

GSMA 5G TRANSFORMATION HUB

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5G First Class Experience at Concert Scenarios

Sports and entertainment content has become one of the highest-ranking consumer services, with consumers and fans increasingly eager for interactive and even immersive content. Music concerts in China attract large audiences and crowds at the venue. In 2023, China had nearly 450,000 live performances which attracted audiences totalling more than 170 million.

Many of these were extremely large audiences numbering in the tens of thousands. Beyond the imperative to provide reliable mobile coverage to such large crowds, operators face particular challenges in terms of network congestion and user experience, as users typically take a lot of photos and videos and then proceed to share or live stream their content.


China Mobile Group's Henan Company Limited (HCL) is the largest mobile operator in the Henan province in Central China. As one of the OpCo's that have launched 5G standalone networks in China, HCL has deployed a 5G Intelligent Packet Core solution that effectively taps into the Network Data Analytics Function (NWDAF) interfaces which are embedded into the 5G. This allows HCL to gain much greater intelligence on their network's coverage and conditions at any given time. This new solution has also enabled HCL to offer Service Assurance to their premium (VIP) users within the GoTone service brand. HCL can quickly identify network issues and then optimize network resources in a highly automated manner. Not only does this approach lower operational costs but it also has a direct and positive impact on boosting user experience.



5G First Class Experience at Concert Scenarios

CASE STUDY LEAD:
CHINA MOBILE GROUP
HENAN COMPANY LIMITED,


+ CHALLENGE

 With the advent of 5G, a raft of new services and applications have been launched for consumers. However, these popular services come with significant demands on network resources which can cause inconsistent or degraded user experiences at different times. Maintaining user experience is critically important for mobile operators' efforts to monetize their 5G investments and increasing user stickiness and willingness to pay.

Even if the operator is able to meaningfully improve user experience, this alone is not sufficient to sway consumer sentiment. Rather, there should be a way for them to visibly be notified of improved conditions so that it creates explicit recognition and increased user engagement and stickiness. Consumer demand for guaranteed bandwidth is much greater at live entertainment or sporting events,

where they place a premium on capturing live moments and sharing it with their communities.

+ SOLUTION

 HCL deployed the Network Data Analytics Function (NWDAF) module as part of the Intelligent Packet Core of the 5G Standalone network to drive its new assurance-based tariff packages. The NWDAF module of the Intelligent Packet Core dynamically detects poor user experience and determines whether to dynamically initiate service assurance based on the radio resource status and user subscription information.

The NWDAF module is utilized to scan and evaluate, in real-time, the network conditions for those users who have subscribed to the GoTone high-end packages. By scanning over 30 key services in real time, the NWDAF is able to detect whether the quality of top services of these subscribers is poor, following which the

NWDAF automatically triggers the dynamic assurance service and updates the UE logo in the upper left corner of the handset display screen. In this way, the customer becomes aware of when their service quality is being "guaranteed". When the customer stops using the service or the guarantee period ends, the guarantee service is terminated.


+ IMPACT & STATISTICS

 After the large-scale construction of 5G, with the formal deployment of network intelligent in 5G-A in 2024, China Mobile Group Henan Company Limited launched three new tariff packages Q1 2025 based on target customers' preferences, targeting high-end GoTone users. The strategy was based on creating a tiered assurance-based segmentation of their consumer base and building tariff packages with assured traffic, excellent service perception, and rich rights and applications to meet customers'

all-round needs, thereby improving users' ARPU.

An example of the "smart network" tariff packages offered by HCL is shown below, with a focus on enhanced uplink features to suit specific usage profiles. In the concert example, users with these packages would have had a superior user experience relative to other users without these assurance-based subscriptions.

+ NEXT STEPS

 Based on the success of these assurance-based packages, HCL is working on designing add-on tariff packages which it will release to its customer base in the near future.

