通信世界
COMMUNICATIONSWORLD
October 10th, 2023

New Era New Calling New Future

New Calling, New Future

Visualized Voice Calling

Enjoy More Fun by Designing Your Own Character

UHD Intelligent Interactive

Native Services on Your Terminals, Avoiding the Need to Install Apps

5G New Calling: Heralding a New Era of Communications

Liu Hong, Head of Technology at Greater China, GSMA

5G New Calling harnesses the capabilities of 5G and the IP multimedia subsystem (IMS) to bolster high-quality, secure interactions between individuals and between enterprises and consumers. With 5G New Calling, users are able to access an array of services and functions during voice and video calling, without installing or updating any applications on their smartphones. Users can fully utilize high-speed, low-latency, and high-stability 5G connections to enjoy services empowered by artificial intelligence (AI), virtual reality (VR), and mixed reality (MR). 5G New Calling not only metamorphizes the calling experience, but also lays a cornerstone for people to step into the metaverse world.

Over the past few years, operators have built substantial underlying IMS networks, making 5G New Calling a present-day reality. These network devices now can be used for piloting 5G New Calling services after being slightly changed to fit existing specifications and configuration files formulated by GSMA. In the foreseeable future, the Data Channel (DC) will be introduced to the IMS network. This will further improve the service quality and extend the capabilities of 5G New Calling. In a collaborative effort, multiple international organizations, such as 3GPP, GSMA, World Wide Web Consortium (W3C), and IETF, have been developing DC specifications, and it is predicated that commercial products will be seen in the near future. Currently, related devices can be used for demonstration and Proof of Concept (PoC) verification. When 5G New Calling is fully tested and applied, operators will have accumulated extensive experiences and will create a new and large ecosystem with the help of open source communities.

With 5G New Calling, operators are expected to outperform these over-the-top (OTT) players, open up advanced 5G capabilities through globally defined APIs, improve the cost effectiveness of their 5G and IMS networks, and achieve shared success together with third-party application developers.

Today, calling services remain stagnant, and their free alternatives, such as Skype, Viber, WhatsApp, and WeChat, are nibbling up the market share, which lead to a decline of the minute of usage (MOU) in some countries and regions. However, as terminals upgrade and more and more enterprises hope to enhance connections with their consumers, communication needs that can only be fulfilled with operators' networks rebound and continue to grow.

Although these free alternatives always overshadow operators' traditional calling services in some scenarios, such as international roaming and acquaintance interactions, calling services are still the first choice when people want to contact colleagues or strangers. Born on operators' networks, traditional calling services are endowed with high reachability, availability, stability, and security. To rejuvenate traditional calling services, cutting-edge technologies must be introduced. In this case, 5G New Calling comes into its own element.

In 2023, GSMA established the 5G New Calling Task Force, chaired by China Mobile Research Institute, to coordinate network and terminal working groups to develop IMS DC specifications and prepare the 5G New Calling White Paper. By the concerted efforts of all parties, GSMA hopes more 5G New Calling products can be developed and new service forms and business models can be discovered, so as to advance the maturity of 5G New Calling and build a solid 5G New Calling ecosystem.

Considering the current development situation, the writer proposes three suggestions for operators on promoting the development of 5G New Calling.

First, clarify the core capabilities of 5G New Calling in different phases. Operators should determine the capability list of the first phase as soon as possible and roll out 5G New Calling services to gain the first-mover advantages. In addition, they need to plan the roadmap of the next phase in advance to ensure seamless service upgrades.

Second, focus on the most critical demands that 5G New Calling can satisfy. For one thing, operators can seek more opportunities from calling markets formed by enterprises and consumers. For another thing, operators can leverage cutting-edge capabilities, such as AI, to develop new services fitting acquaintance interactions.

Third, pull efforts from relevant parties to build the 5G New Calling ecosystem. Operators should establish a 5G New Calling application developer community, standardize and reinforce capability invoking APIs, settle on the cooperation model and benefit distribution model, and launch a pack of flagship applications.


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通信世界
COMMUNICATIONSWORLD

Communications World Weekly

Chief Editor: Liu Qicheng

Deputy General Manager: Zhang Peng

Executive Chief Editor: Shu Wenqiong

Executive Vice Editor in Chief: Cheng Linlin

Editors: Wang Tao, Zhen Qinglan, Mei Yaxin, Wang Yurong, Sun Tian, Zhu Wenfeng, Wang Hejia, Bao Jianyu, Gai Beibei

Designers: Yang Sihan, Li Man, Zhang Hang

Journalists: Liu Qicheng, Diao Xingling, Cheng Linlin, Zhen Qinglan, Qie Yongzhi, Wang Yurong, Liu Hualu, Liang Haibin, Niu Xiaomin

Marketing Department: Shen Qing, Meng Yue, Jiang Beibei, Shen Xinzhu, Liu Shizhi, Cao Junying, Yin Yuan

iiTime: Qie Yongzhi, Liu Yanling, Hu Jinming

Video Editors: Lin Song, Huang Yangyang, Lu Ruixu

IT Support: Wu Zhaohui

Address: 3rd Floor, Beiyang Chenguang Building, Building 2, Shunbatiao No.1 Courtyard, Fengtai District, Beijing

Post Code: 100079

Editorial Department: +86-10-52266521

Marketing Department: +86-10-52266541
+86-10-52265997

Distribution Department: +86-10-52265707

Website of Communications World: www.cww.net.cn

Publication Date: October 10th, 2023

Printed by: Zhuozhou Rongsheng Xinchuang Printing Co., Ltd.

New Era New Calling New Future

In this 5G age, voice services are increasingly growing to enrich people's communication experiences. As AI and enhanced computing power integrates with the existing network, 5G New Calling has overhauled the conventional calling service, transitioning the calling experience from voice-only to intelligent, interactive, and immersive, leading us towards a brand-new era of communications.

Opening up more and more possibilities for communications, 5G New Calling has become a key engine for operators to achieve their digital transformation goals and empower diverse industries for higher production quality and efficiency. Currently, the voice industry is committed to building an open, beneficial, and collaborative 5G New Calling ecosystem, aiming to unlock more new 5G application scenarios, and map out a new vision of 5G and intelligent lives.

