

ZTE

Case Study

# How Radio Composer Helps China Mobile Prevails in 5G User Experience





## Introduction

Operators have long been looking for ways to improve user experience and enhance utilization of expensive yet limited spectrum. More than ever, 5G poses great challenges to operators in delivering quality network and optimal user experiences as today's mobile networks are more complex than ever with so many spectrum bands to manage and so diverse services to support.

Thanks to the massive rollout of 5G, China has become a global leader in 5G applications. Benefiting also from the 5G user device industry, the number of new 5G connections in China has exceeded 285 million in 2021, accounting for 75% of the world's 5G connections. A total of 1.425 million 5G base stations have been built by the end of 2021, among which 650,000 were deployed in that year alone. 5G is now available in all cities and over 98% counties in the country.

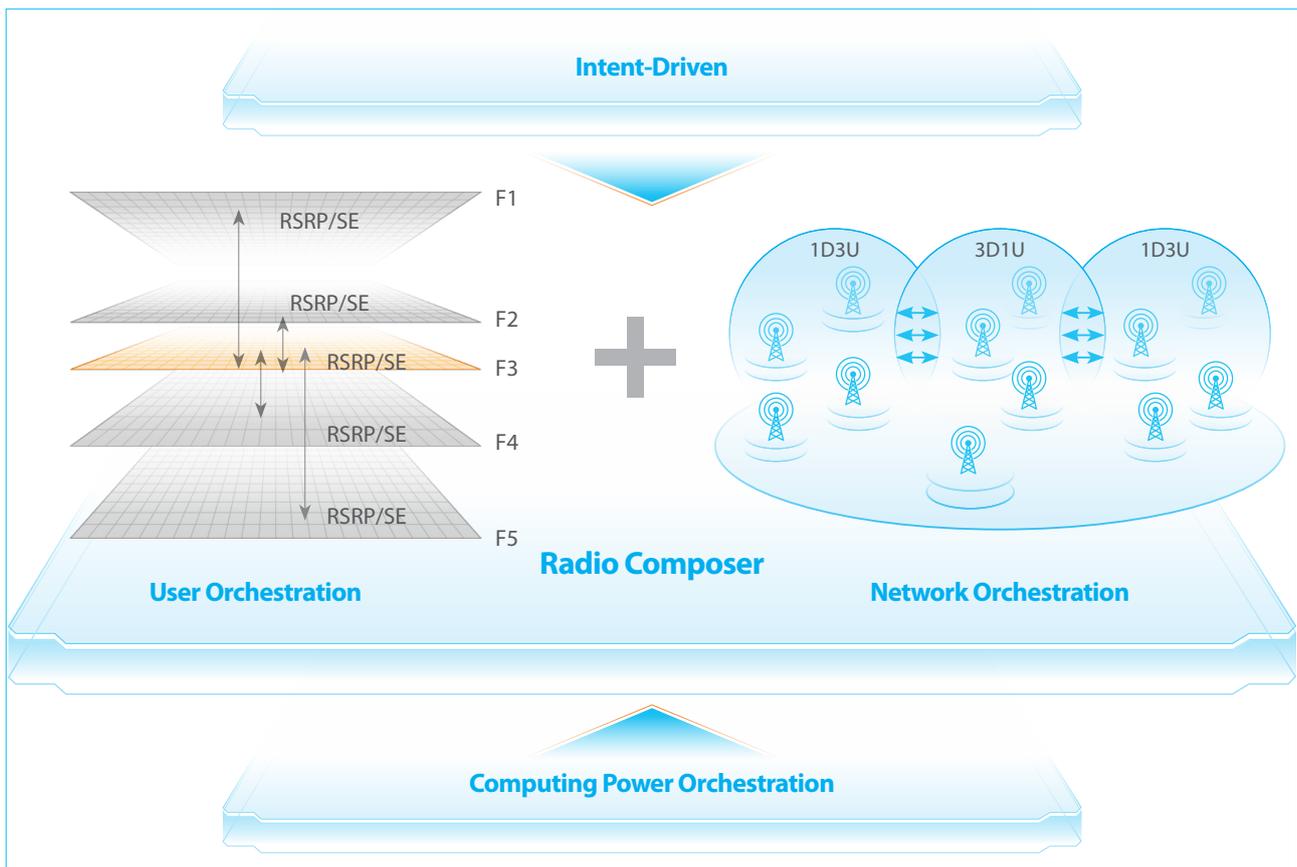
5G user experience, however, is still a big challenge. One reason is that 5G still uses some radio resource management technologies that are not really up to the task. As a key infrastructure of the digital society, 5G network not only serves consumers with more and more diverse and demanding apps, but also should support digital transformation for a variety of vertical industries. This is why the old-fashion way of treating all 5G users with just one inflexible policy of radio resource management is never aware and adaptive to the users' unique individual needs. It is therefore of great importance for operators to deliver user-centric experiences for industry applications and consumers within limited network resources.

