world. This situation is expected to continue and become even more undeniable in the future. Currently, many operators are facing the challenge of booming traffic. At the same time, 5G is at the gate. Amid such a situation, global operators started the study on NFV[1], CUPS[2], and 5G Since 2014, aim to identify the future needs of 2020 and beyond. Operators, vendors and standard bodies are working closely to identify the right system concept and technologies. After several experimental trials, commercial deployments with world-leading vendors are ongoing. The goal is to provide an initial 5G deployment by 2020. This white paper addresses driving force, evolution concept, technical solution, and deployment experience shared on CUPS for realizing 5G targeting and beyond.

2. Challenges for Operators

2.1 Need to balance traffic growth and subscriber growth.

With the popularity of 4G in recent years, Some Top Operators' subscriber base growth slowed down, but the throughput of the entire network continues to grow at a high speed. The capacity of the Evolved Packet Core (EPC) network needs to be expanded continuously to meet service development requirements. In particular, the capacity expansion of System Architecture Evolution Gateway (SAE GW) has been undergoing immense pressure.

The deployment and capacity expansion solution for traditional EPC is a rather passive solution, which can only solve the current problems. This type of solution can further

[1] NFV: Network Function Virtualization ---- Source: NFV white Paper

[2] CUPS: Control and User Plane Separation ----Source: 3GPP CUPS Protocol

expand the EPC network but cannot solve all the problems. The potential problems faced by the traditional EPC network are yet to be solved completely. These problems include difficulties in user experience improvement, flexible transmission path selection, easy O&M, and smooth evolution to 5G networks.

2.2 Need to continuously improve service experience

With the further enrichment of mobile services, especially the rapid development of video services, the network bandwidth required for services is gradually improving.
As traffic continues to grow, we found that traffic grows faster during busy hours than at average. Video is the root cause of this problem. Different from other access methods (such as web traffic or file sharing), video access has obvious "golden time". Real-time video, on-demand video, VR call, etc. all have a great impact on short-term traffic.
The role of CDN is increasing, which brings changes in the network topology. A large number of CDNs have been sunk to the Local DC. However, when users access video in the CDN, they still need traffic to the backbone network, which brings impact on the backbone network traffic. Generates a large amount of transmission delay.

2.3 Need to deal with the uncertainties of new services

Most of communication networks are currently focused on providing services for people. However, the communication networks also designed to a large number of things. The differences between communications with Internet of Things (IoT) terminals are greater than the differences between communications with people.

IoT terminals can be classified into three categories: big-bandwidth applications (such as surveillance cameras and electronic billboards), medium-speed applications (such as smart homes, point of sale (POS) terminals, and low-speed applications (such as tele-metering). Not all of these scenarios can be well supported by the current EPC network. For example, the Narrowband Internet of Things (NB-IoT) solution is not supported. The

potential requirements need to be considered before the deployment of new devices and version upgrades.

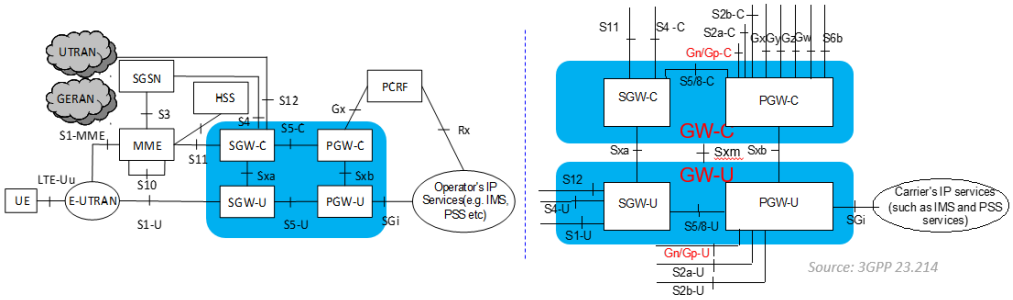
2.4 Tackle 5G challenges in advance

As defined in 3GPP, SBA (Service Based Architecture) based 5G Core Network must be CUPS capable from Day1. A smooth evolution from EPC to 5G should be considered. Therefore comes the challenge to support CUPS in EPC.