To promote the prosperity of the voice industry, CWW Omnimedia prepared this special issue themed New Calling, in which we summarized eye-opening thoughts of leading minds from all walks of the industry, including operators, standards organizations, equipment vendors, and terminal vendors. Delving into industry insights and achievements, leading technologies, as well as best practices, this issue will shed light on the development trend of the voice industry and the commercial maturity of 5G New Calling. We hope that it can be an important reference and inspiration for you. Let's embark on this journey with 5G New Calling together.

Editor | Zhen Qinglan <zhenqinglan@bjxintong.com.cn >

Centennial Development History of Voice Industry

1837

Samuel Morse developed telegraphy, marking the birth of modern communication technology.

1876

Alexander Graham Bell invented the telephone, changing the way people communicate with each other.

1891

The world's first electromechanical stepping switch telephone exchange system was invented.

1896

Guglielmo Marconi achieved the first wireless communication in human history.

1926

The world's first crossbar telephone switching system came into use.

1973

Martin Cooper invented the first mobile phone, paving the way for universal communication.

1979

NTT introduced the world's first commercial 1G network.

1991

Finland's Radiolinja company launched the world's first commercial 2G network.

1997

The next generation network (NGN) concept emerged, ushering in the IP era for telecommunications.

1998

NTT Docomo launched the world's first commercial 3G network in Japan.

2002

3GPP released IMS specifications, propelling the voice industry into the multimedia era.

Editor | Zhen Qinglan <zhenqinglan@bjxintong.com.cn >

1837—2023

1947

Bell Labs invented the transistor, ushering in the Information Age.

1957

The world's first artificial satellite was launched, heralding the beginning of satellite communication.

1965

The world's first stored program control (SPC) switching system, No.1 ESS, was commercialized.

1970

The world's first digital SPC switching system E10 was launched, marking the start of a new era in digital switching.

2009

Sweden inaugurated the world's first public-oriented LTE network.

2019

South Korea launched 5G services, becoming the first country with a commercial 5G network.

2020

3GPP Release 16 introduced the IMS Data Channel concept, leading to the birth of New Calling applications.

2022

China Mobile launched the 5G New Calling service, ushering in a new era of calling services.

2023

GSMA established the New Calling Foundry project, driving the rapid development of the New Calling industry.

Editor | Zhu Wenfeng <zhuwenfeng@bjxintong.com.cn>

Forging the New Calling Future

Calling has not only stood the test of time but continues to form the core service provided by operators, acting as an indispensable and unique form of social value. And despite the advances in modern technology, calling remains the most common method of communication between people. With 5G New Calling, connections will soon accelerate, providing more intelligent and advanced capabilities, increasing efficiency, and adding significant business and social value.

Zhu Wenfeng, Reporter of CWW

5G New Calling Industrial Roundtable held during MWC Shanghai 2023

Calling services continue to act as the foundation stone of operators' core business and offer both indispensable and unique social value. Even in today's advanced society, phone calls make up the bulk of the communication methods between people.

5G New Calling offers ultra-high definition (UHD), intelligent, and interactive calling capabilities to enhance basic voice and video calls. By leveraging the IP multimedia subsystem (IMS) Data Channel (DC), the native call screen can provide a web view and allow users to invoke various mini programs from the network platform, thereby improving communication efficiency. The service enabling platform can expose network capabilities to external systems, empowering a wide range of communication

scenarios and propelling vertical sectors to develop new services and digitalize themselves. Individuals can enjoy an enriched voice and video calling experience, whereas enterprises can improve communication efficiency and create greater business and social value.

Light Reading speaking with Henry Calvert

To construct a robust New Calling ecosystem, standards organizations, operators, equipment suppliers, terminal and chip vendors, and content producers need to make concerted efforts to make this happen. In the same year that New Calling was launched, GSMA established the 5G New Calling Foundry project at MWC Barcelona 2023, in the hope that more partners can participate in the construction of the New Calling ecosystem, work together to promote the development and prosperity of the New Calling industry, and achieve a win-win future.

On June 29, GSMA hosted a 5G New Calling Industrial Roundtable during MWC Shanghai 2023. This roundtable gathered global operators, device suppliers, terminal chip vendors, industry partners, content providers, and more, to discuss New Calling in terms of development direction, challenges, and opportunities. The delegates and attendees at the roundtable also shared their practices and future plans on how to promote the prosperity of New Calling.

The roundtable is one of the activities of the 5G New Calling Foundry project. Based on this project, partners from the industry chain work together to develop typical application scenarios and clarify the industry development direction by means of roundtables, webinars, white papers, and forums. Henry Calvert, Head of Networks at GSMA, said that this Foundry project has attracted attention from the GSMA Board of Directors, who hope that New Calling can rejuvenate voice services and bring more business opportunities.

During the roundtable, Light Reading spoke with Henry Calvert about the New Calling industry development and 5G New Calling Foundry project. Here are some key points of the interview.

Light Reading: Today we're taking a look at the prospect of an interesting emerging technology called New Calling. I'm here with Henry Calvert, Head of Networks at GSMA. 5G has been deployed and adopted at a high rate but there hasn't been a huge focus on voice. What's GSMA's view on the outlook for 5G voice?

Henry Calvert: Well, I'm responsible for the generational changes across the mobile industry. We are very excited to see the changes from 4G to 5G and how new voice is going to bring more innovation back into the industry.

5G adoption has been the fastest generational change we've ever seen. Already, there are 228 networks launched with 5G across 87 markets and there are over a billion mobile subscriptions. By 2030, we're predicting that 5.3 billion connections will be on 5G networks. That's phenomenal. And while we have often talked about data and its role across 5G networks, voice is still very important and very relevant.

With the closure of 2G and 3G networks over the next few years, we can expect to see existing circuit-switched voice traffic transition over to VoLTE, Voice over LTE

Editor | Zhu Wenfeng <zhuwenfeng@bjxintong.com.cn>

networks, and VoNR, Voice over New Radio 5G networks. 45% of operators around the world already support VoLTE, which shows that there's a clear recognition that voice is required in these new generational technologies.

We've also seen a shift in usage behaviors. We see a lot of consumers who use voice messaging as a daily tool. They talk into their messaging app and send that as a voice message. That's a critical behavior to understand because it shows the importance and the relevance of voice traffic to our industry. It's good to talk, people like to communicate, so I think voice and 5G voice will remain very important in the future.