In this case study, we will deep dive into how China Mobile transforms their subscribers' 5G experiences with ZTE's Radio Composer, and a solution that changes the way 5G user experience is delivered.



## Radio Composer is the Industry's First Intelligent Orchestration Radio Network Solution

At the beginning of 2021, ZTE released the industry's first intelligent orchestration radio network solution that improves 5G user experience with comparable significance only more physical and more expensive alternatives can pull off. It leverages AI built right inside 5G base station for delicate management of radio resources, and can realize up to 30% more 5G base station capacity and up to 300% faster download speed. The best thing is such enhancement of user experience and increase of data revenue requires nothing but software upgrade. Powered by base station native AI, Radio Composer flexibly allocates network resource by virtue of user orchestration and network orchestration. User orchestration optimizes user experience through user steering and user scheduling based on accurate predictions of network service capabilities and precise recognition of service requirements, while network orchestration adaptively adjusts network serving capabilities by means of spectrum, frame structure and beam pattern to meet variable traffic pattern predictions. Radio Composer has now evolved to incorporate Intent-driven network and computing power orchestration as the key technology to improve network intelligence. Intent-driven network can deliver real-time and precise intentions to help operators meet the requirements for specific scenarios and services, achieve resource allocation efficiency and greatly save operation and maintenance costs. Computing power among different base stations can be coordinated to support this orchestration process. In terms of how to improve user experience and network resource efficiency, ZTE has been working with operators around the world. The following will take China Mobile as an example to illustrate the excellence of Radio Composer.





## Success Story of Radio Composer<sup>5</sup> with China Mobile

China Mobile was founded in 2000 and it is a leading operator in the Chinese telecommunication industry with the largest number of subscribers. Nevertheless, its revenue growth is under pressure with ever increasing demands from its customers. To reduce customer churn rate particularly of those at the north end of the ARPU spectrum, shape better brand image and remain a world leader, China Mobile deploys Radio Composer to enhance user experience, network traffic and network efficiency based solely on the already deployed network infrastructure.

### User Orchestration in Zhejiang Province

#### Background & Solution

In need of experience assurance of mass gatherings, China Mobile and ZTE conducted a user orchestration trial at one of the largest venues in Hangzhou, simulating the spatial location flow characteristics of user groups in the venue at different times during the big events, autonomously predicting the traffic distribution, and combining intelligent user scheduling to ensure good user perception.

As large venues that mainly undertake concerts or expositions which will have to accommodate tens of thousands of audiences and media staff, they usually have the characteristics of flow volatility, load unevenness, and service diversity. However, the traditional network coverage and capacity model was rigid and fixed, making it unable to cope with such high network load and differentiated user requirements. Therefore, on account of present network layout, how to actively explore innovative and intelligent solutions, and ensure the experience of users was the main issue for China Mobile to resolve.

Radio Composer is at the core of the project solution. It realizes stable and high-quality services in complex networks

through intelligent service perception, user navigation and experience guarantee to accurately meet individual demands. User orchestration is utilized to achieve improvements of both user experience and network efficiency, powered AI inside the base station. Based on big data, the network learns to accurately identify diverse service requirements. When current user experiences cannot match service requirements well, with intelligent experience prediction based on the grid knowledge base, the users can be rapidly guided to the targeted grids, ensuring the optimal resource allocation. Finally, based on real-time user data analysis and service performance monitoring, the network can detect fluctuations in user experience in time and escort them throughout the process.