+ STAKEHOLDERS

 China Mobile Group Henan Company Limited

China Mobile GoTone Brand





Live video streaming at concerts and events is **a major 5G use case**

Live Streaming of video content is one of the major new use cases that is being touted for mobile operators as a way to drive 5G monetization. Sports and entertainment content has become one of the highest-ranking consumer services, with consumers and fans increasingly eager for interactive and even immersive content. Music concerts in China attract large audiences and crowds at the venue. In 2023, China had nearly 450,000 live performances which attracted audiences totaling more than 170 million. Many of these were extremely large audiences numbering in the tens of thousands. Beyond the imperative to provide reliable mobile coverage to such large crowds, operators face particular challenges in terms of network congestion and user experience, as users typically capture a lot of photos and videos and then proceed to share or live stream their content.

A recent concert held by the artist Zhou Chuanxiong in Zhengzhou in Henan province in China, is a great illustration of the challenges related to delivering reliable and consistent video content through the mobile network. HCL has observed that uplink usage and load increases sharply when users enter a concert venue, with up to 90% of available uplink bandwidth quickly used up. While this eventually decreases, mobile coverage without guaranteed

assurance will prove to be a frustrating experience for consumers.

The following table provides details of the test result from the concert with large number of user simultaneously on social media channels like WeChat, TikTok and others.

“The live network verification result of the concert is exciting. It fully proves that enabling

NWDAF experience assurance will significantly improve user experience even if the network is heavily loaded. This provides a favorable technical proof for the key scenario assurance service

package to be launched by Henan Mobile” says Zhang Le, Core network manager of the planning department China Mobile Group Henan Company Limited.

NETWORK	USER SERVICE	WEAKNESSES	OPTIMUM FOR
The network is extremely heavily loaded The signal quality is poor. Uplink PRB 80%-90% RSRP: -74db SINR: <0	WeChat (Upload video file 65MB)	- Upload time is 90s - Average bandwidth 3.3Mbps	- The Upload time is 38s The Upload time decrease 57% - Average bandwidth 10.6Mbps
	Live broadcast (TikTok: HD) Experience base line (2Mbps)	- Unable to enter the live broadcast room - Average bandwidth 1.1Mbps	- Smooth live broadcast without frame freezing - Average bandwidth 2.1Mbps
	Live broadcast (HUYA: HD) Experience baseline (5Mbps)	- Frame freezing occurs for 14 times and the frame freezing duration is 39.3s. - Bandwidth < experience base line(5Mbps)	- Frame freezing occurs for 7 times, and the frame freezing duration is 13s. - The bandwidth occasionally lower than experience base line (5 Mbit/s)
The network is extremely heavy-loaded the signal quality is good. Unlink PRB: 80%-90% RSRP: -67db SINR: 13	Wechat (Upload video file: 136MB)	- The Upload time is 103s - Average bandwidth 6.1Mbps	- The s Upload ending time is 66s, which decreases by 36%. - Average bandwidth 17.8Mbps
	Live broadcast (TikTok: HD) Experience base line (2Mbps)	- Smooth live broadcast without frame freezing - Bandwidth > experience base line (2Mbps)	- Smooth live broadcast without frame freezing - Bandwidth > experience base line (2Mbps)
	Live broadcast (HUYA: HD) Experience base line (5Mbps)	- Frame freezing occurs 11 times and the frame freezing duration is 10s. - Bandwidth > experience base line(5Mbps)	- Frame freezing occurs once and the frame freezing duration is 1.5s. - the bandwidth occasionally lower than experience base line (5 Mbit/s)



Frozen Frames and Buffering are **Common Challenges**

One of the most common issues with consuming video content in a highly congested network environment is dealing with frozen frames. A secondary problem is buffering.

cause a degraded level of user experience and satisfaction, which is detrimental to the operators' brand and revenue potential.

Repeated frame freezing will cause a degraded level of user experience and satisfaction, which is detrimental to the operators' brand and revenue potential.

This phenomenon occurs due to multiple users having to share the finite bandwidth on offer. In the example of the concert in Zhengzhou, a significant number of "common users", that is, users without the VIP packages that guaranteed service assurance, suffered from numerous instances of frame freezing with the available bandwidth dipping below the baseline of 2 Mbps. Repeated frame freezing will



Deploying an Intelligent Packet Core with NWDAF

Improving user experience depends on a large amount of data analysis and network configuration optimization. Prior to 5G SA, 3GPP standards did not define a lightweight data analysis system, thereby making network analysis cumbersome. In addition, data analysis and processing were not automated, and even once the analysis was completed, there was no way to dynamically adapt the network in real time. As a result, mobile operators were forced to spend significant resources on manpower and materials in order to optimize their networks.