Light Reading: What is GSMA's view on the development of New Calling?

Henry Calvert: 5G New Calling is going to bring the coolness back into voice. It's about having new services that consumers actually want to use and can use to communicate with each other.

One of the killer apps in 5G new voice is real-time translation. This breaks down the barriers of different languages, and allows users to talk to friends across the world in their own native language. When you talk in a 5G New Calling session, it provides a translation in text of what you've just said, and your counterpart can actually read what you said in their own language. You can communicate better with each other.

In the future, we expect that translation will be simultaneous so you can talk in your own language and dialect and it will be translated and repeated as a voice track in your communication partners' own language and dialect. That's a phenomenal change for international calling. In the famous novel "The Hitchhiker's Guide to the Galaxy", they called this "the Babel fish", and everyone loves it when this sort of science and technology and that innovation is brought to real life.

New Calling will be able to offer other services such as immediate insurance claims response. So, if you have a car accident, you'll be able to show the video of the accident and what's actually happened using rich media, and within a matter of minutes, your claim can start to be settled. Or if you have a water leak, you can show your insurance company the nature of the damage and how important it is for you that your insurers resolve the problem quickly.

We'll also bring back the fun into voice. You can present yourself in front of different backgrounds, or maybe you could be portrayed by your avatar when you're having a conversation. These are the sorts of funny features that consumers like: remember caller ringback tones, when we could put our own favorite music as a ringtone? So, it will really bring additional value to the consumers and users, which I think will just bring voice back to being a bit more cool again.

Light Reading: New Calling looks like it will be a major new segment for the industry. What's GSMA's view or what is GSMA's role in developing or promoting that new segment?

Henry Calvert: The standards and specifications for New Calling have been around for some time, as part of Release 15 and Release 16 of the 3GPP specifications. GSMA's role in this, supported by operators and vendors, is to develop the necessary technical profiles which enable operators to bring commercial services to market. We can help drive adoption in the device ecosystem, and adoption in the networks, and we can show off the fun use cases that let people see that voice is cool again.

So, GSMA membership has a vital role to play and we've been working with our members on some GSMA Foundry projects, which is the way operate at GSMA when we start to bring things to market. We now have four use cases that will be published on the GSMA Foundry website.

On September 20, GSMA held a 5G New Calling webinar. Later, a 5G New Calling white paper will be released to global operators so they can learn about the global adoption of 5G New Calling. Through these measures, GSMA hopes that more people can understand the value and the benefits they can get out of 5G New Calling.

5G New Calling: 3GPP Standardization Development

Basic industry standards have now been put in place for the development of New Calling. 3GPP Release 16 has introduced the Data Channel (DC), on top of the existing voice and video channels. In December 2021, 3GPP initiated the Next Generation Real Time Communication (NG_RTC) project in Release 18, with the aim to enhance network capabilities by adding new network elements, such as the DC Signaling Function (DCSF) and Media Function (MF). This functional architecture, frozen in June 2023, provides a strong standard support for the implementation of New Calling.

Issam Toufik
Head of the 3GPP Mobile Competence Centre
CTO of ETSI

3GPP Timeline for 5G and Beyond

3GPP has already delivered specifications for phase 1 and phase 2 of 5G, which are detailed in Release 15 and Release 16, respectively. Release 15 defined a new radio interface known as New Radio (NR) and the core network to meet the requirements of 5G. Then in Release 16, the ultra-reliable low-latency requirements and the support of massive IoT were addressed, so that all the use cases defined by the International Telecommunication Union (ITU) were covered.

Both Release 15 and Release 16 have been submitted to the ITU and are part of the International Mobile Telecommunications (IMT) 2020. In terms of deployment, according to the Global mobile Suppliers Association (GSA), 255 commercial 5G networks have been launched around the world up to June 2023. This took place just three years after the completion of the standards, so it is safe to say that the deployment is remarkable. So as expected, 5G is being deployed at a very large scale, and this trend will continue. The forecast from the Global System for Mobile Communications Association (GSMA) notes that we will have more than 1.5 billion 5G connections by 2025, which roughly covers 15% of the global population.

3GPP also completed Release 17 in March 2022 and is currently working on Release 18. Release 18 is the first release of what we marked as 5G-Advanced. In both of these releases, we see a combination of enhancements of the 5G radio interface and the wide area network (WAN), but also the introduction of a number of important services and features. One of these services is New Calling, also termed as NG_RTC in 3GPP standards.

The Concept of IMS DC

New Calling is an enriched and interactive calling experience enhanced with IP multimedia subsystem (IMS) Data Channel (DC) technology, which provides an extra data channel in addition to the video and audio channels. New Calling enables a richer feature set natively on mobile devices, including interactive visual menus, real-time on-screen translation, screen and camera sharing, and augmented reality (AR) telephony.

The concept of adding an IMS DC was first encapsulated in 3GPP Release 16, completing and standardizing it, with the basic framework and principles being defined in its early form. However, this is by no means the end of the story. There was a lot more work to be done to fully reap the benefits of IMS DC. Nevertheless, there is sufficient in place to enable early trials to take place.

In terms of the architecture, 3GPP Release 18 will look at next-generation real time communications. This is where the IMS DC architecture and related procedures are fully described. The network functions for IMS DC architecture will be comprehensively specified using 5G service-based principles. Also, the IMS DC architecture enables third-party data channel applications to be seamlessly deployed in operator networks

Editor | Zhu Wenfeng <zhuwenfeng@bjxintong.com.cn>

and provides an open platform for service innovation by both operators and the third parties.

Enhancing the User Experience

It is expected that the inclusion of IMS DC will be native on the whole raft of innovative additions to the basic calling experience. When discussing 5G technology, the first thing that often comes to mind is its application in robotic surgery or its potential use in agriculture, ports, and power station management. Nevertheless, it is important not to overlook the fact that a significant number of people rely on 5G for basic calling. It is obvious that we should explore ways to gain much more out of that basic service by providing a richer experience to individuals who simply want to make basic calls.

We all know what a traditional voice or video call is and what it looks like, but what New Calling is doing is adding an IMS DC to voice and video in order to leverage the multimedia to offer a much richer, more interactive, and more immersive call experience. We can imagine all these use cases are bringing considerable added value to both individuals and enterprises. Some of the New Calling applications include among others Interactive Menu, Real-Time Translation, Fun Calling and Remote Damage Assessment.