3. CUPS: Milestone of Development

3.1 CUPS Definition

Control Plane and User Plane Separation



3.2 Conditions for CUPS deployment

1）GW-C adopts the centralized deployment mode. It mainly processes signaling plane messages, which has low performance requirements for network elements, and can fully meet the requirements by using cloud technology.

2）According to the different requirements of GW-C and GW-U, different DCs is selected for construction.GW-C is centrally built in the central DC while GW-U should be deployed in local DC.

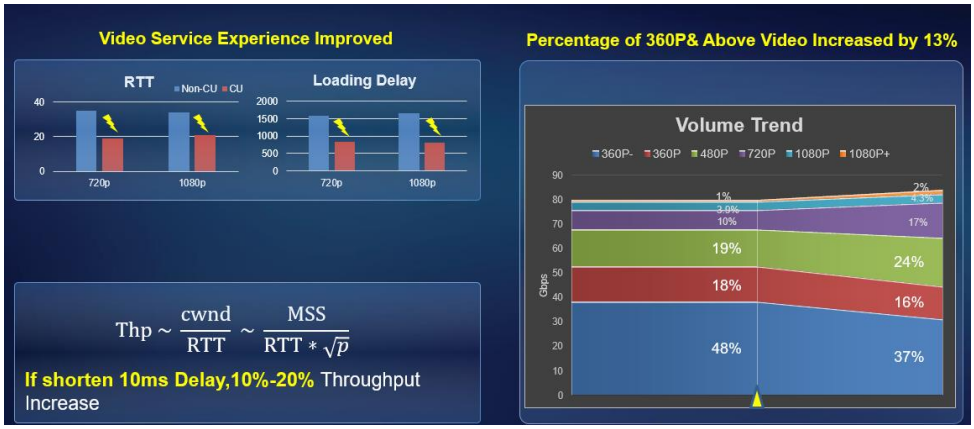
3）GW-C connects to multiple GW-Us and serves a large number of subscribers. If the GW-C becomes faulty due to earthquake services are possibility affected. Therefore, it is mandatory to support session redundancy for GW-C. This feature allows two GW-Cs to work in active/standby mode, ensuring high reliability of the control plane.

4. Benefits from CUPS Deployment

Huawei CUPS solution is a 3GPP-compliant, new-generation MBB solution based on Cloud Native architecture. It separates the user plane from the control plane, provides centralized gateway configuration and unified interfaces for the control plane, and flexibly distributes user plane gateways. This solution provides the following advantages:

4.1 Better user experience

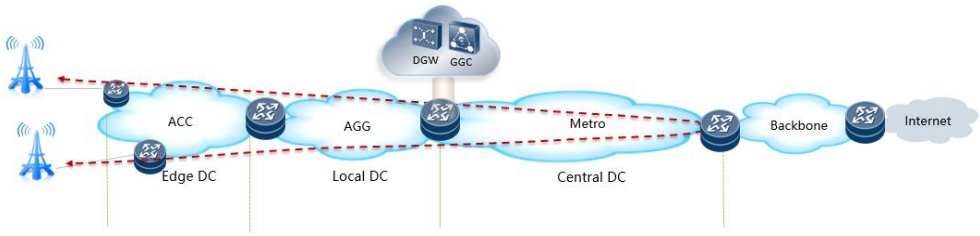
Subscribers can access the nearest GW-U for services, reducing end-to-end access latency and improving user experience. At the same time, DOU can be increased due to better use experience.