On November 16th, 2024, HCL deployed an extended network at the Zhengzhou Olympic Stadium for the Zhou Chuanxiong concert. The network featured 18 cells, with 187 RRUs deployed on 2.6 GHz and 4.9 GHz bands. Three service types were trialed including HUYA and TikTok for live broadcast and WeChat for video content uploads.

The core element of the solution is the NWDAF module of the Intelligent Packet Core, which dynamically detects poor user experience and determines whether to dynamically initiate service assurance based on the radio resource status and user subscription information.

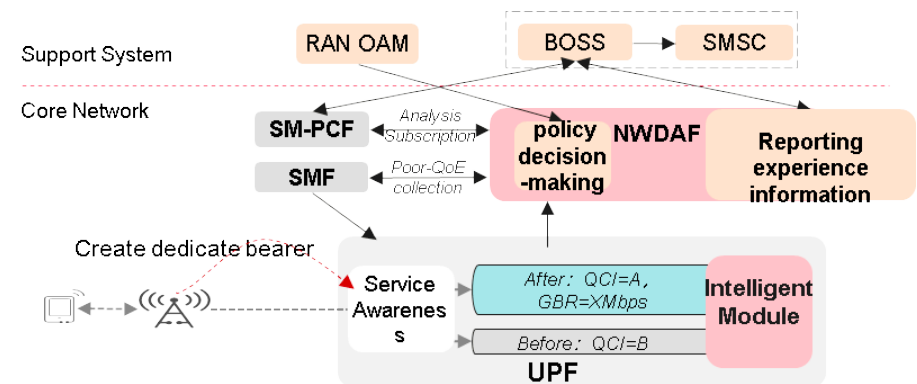
The solution deployed for the concert taps in NWDAF to evaluate network conditions. To do this, NWDAF evaluates the experience of 30 Key services in real time for users who have subscribed to the GoTone first-class package to determine whether service experience is poor. These include many of the top apps and services used in China, including:

- Games (King of Glory, League of Legends, etc.)
- Live broadcast (TikTok, Kuaishou, etc.)
- Instant messaging (Wechat, QQ, etc.)
- Video (iQIYI, Migu Video, Mango TV, etc.)

- Office (ViLin , Tencent conference, DingTalk, and Lark)
- New services (such as Migu cloud games)

Once the NWDAF detects poor network quality conditions, the NWDAF automatically triggers the dynamic assurance service that “VIP users” have subscribed to. On their phones, these users will see an updated logo in the upper left corner, as shown

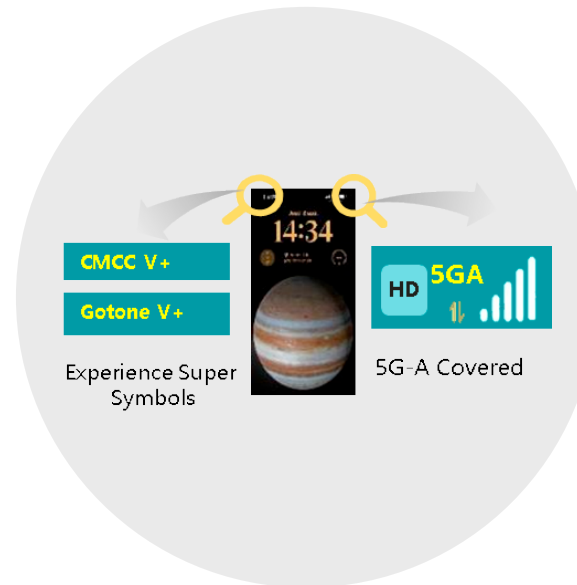
in the left part of the following figure. When the customer stops using the service or the guarantee period ends, the guarantee service is terminated. For users who have subscribed to these packages, China Mobile-5GA is displayed in the upper right corner of the mobile phone that supports 5GA signal bars, such as iPhone 12 or later, VIVO x90s, VIVO s12, and ZTE A20/30, as shown in the right part of the following figure.