Interactive Menu

One simple use of the Interactive Menu is the straightforward restaurant example. As you browse the menu, you have the ability to select the dishes you wish to order. Furthermore, within a sub-menu, you can find detailed descriptions of each dish. In essence, this menu allows you to inquire about the specific ingredients used in each item.

Real-Time Translation

To illustrate the concept of a real-time translation service, consider a scenario where two individuals are engaged in call but do not speak the same language. With the Real-Time Translation service, these two individuals can exchange ideas and communicate efficiently thanks to the seamless real-time translation within the same interface.

Fun Calling

The younger demographic finds avatars particularly captivating. This innovative approach leverages a person's physical movements to animate an avatar. When the individual waves at their interlocutor, the on-screen avatar mirrors the gesture by also waving. Similarly, if the individual utters straightforward phrases such as "I'd like to wish you a happy birthday," AI technology on the screen can dynamically generate an image of a birthday cake adorned with candles.

Remote Damage Assessment

New Calling also holds significant value for commercial uses. Consider a scenario where, in the unfortunate event of a car accident, you contact your insurance provider and explain that you've been involved in a collision with the vehicle in front of you. Through the interactive menu, you have the option to capture video footage of the incident, which you can then share with your insurance company. In some cases, the insurance company might request additional video angles if they require a clearer understanding of the impact and resulting damage. This enhanced capability provides a richer and less arduous experience when dealing with a situation that would otherwise be quite distressing.

New Calling Enhancement for Further Standardization

To define New Calling, 3GPP has a work item in Release 18, which has three objectives. The first objective is to specify enhancement to support the DC usage in IMS. The second objective is to study the applicability of service-based principles in IMS media control interfaces. The third objective is to specify the IMS architecture and procedures enhancements for the support of AR telephony communications. The results of this standardization work and this work item involve changes to the IMS architecture, which translate into enhancements to certain of the existing network functions.

The potential for leveraging the IMS DC to deliver value is virtually boundless. As we look ahead to the forthcoming Release 18, a new wave of network innovations is on the horizon. The true extent of the IMS DC's capabilities will be fully realized upon the completion of Release 18. However, even before reaching this milestone, we have witnessed earlier deployments and initial proofs of concept. The IMS DC serves as a crucial infrastructure that can be harnessed by third-party application developers, opening up a realm of creative possibilities. This journey does not conclude with Release 18; instead, it extends into Release 19, where 5G-Advanced will continue to evolve. This simple yet powerful concept of connectivity will undergo further enrichment over time.

New Calling: Advancing Towards a More Prosperous Future Through Industry Collaboration

New Calling promises a synthesis of convergent, intelligent, and interactive experiences for users. CAICT will actively work with industry partners to promote technology standardization and commercial development of New Calling and build a sustainable ecosystem encompassing terminals, applications, and content. The above measures aim to establish a strong foothold for the calling industry and increase users' accessibility to 5G services.

Wang Zhiqin, Vice President of China Academy of Information and Communications Technology (CAICT)

New Calling industry cooperation initiative launch ceremony

As 5G applications transition from the proverbial shallow testing waters to the deep-water zone, innovatively integrating them with industries has become the key to 5G's business success, with 5G New Calling leading the way. Leveraging the combination of AI and 5G, including the solid foundation laid by operators' highly reliable voice networks, all industry players are proactively promoting the growth and prosperity of 5G New Calling, aiming to open up infinite possibilities. In the fast approaching era of multimedia real-time communications between people, people and things, and even among things, 5G New Calling will not only transform the way we interact with each other, but will change how we react with the world and objects around us.

Editor | Zhu Wenfeng <zhuwenfeng@bjxintong.com.cn>

Network Construction Lays a Solid Foundation for Integrating 5G with Industry Applications

Earlier this year, the Chinese government rolled out the 'Plan for the Overall Layout of Building a Digital China', which clearly articulates "strengthening the artery of digital infrastructure and propelling the construction of the 5G network". Today, China has built the world's most advanced and largest 5G standalone (SA) network, and is making great strides from a network colossus to a veritable network titan. As of May 2023, 5G base stations in China have burgeoned to an impressive 2.844 million, ensuring a 100% coverage across all administrative regions. This marks the fruition of the 'Ubiquitous 5G' vision. Furthermore, 5G virtual private networks, numbering over 16,000, are a testament to our expansive reach across sectors as diverse as manufacturing, ports, energy, and healthcare.

In tandem with these monumental infrastructural achievements, our commitment remains resolute in pioneering the development of 5G-oriented applications. Within the B2B sphere, the range of China's 5G applications continues its expansive trajectory, delving deeper into the uncharted waters of the industrial ecosystem and spawning scalable innovations in crucial sectors such as manufacturing and mining, thus exemplifying the transformative power of 5G upon the real economy. Turning to the consumer domain, we see that the number of China's 5G mobile users stands at a formidable 651 million, with breakthroughs in 4K/8K ultra-high definition (UHD), extended reality (XR), and 5G messaging service, signaling a new aeon in 5G communication experiences for the public.

New Calling Redefines the Calling Experience as Intelligent and Interactive

Voice communication remains the most emblematic telecommunication service. With the proliferation of mobile communication, calling has become indispensable, just like water and electricity in our daily lives. In recent years, the unmistakable trend in telecommunications has been toward intelligence, interactivity, and personalization. Enterprises within the communication industry have embarked on research centered around enhancing voice communication functionalities, ushering in New Calling.

New Calling provides users with a seamless integration of multimedia calls and data applications, offering intelligent, real-time interactive services. New Calling caters to the diverse communication needs of different user groups, where individual users are offered an enriched and personalized service experience. Meanwhile, industry clients are offered a complete service loop during calls, encompassing user attraction, interaction, and service subscription, fulfilling the communication needs for remote and immediate services across numerous sectors. Guided by the goal of integrating 5G-Advanced communications and intelligence, New Calling has the potential to swiftly capture public attention, enabling global population to rapidly appreciate the immense allure of services combining 5G and artificial intelligence (AI).