Apart from user orchestration, China Mobile and ZTE broke through the computing power bottleneck of a single base station, explored computing power orchestration and sharing schemes across base stations, and built a base station computing power pool by logically aggregating multiple 5G base stations. In the scenario of unbalanced network load, the base station node with remaining computing power in the resource pool can help other site perform data analysis and AI calculation during busy hours.

### The Results

This multi-scenario and multi-terminal trial has significantly improved user experience and greatly shortened service delays, with edge user data rate surging by up to 300%, low-speed users proportion reduced by half, and handover latency decreased by more than 50%. The computing power of the site made available during busy hours was also increased by 14% through orchestration. WeChat pictures and videos were successfully sent within 3s delay, and WeChat video calls were clear and free of lag. The live streaming on Douyin was also clear, without interruption and blur, and the webpage opening delay was less than 3s. VoNR voice calls were 100% connected with no dropped calls. At the same time, the excellent experience in turn stimulated greater traffic demand, achieving enhancements of both user experience and network revenue.

## B2B&B2C Joint Orchestration of Hebei Branch

### Background & Solution

Besides the challenges of user volatility that Zhejiang province faced, B2B business diversity has been troubled Hebei province for a long time. Since the commercialization of 5G, industry digitalization with 5G has been gaining more popularity. Various industries such as energy, manufacturing, ports, and transportation are actively exploring digital transformation with operators. In the data transmission process, 5G technology has become an important infrastructure supporting industry applications with its unique advantages of mobility, wide bandwidth, low latency, and extensive connectivity. However, vertical industries vary widely, and the capability requirements on communication networks in terms of latency, reliability, and speed are also extremely diverse. Taking network latency as an example, the remote control and tablet services require a latency of less than 6-7ms, while the latency of camera monitoring can be as much as more than 100ms. Therefore, accurate service assurance for each service flow is needed, so as to achieve the unification of service quality assurance and efficient utilization of network resources, which is inseparable from intelligent identification and differentiation of service flows.

Under the traditional 5G technology framework, service flows with the same QoS requirements will be assigned a separate static 5G QoS Identifier (5QI), and the system can perform corresponding guarantee processing for services according to different 5QIs. However, this method has a complex SIM card signing process, where SIM card, CPE, and device must be strictly matched to one another. When multiple service devices are connected to the same CPE, different service flows share the same QoS flow, which makes it difficult for per-service experience guarantee. As a result, guarantee measures and service flow requirements cannot be matched, resulting in waste of resources or unsatisfactory service experience.

For situations like this, there is an urgent need for network solution that can dynamically identify service flow types and quickly split and establish QoS flows, so as to achieve accurate service guarantee and avoid the complicated contract management process of SIM cards. Consequently, China Mobile worked with ZTE in Hebei province to launch the 5G RAN cross-domain intelligent orchestration solution. It particularly focused on the intelligent traffic pattern recognition based on user orchestration, and was first applied to the 5G cloud desktop tablet business of Cangzhou Central Hospital.

This customized solution leverages the NodeEngine , a board-level edge computing enhancement for B2B service, and the Radio Composer in the baseband unit for B2C service, which are capable of performing dynamic and accurate service identification at low cost and allocating the required intelligent computing power on demand. For the deployed 5G network, the solution can be activated within one hour when a NodeEngine board is deployed in the existing 5G base station. The dynamic service flow recognition based on user orchestration is the premise of QoS flow splitting and establishment. It can conduct intelligent service guidance and network resource scheduling through deep learning of the service characteristics. The default data flow (default flow) which was originally mixed with two services would be split into a default flow and an exclusive flow. Taking low-latency service guarantee as an example, after the low-latency service data was successfully separated into an exclusive flow, the corresponding network resources and guarantee measures could be precisely matched, which led to efficient resource allocation and shorter service delay. Additionally, all SIM cards can be signed by default. Once the service flow is initiated, it will be automatically recognized, greatly simplifying the signing and opening process of services.

## The Results

This solution solves the big challenge that plagues 5G applications in vertical industries, that is, to complete dynamic recognition and splitting of service flows through intelligent radio orchestration. It can accurately guarantee low-latency services and meanwhile ensure resource efficiency. Considering network security and convenience of trial, the project team took the lead in conducting the experiment in the laboratory in December 2021, and found that the average delay after business splitting was reduced by more than 50%.