Based on standard 3GPP interfaces, the solution focuses on network performance and resource utilization, and provides intelligent, efficient, and controllable experience assurance for key services. This feature helps operators save resources, improve user satisfaction, improve average network efficiency, and enrich their operation modes. In other words, in addition to ensuring service experience of subscribers who have subscribed to the package, this solution has the following features:

- Real-time user experience awareness and on-demand dynamic assurance
- Guarantee is performed only when users experience poor quality. This prevents network resource waste caused by guaranteed bit rates (GBR) immediately when users who have subscribed to the guarantee package trigger services, regardless of service experience.

- If user experience is not improved after the guarantee, RAN determines that the guarantee is invalid and releases GBRs for sessions that fail to be guaranteed in a timely manner to maximize the use of radio GBR resources. Maintains network scheduling fairness and protects basic network experience.
- Build models based on historical RAN data to predict physical resource block (PRB) data in the next two hours, solve the problem that RAN traffic statistics are not reported in a timely manner, and determine whether to enter overload protection based on the predicted PRB load. This feature prevents fairness problems for common UEs caused by dedicated bearers for guarantee after the PRB is heavily overloaded.



If user experience is not improved after the guarantee, RAN determines that the guarantee is invalid and releases GBRs for sessions that fail to be guaranteed in a timely manner to maximize the use of radio GBR resources.



The challenge of moving past 5G adoption to monetization

Despite its status as the one of the leading provincial mobile operators in China, HCL was previously unable to support a consistent user experience for high end users who wished to live video stream during concerts and events. This could not be done without deploying huge amounts of manpower and material resources to address the problem. With the introduction of NWDAF, HCL is able to move beyond network slicing technologies like Radio Resource Partitioning (RRP). Now, user experience can be evaluated in real-time, and assurance can be triggered dynamically.

HCL can now profile and keep track of usage and traffic patterns and determine levels of segmentation that could then be applied through policies in the 5G core network. This has allowed HCL to focus on generating differentiated connectivity and experience levels for their customers. Once this service gets launched commercially, HCL's GoTone customers can receive higher levels of user experience at concerts and other live events.

Conclusion

As operators continue to invest in 5G, newer networks based on 5G SA will offer differentiated connectivity experiences to users and applications.

HCL's assurance-based tariff packages have tremendous potential to not only drive ARPU uplift from its 5G user base, but also offer significantly differentiated experiences. HCL can dynamically tune and optimize their 5G network to meet the increasing diversity of demands from their subscribers. Beyond the enhanced user experience, HCL will also benefit from the conservation of network resources and reduce operational costs significantly.

HCL can dynamically tune and optimize their 5G network to meet the increasing diversity of demands from their subscribers



About the GSMA

The GSMA is a global organisation unifying the mobile ecosystem to discover, develop and deliver innovation foundational to positive business environments and societal change. Our vision is to unlock the full power of connectivity so that people, industry, and society thrive. Representing mobile operators and organisations across the mobile ecosystem and adjacent industries, the GSMA delivers for its members across three broad pillars: Connectivity for Good, Industry Services and Solutions, and Outreach. This activity includes advancing policy, tackling today's biggest societal challenges, underpinning the technology and interoperability that make mobile work, and providing the world's largest platform to convene the mobile ecosystem at the MWC and M360 series of events.

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GSMA 5G Transformation Hub

The GSMA 5G Transformation Hub is a source of information on some of the most innovative 5G solutions in the world. This portal contains case studies detailing design, benefits, key players, measured value and the future impact of scaling up these 5G solutions worldwide. The 5G Era is now firmly established and this family of standardised GSM technologies, including mmWave, are being rolled out successfully across the globe. The GSMA 5G Transformation Hub, launched at MWC Barcelona in 2022, provides details of how 5G is best placed to deliver real value for a range of key sectors including manufacturing, energy, transportation, media and live entertainment, smart cities and construction. Many more case studies will be added, in the coming months, covering even more industries and the GSMA is asking Members to nominate innovative 5G case studies to add to this global digital showcase. The 5G Transformation Hub and this particular Case Study are both sponsored by Qualcomm.

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