New Calling: Advancing Towards a More Prosperous Future Through Industry Collaboration

We recognize, with utmost clarity, that New Calling is still in the nascent stages of industrial development. It confronts challenges in areas such as technical standards, chip and terminal technologies, and the integration of industry-specific applications. We earnestly invite more industry partners to join us, to further propel the technical standards and commercial evolution of New Calling. We aim to stimulate growth within terminal, application, and content ecosystems, thereby allowing a broader spectrum of users to truly experience the innovations borne out of this technological shift.

To this end, CAICT pledges the following initiatives to promote collaborative advancement in the New Calling domain.

First, within both international and domestic 5G-Advanced standardization processes, we aim to promote the development of technical standards. By leveraging our domestic advantages in the industry, we are committed to enhancing interconnection, including improvements in network functions (NFs) and charging capabilities. We hope to guide the evolution of research standards beyond IP

multimedia subsystem (IMS) and foster industry consensus, thereby accelerating a synergy between international and domestic standardization capabilities.

Second, we plan to fortify the collaborative development of the New Calling industry. This entails enhancing the understanding of New Calling technologies among chip manufacturers, terminal producers, equipment vendors, operation enterprises, and application developers. Our objective is to cultivate industry partners with profound technical acumen and jointly promote customer and user base development, thereby solidifying the foundational pillars of the New Calling industry.

Last but not least, we aspire to elevate both public and corporate user sentiment towards 5G services. We are committed to deeply engaging in the fusion of novel 5G communication characteristics, capabilities, and industry-specific applications. Our aim is to harness 5G to better serve the public, delivering convenience and creating tangible value across a spectrum of industries.

On June 4, 2023, during the PT Expo, CAICT, in collaboration with Huawei, hosted a New Calling Industry Development Forum. This forum saw the congregation of industry leaders and experts from global operators, standard organizations, equipment vendors, and terminal manufacturers. Together, they delved deep into pressing topics surrounding the developmental trajectory, business landscape, and ecosystem of the New Calling industry, aiming to jointly foster its prosperous growth. Concurrently, at this forum, we, along with the China Communications Standards Association, China Communications Enterprises Association, China Mobile, China Telecom, China Unicom, China Broadnet, Huawei, Xiaomi, UNISOC, iFLYTEK, and CommChina, launched a New Calling industry cooperation initiative. This collective pledge seeks to drive the standardization and industrial progression of New Calling, amplify its industrial ecosystem, inject prosperity into the industry, and enrich people's communication experiences and lives.

In terms of implementing New Calling, Chinese operators are considered pioneers in this industry and are collectively spearheading the development of this sector. At the onset of 2023, China Mobile announced the initiation of friendly user trials in the provinces of Jiangsu, Zhejiang, and Guangdong. By the latter half of the year, they embarked on large-scale network construction projects across entire China, propelling the mature commercialization of New Calling. Similarly, China Telecom, China Unicom, and China Broadnet have also kick-started pilot programs and commercial validations. We are confident that with the concerted efforts of operators, equipment vendors, and other stakeholders in the entire industry chain, New Calling is poised for exponential growth, thereby elevating the sentiments of both public and corporate users towards 5G services.

Editor | Sun Tian <suntian@bjxintong.com.cn>

Building on 10 Years of VoLTE

Voice over LTE (VoLTE) remains the stalwart of the communications industry and has attracted a considerable number of adopters since its launch, a little over ten years ago. With the rise of 5G and the sunsetting of both 2G and 3G, global operators have elevated the importance of VoLTE, for not only its essential role in maintaining service continuity and addressing roaming problems, but also the benefits it brings to voice transition towards 5G. Undoubtedly, VoLTE has become an inevitable trend and will gain more development opportunities in the future telecom market.

Sun Tian, Editing Department of Communications World

Over the past decade, several operators have deployed all-IP VoLTE networks, upgraded the voice service quality, and improved network efficiency and cost-effectiveness. As 5G continues to shape the telecommunications market and legacy 2G and 3G networks are gradually wound down, calling services need to be migrated from antiquated circuit-switched (CS) devices to the IP multimedia subsystem (IMS). The IMS still continues to form the core network for implementing calling services in 5G because Voice over NR (VoNR) is also based on it. As a result, operators should deploy VoLTE as early as possible to pave the way for the future network transition, in addition to protecting the voice service quality and commercializing 5G.

At the 5G Core Summit 2022 held by Informa Tech in Bangkok, Emanuel Kolta, Lead Analyst of Network Sustainability and Innovation, GSMA Intelligence, delivered a keynote speech titled "Building on 10 Years of VoLTE". The speech elaborated on current VoLTE developments and analyzed both its driving forces and challenges. Emanuel Kolta stated that operators should embark on VoLTE deployment as early as possible to improve voice quality and develop new calling services, thereby maximizing network efficiency and creating more revenue.

At the same time, GSMA Intelligence released a research report on VoLTE development — Building on 10 Years of VoLTE. This report elaborated on the imperative of VoLTE development, current status of VoLTE penetration, barriers to VoLTE ramp-up, necessity of VoLTE roaming, as well as the prospect of VoLTE in 5G.

Emanuel Kolta of GSMA Intelligence delivering a keynote speech at 5G Core Summit 2022

Imperative of VoLTE Development

VoLTE enables operators to migrate their circuit-switched infrastructure to a fully IP-centric network. It represents a key pillar of mobile operators' core service offering, especially as a result of the sunsetting of legacy 2G and 3G networks. Several legacy networks have been already closed down, with more expected over the coming years. With no circuit-switched voice to fall back on, VoLTE will be more than a 'nice to have' solution. They will be required for

voice roaming and essential to the commercialization of 5G, particularly 5G SA.

The first VoLTE networks were launched a little over ten years ago. They began utilizing IMS technology and offering voice services delivered over IP via the LTE access network. VoLTE technology has matured significantly since then, with many of the initial issues ironed out. However, the number of operators yet to introduce VoLTE remains high: there are 247 operators with more than 1 million connections that lack VoLTE. In total, the network operators without VoLTE account for 2.1 billion connections.

Over the past ten years, VoLTE has offered network operators a range of benefits, including greater efficiency and helping operators improve network economics; it has a role to play in aiding operators' full migration to IP; it brings significant quality improvements for voice services; and it can help support the wider commercialization of 5G.