In May 2022, after continuous coordination with customers from multiple departments, China Mobile and ZTE took the lead in trialing the solution on the 5G cloud desktop project of Cangzhou Central Hospital in Hebei province. The cloud desktop enhances the security of users and improves the efficiency of IT management through centralized control and rapid installation, making mobile work more flexible. However, a prerequisite for using cloud desktops

is that there must be a good data connection between the cloud desktops and the data center to ensure user experience, which cannot be satisfied by existing network. By splitting the low-latency data stream from the default data stream, this solution reduced the average latency of service data from the original 16ms to about 10ms, which greatly improved the experience of latency-sensitive services and helped promote cloud desktop system.

In the follow-up, China Mobile and ZTE will continue to advance the application of this solution in the 5G cloud desktop project of Cangzhou Central Hospital, and make use of network orchestration technologies such as frame structure configuration and multi-layer network coordination to pursue the ultimate latency of 6ms and create a new path for low-latency services under differentiated business requirements.

## Intent-Driven Smart RAN with Fujian Branch

When network resources are sufficient, operators can implement real-time resource scheduling through user orchestration and network orchestration. However, when network resources cannot satisfy all service requirements, there is a problem worth thinking. How can network resources be intelligently allocated according to service priorities?

China Mobile together with ZTE has trialed the Intent-driven Smart RAN in Fujian province. It is the industry-first commercial trial which innovatively introduces the most concerned intent network into the communication industry, with over 7000 identifiable service types covering 95% mainstream services. It deeply integrates intent-related technologies into the most common daily scenarios, such as epidemic prevention code scanning, Douyin live streaming, Tencent video streaming and WeChat online conferencing. By simply using natural language as the input, users can easily initiate the whole-process service guarantee, including millisecond-level automatic generation of service scheduling policies, minute-level monitoring, and automatic optimization of service experience. Based on advanced artificial intelligence technologies, the Intent-driven Smart RAN automatically optimizes strategies according to the operation goals. It successfully guarantees customized service needs in real time, bringing a 100%+ improvement in specific business experiences, 500% increase in operation and maintenance efficiency, and 30% increase in network traffic. This attempt of Intent-driven network in safeguarding applications has also laid a solid foundation for other scenarios for the near future.

A night cityscape with a network overlay. The background shows a city skyline at night with illuminated buildings. Overlaid on this is a blue and purple network diagram with nodes and connecting lines, suggesting a digital or network theme.

## Conclusion and Inspiration

As an intelligent radio orchestration solution that precisely match differentiated service requirement with network resources, Radio Composer has been applied by China Mobile in multiple cities to achieve enhanced resource efficiency and user satisfaction. With Radio Composer, China Mobile becomes more capable in ensuring better user experience and empowering B2B digital transformation. Apart from applications by China Mobile, ZTE is also working with China Telecom to launch Cluster DSS, a cluster-level dynamic spectrum sharing solution based on network orchestration, which enables adaptive spectrum configuration according to traffic pattern. The field trial of China Telecom in Sichuan province shows that Cluster DSS improves the downlink rate of 5G users on the 2.1 GHz network by 70% without impact on 4G users experience, greatly improving 5G user experience and network efficiency. Besides domestic applications, Radio Composer is also currently under the commercial trial in the global market with AIS, Orange Spain and Wind Tre to help build better quality networks and offer much enhanced user experiences.

Radio Composer also changes the economics of the mobile industry by increasing operators' revenue with no need of any investment on deploying more base stations or new spectrum resources. A 5G operator nowadays would pay up to tens of billions for even just one spectrum band resource. Increasing 5G user data usage without new investment is great, maximizing the efficiency of the usage of exiting network resources is even greater. For a network with hundreds of thousands base stations, Radio Composer can save millions of US dollars of investment that are otherwise required for more data usage.

Radio Composer will continue to evolve in response to different stages of network development and differentiated service requirements, and exploits the best ways to combine new services and application scenarios to offer best experience and optimal efficiency. Moreover, Radio Composer can be support more intentions at the same time, such as energy-saving intention for carbon neutrality and the comprehensive integration of multiple intentions, like experience, efficiency and energy efficiency. With the introduction of cross-domain information, the joint orchestration of consumers and industry segments will be further strengthened to implement more flexible coordination of user experience, network efficiency and other intentions within a single network, thus facilitating social digital transformation and 5G business prosperity.