Source：Huawei

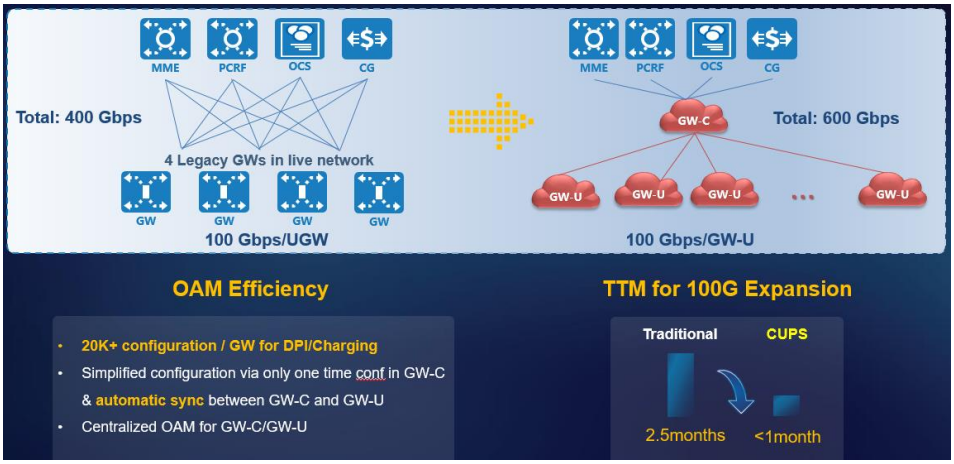
4.2 Higher transmission resource efficiency

Subscriber services access the Internet through the nearest GW-U and do not need to access the backbone transmission network. During an upward trend of subscriber traffic, the transmission pressure on the backbone transmission network can be significantly reduced.



4.3 Reduce OPEX

In CUPS deployment mode, the GW-C connects all signaling interfaces and distributes service configurations, unified the signaling interface with all neighbor NE, the configuration for GW-U also simplified, so can reduce the competence requirement for local O&M team.

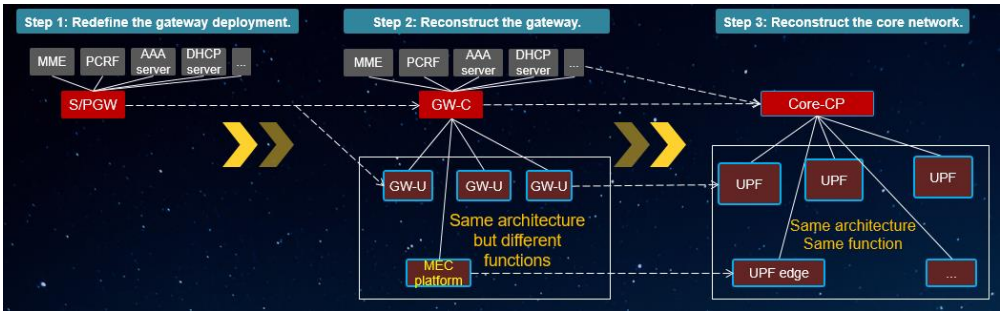


Source：Huawei

4.4 More flexible capacity expansion

After CUPS, only the GW-U needs to be added to connect to the GW-C, this will solve Operator's high-speed throughput growth problem, even with the low subscriber base growth. The capacity of the GW-C on the control plane does not need to be expanded, at the same time, GW-U can be deployed only on traffic booming area and saving part of GW-C expansion requirement.

4.5 Smooth evolution and ready for 5G



The architecture of 5G SA core networks has been finalized based on CUPS, and service-based interfaces are used between control planes. 5G core network gateways are designed based on the CUPS architecture .This means that CUPS is the only way to 5G core networks. With current CUPS network architecture, Operator are ready for 5G any time.

5. Summary

As the Existing Systems and applications goes end of life support gradually, such network functions will be virtualized and migrated to cloud platform solution. With CUPS solution, it can guarantee the network reliability during the migration and improve the efficiency. After that, Operator's Network is capable to support for the New Radio (5G) with the NSA (Non-Standalone) infrastructure ready.