In an era in which the 2G to 5G range of networks co-exist, VoLTE is becoming essential, as operators' voice networks face multiple, co-existing core costs and technical issues. As specified in the 3GPP specifications, circuit-switched fallback of 5G to 2G/3G is not supported, so voice services can only fall back to the LTE network through Evolved Packet System (EPS) fallback technology. VoLTE is both crucial to the continuity of voice services in the early stages of 5G development and after the 5G network is built.

Current Status of VoLTE Penetration

By the end of 2022, global VoLTE penetration had reached 46%, with around 3.9 billion VoLTE connections out of a total of 8.4 billion. There are significant regional differences, as countries are at different stages of the adoption curve.

VoLTE will continue to increase its footprint: together, VoLTE and Vo5G will reach more than 5 billion connections globally by 2025, up from 2.2 billion in 2019. This will represent nearly 60% of mobile connections (excluding licensed cellular IoT), compared to around 30% in 2019. China will be the largest market, with 1.7 billion connections. North America and Europe will record around 370 and 520 million connections respectively.

Operators that deployed VoLTE at the beginning of the all-IP voice era have now reached the mature stage of VoLTE. They likely have significant LTE network coverage, have optimized networks and have few issues with device availability. According to GSMA Intelligence, the top 50 networks globally all have a VoLTE penetration rate of over 83%. China, the Philippines, Australia, and the US are among the leaders in terms of VoLTE penetration; operators from these countries launched VoLTE initially, so can be considered innovators and early adopters. In absolute numbers, China leads on VoLTE adoption, with 1.5 billion VoLTE connections, followed by India, the US, Japan, Indonesia, and Germany.

2019 was a significant turning point in the development of VoLTE: by then, most devices supported VoLTE. Apple started to support VoLTE from September 2014 and the iPhone was set to default to VoLTE from 2019. From a network perspective, LTE had reached a significant level of maturity by 2019, in terms of coverage and network optimization. Network operators continued to optimize their VoLTE networks, and network KPIs were significantly improved. By the end of 2022, VoLTE adoption reached the majority of operators; those who have not launched VoLTE could be defined as 'laggards' on the adoption curve.

Barriers to VoLTE Ramp-up

As of October 2022, there were 239 VoLTE networks in 107 markets globally, with operators recording 3.9 billion VoLTE connections. Technical challenges, lack of LTE network coverage and VoLTE-capable device affordability are significant barriers, but the arrival of 5G is expected to speed up VoLTE adoption.

The global deployment of VoLTE networks was initially held back by technical challenges, such as a lack of device support, limited LTE network coverage, lack of network optimization, QoS issues, and market dynamics. A significant part of the early technical challenges originated from the complexity of the relatively new IMS architecture. To a certain extent, the adoption of IMS by service providers correlates to the rise of VoLTE.

Editor | Sun Tian <suntian@bjxintong.com.cn>

Operators' expectations and VoLTE-related constraints have evolved as the technology has progressed along the adoption curve. GSMA Intelligence asked 100 mobile operators about the factors most relevant to scaling VoLTE. The leading area was LTE coverage, while device-related issues came second and third. Despite VoLTE being a mature technology, some original equipment manufacturers (OEMs) are still controlling VoLTE settings in their devices, and the price of VoLTE-capable devices is still an entry barrier in many developing regions.

According to the GSMA Intelligence VoLTE Survey, operators faced the most end-user voice complaints immediately after the launch of VoLTE. But once VoLTE reached a more mature status, they received significantly fewer complaints. Further interviews confirm that operators face fewer end user complaints following VoLTE maturity. Moreover, it is worth noting that the interviewed operators launched VoLTE more than three years ago; since then, VoLTE and IMS deployment has become even more established. Thus, if an operator decides to deploy VoLTE today, it can expect fewer end user complaints than during the initial phase of the first three years.

Necessity of VoLTE Roaming

Since the pandemic ended, the number of international roamers has bounced back and roaming is firmly back on the agenda for operators. As more and more operators are decommissioning their legacy 2G/3G network to refarm the spectrum for 4G and 5G, those operators without VoLTE roaming agreements are putting themselves at risk with the sunsetting of 2G/3G networks.

The importance of VoLTE roaming is expected to increase, driven by the growth in VoLTE penetration, the recovery of international roaming, and further 2G/3G network shutdowns. Despite the heightened importance of VoLTE, GSMA Intelligence's latest survey shows that 37% of operators still don't have any VoLTE roaming agreements. With an average of fewer than 10 VoLTE roaming agreements per mobile operator according to the survey, there is still some way to go to providing globally available and interoperable VoLTE networks.

Prospect of VoLTE in 5G

Growth in the use of 5G is expected to lead to major changes for most operators. With the arrival of 5G Core, operators will no longer have the option to offer IP voice with legacy voice service support, unless they adopt VoLTE. 5G is forecasted to become the most widespread wireless technology by the end of 2028, and subscribers need to be migrated from the previous generation CS infrastructure to IMS. 5G VoNR is also only feasible through migration to an IMS-based core network, which will be the foundation of future voice services. Due to limited 5G NR coverage and limited VoNR user equipment support, voice services are mainly being provided by EPS fallback to VoLTE during the initial transition phases of 5G SA. VoNR is expected to be put into commercial use on a larger scale from 2025.

VoLTE can also enable future voice services based on IP networks — for example, high-value, niche-market video services. VoLTE enables video calls to be provided in conjunction with HD voice (video over LTE or ViLTE), as well as video calls being made possible between VoLTE subscribers, and enabling switching between video and voice.

To better utilize mature VoLTE networks and cater to ever-changing user demands in the 5G era, New Calling is emerging. New Calling will not only give rise to an array of new services, but also elevate calling experiences to a brand-new level. Emanuel Kolta said that this solution is not just about improving the quality of services with the introduction of VoLTE, but also new services will be added and even monetized.

New Calling enables customers to share their screens, offers instant translation, and provides new services related to customer support and customer care via video calling, helping people overcome communication barriers.

Mobile operators can leverage New Calling to offer a new and wide range of services globally for their customers and enterprises as well. GSMA is also currently working with operators, ensuring that this new solution will be interpretable and widely available in most places around the world.

From Voice-Only Operations to Content Operations, New Calling Opens Up a New Horizon for Communications

Today, calling continues to be the most common and reliable form of communication. In order to meet users' increasing interaction expectations, Huawei collaborated with leading operators and launched the New Calling solution based on the "1+3+N" architecture. Specifically, the New Calling solution leverages one solid underlying network to enable ultra-high definition (UHD), intelligent, and interactive calling capabilities, allowing operators to roll out numerous innovative services. This solution aims to transform calling into a platform product, help operators develop 5.5G-oriented flagship services, and ultimately open up a new horizon for communications.

George Gao, President of Huawei Cloud Core Network Product Line

In line with various user demands and technological advancements, calling services have radically changed over the years. Looking back over the history of 1G to 5G networks, calling services have transitioned from voice-only in the early days to video in recent years, and are now gradually moving to intelligent and interactive communications, ushering in a fresh wave of superlative calling experiences.

Editor | Zhu Wenfeng <zhuwenfeng@bjxintong.com.cn>

Calling Shifts from Fulfilling Basic Communication Needs to Empowering a Wide Range of Differentiated Services

From the perspective of network transformation, calling services have been developed in three phases.

In the first phase, operators built solid voice networks and offered basic calling services to meet users' essential communication needs, which in turn, yielded a large, robust user base and tangible revenue growth for those operators.

In the second phase, leading operators explored and implemented multimedia calling based on Voice over LTE (VoLTE) networks. By combining video calling with content, operators further unlocked the business value of calling and improved user experiences.

In the third phase, 3GPP Release 16 defined the IP multimedia subsystem (IMS) Data Channel (DC), and following that, New Calling was launched. New Calling builds intelligence capabilities, compute power, and extended reality (XR) into underlying networks to enable an array of innovative services. It not only helps meet individuals' differentiated communication needs and improves the communication efficiency of industries, but also drives calling towards intelligent, interactive, and immersive communications.

New Calling Centers on Content Operations and Will Create More Value with New Services

The commercial rollout of the video ringback tone service reveals that calling is moving towards video- and content-based.

With the video ringback tone service, users can deliver information through the call screen before calls are answered. By the end of 2022, the video ringback tone service had reached over 700 million users in China, bringing about CNY10 billion in revenue each year and creating immense social value. The success of the video ringback tone service lies in rich and high-quality content, including user-generated content (UGC), professionally-generated content (PGC), and content generated by over the top (OTT) platforms.

As 5G continues to command the telecom market, Chinese operators have increased their VoLTE/Voice over NR (VoNR) penetration rate to over 85%, and as early as 2021, video interconnection had been achieved between the three major operators. So far, mature network and user environments are already ready for service innovation, laying a solid foundation for the emergence of New Calling.

New Calling will unlock the full potential of calling and bring huge market opportunities. Take visualized voice calling as an example. This service allows users to transmit multimedia content during voice calls. With this service, individuals can present their virtual avatars to others to convey emotions and express personalities; enterprises can customize their promotional materials to improve brand awareness; operators can conduct public welfare advertisements to fulfill their social responsibilities. By means of content operations, New Calling will elevate calling to a whole new stage and create greater business and social value.

As regards to the standards surrounding this industry, 3GPP Release 18 has defined the network architecture for Next Generation Real Time Communication (NG_RTC), which will fast track the implementation of New Calling.

In terms of industry development, GSMA had established a New Calling Foundry project at MWC Barcelona 2023 and held a New Calling industry roundtable during MWC Shanghai 2023. Currently, GSMA is working with global leading operators, terminal and chip vendors, network device providers, and vertical industry partners to promote the development of New Calling. For the terminals that support IMS data channels, it is predicated that they will be commercialized by the end of 2023.

New Calling Is Developed in Phases, Aiming to Build a Solid Ecosystem

In order to help operators enhance user loyalty and develop calling into a platform product, Huawei collaborated with leading operators and launched the New Calling solution based on the "1+3+N" architecture. With this solution,

operators are able to leverage one decent IMS network to enable UHD, intelligent, and interactive calling capabilities. By utilizing these capabilities, operators can roll out numerous innovative services, thereby upgrading user experiences and helping enterprises reduce costs and improve communication efficiency.

The development of New Calling is closely relevant to two aspects: VoLTE/VoNR user base and an ecosystem that encompasses chips, terminals, networks, and services. However, a solid user base and ecosystem cannot be built in just one step. It is recommended that New Calling be developed in phases.

In the first phase, enhance calling with intelligence capabilities and deploy terminal-agnostic services to improve user experiences and form user habits.

By embedding intelligence capabilities into calling, operators can attract more users to enjoy their video services, so as to expand the user base and finally develop video calling into a standard service.

Typical services in this phase include fun calling and real-time translation. Fun calling allows users to express themselves and convey emotions more easily. Real-time translation can provide both language translation and speech-to-text conversion, helping people from different cultures and those who are hard of hearing break down communication barriers.

In the second phase, enhance calling with interactivity capabilities, promote terminals to natively support data channels, and introduce New Calling into vertical sectors.

On top of existing voice and video channels, data channels are added to transmit data of any type during calls, which gives rise to interactive calling services, such as remote sharing, AR annotation, and file transfer. With these services, New Calling is able to permeate into vertical sectors to expand its service boundaries. However, to implement these services, terminals and chips must support data channels.

Once terminals that natively support data channels are brought to the market on a large scale, user experiences will be further improved and service scenarios will be further enriched.

In the third phase, enhance calling with artificial intelligence (AI) and open network capabilities to external systems to enrich content and build the industry ecosystem, so as to promote industry prosperity.

By utilizing AI Generated Content (AIGC), large models, and compute power, New Calling networks are able to understand, exchange, and convert information flows of different formats, such as audio, video, texts, and images. In this way, the digital character of each user can be driven by AI in real time, improving users' interaction experiences.

In addition, by standardizing APIs, New Calling network capabilities can be exposed to external developers and independent software vendors (ISVs) through the Network as a Service (NaaS) model. In doing this, the New Calling network can be built into an open service enabling platform that aggregates and encapsulates network capabilities, such as audio and video media processing and real-time data interaction, and then exposes these capabilities to vertical industries. This not only aids fast service innovation, but also helps build the industry application ecosystem and creates more market opportunities.

New Calling has created a watershed moment for the calling industry. On the one hand, it helps operators transform their business model from voice-only operations to content operations and opens up more revenue streams. On the other hand, it allows users to have a more enjoyable experience and communicate more efficiently during calls.

Nevertheless, New Calling is still in its infancy. It is hoped that all concerned parties can work together to overcome industry hurdles and jointly build a solid New Calling ecosystem. In this way, New Calling can truly shift voice-only operations into content operations and transition voice and video calling into multimodal communication. There is no question that New Calling, bolstered by AI, will bring significant rewards to both users and operators and continuously unlock the potential of calling networks.

Editor | Sun Tian <suntian@bjxintong.com.cn>

5G New Calling: Striving to Innovate, Innovating to Thrive

At this critical juncture of 5G development, 5G New Calling creates new opportunities to improve voice quality and further unleash the value of 5G. In light of this development, 5G New Calling has become an irresistible choice for operators to revolutionize their voice services in the 5G era. As networks, technologies, and terminals continue to grow, now is the time to shape the landscape for 5G New Calling.

Liu Qicheng, Chief Editor of CWW

Widely considered an innovative breakthrough, 5G New Calling has transformed the conventional voice-only calling to immersive and interactive communications, gradually bringing intelligent communications ideas to life and continually injecting new vitality into the development of 5G. 5G New Calling not only rejuvenates traditional voice services, but redefines the calling experience. Most importantly, it also serves as a key driver to fast-track the digital transformation of both operators and various industries.

At present, the industry is committed to building an open, beneficial, and collaborative 5G New Calling ecosystem, so as to promote the prosperity of the 5G New Calling industry and enrich people's life through communications.

There's No Time Like the Present to Develop 5G New Calling

Calling has been and remains the cornerstone for the communications of the earth's 8 billion citizens. With clear business value and an indispensable role in shaping our society, calling has been positioned as the most important and fundamental service of operators. Riding the evolutionary waves of mobile communications, voice services have experienced several rounds of upgrades, ultimately satisfying people's basic communication requirements. That said, people's desire for an elevated calling experience grows along with the development of 5G — they are expecting enriched calling experiences featuring intelligence, interaction, and immersive communications. This, combined with operators' digital transformation strategy, gave birth to 5G New Calling.

Leveraging 5G features, 5G New Calling redefines calling for both individual and industry users, transitioning their experiences from voice-only to voice plus video and immersive interactions. 5G New Calling also augments the voice and video communications to ultra-high-definition (UHD), trusted, and interactive real-time communications, while extending such communications to an enriched array of terminals and devices, including glasses, helmets, watches, TVs, cars, and even robots.

Powered by front-edge technologies, particularly artificial intelligence (AI) and enhanced computing power, 5G New Calling allows users to enjoy multimedia, visualized, and immersive communications via a suite of practical, heuristic, and interactive services, such as Voice over NR (VoNR) based UHD calling, intelligent translation, fun calling, intelligent customer services, content sharing, and remote collaboration. For example, with the remote collaboration service, we can help the elderly and children use home appliances by marking images, such as where buttons and switches are during video calls.

In terms of application scenarios, 5G New Calling meets

the diversified requirements for information consumption from individual users, while also finding its way into the B2B market as it helps industry customers improve their work efficiency and even extract greater business value from calling. With the audio-visual quality outperforming that of Internet-based video services in terms of both clarity and stability, 5G New Calling is expanding its footprint in the B2B sector.

As 5G development approaches this critical juncture, 5G New Calling creates new opportunities to further elevate voice services and extract the value of 5G. It has become a natural fit and optimal choice for operators to reinvigorate their voice services in the 5G age. To expedite the development of 5G New Calling, the industry has been focused on advancing the networks, technologies, and terminals associated with it. As the readiness of these elements continues to accelerate, there's no time like the present to develop 5G New Calling.

Seeking Breakthroughs with Pooled Efforts

Even though 5G New Calling is in a receptive, progressive environment, it still needs to navigate a series of challenges, particularly those concerning networks, terminals, and markets, to finally achieve economies of scale.

On the industry side, 5G New Calling is still considered in its infancy stage of development and is confronted with questions regarding technical standards, chipsets and terminals, and industry-oriented applications. On the consumer side, it is difficult to change users' inherent habits — they have been accustomed to using the over the top (OTT) applications which offer calling as a value-added handy service, such as WhatsApp and FaceTime. In addition, the concept and related languages that are connected to 5G New Calling have not been unified among operators, neither have they been popularized with the public.

Nevertheless, these challenges certainly do not hinder the industry from pursuing a bright future for 5G New Calling, but further promote the collaboration among industry players. For example, a 5G Voice over NR plus (VoNR+) work group was built under the 5G Deterministic Networking Alliance (5GDNA), marking the world's first official organization for co-developing 5G New Calling. Led by China Mobile, over 10 members including Huawei in this work group have been devoted to setting up benchmark applications, addressing key technical issues, and stimulating the maturity of terminals and chipsets for 5G New Calling. With more and more participants engaged and work mechanisms continuously refined, the work group aims to establish the most far-reaching alliance for 5G New Calling, and unite all members to further promote consensus and propel 5G New Calling to move faster towards commercial use, allowing users to enjoy the calling experience that 5G differentiates from previous communication generations.

With the joint efforts of all parties in the industry, China's 5G communication services are making steady strides forward. Alongside this, we have taken the lead in developing 5G New Calling. As early as July 2022, China Mobile started a pilot verification of 5G New Calling. This year, China Mobile recruited a batch of users and beta-tested more services. China Telecom is committed to promoting the construction of the 5G New Calling service platform, upgrading "intelligent video calling applications on existing terminals" to "real-time interactive services with terminals that natively support 5G New Calling" at well-planned phases. At the World Telecommunication and Information Society Day, China Unicom launched its 5G New Calling products. Leveraging the world's largest jointly-built and shared commercial 5G network, China Unicom is delivering 5G VoNR services to users in 125 cities across China. China Broadnet also released a 5G New Calling white paper, and under its guidance, they planned to launch a full range of innovative calling services. To help operators unlock more possibilities with 5G New Calling, Huawei put forward the "1+3+N" architecture centering on a New Calling Service Enabling Platform. Specifically, this architecture utilizes a single robust voice network to enable UHD, intelligent, and interactive calling capabilities, which then help operators roll out numerous innovative services.

Endeavoring to Achieve Leapfrog Development

In 2023, China placed 5G New Calling into the fast lane, pioneering the development of the 5G New Calling industry.

Editor | Sun Tian <suntian@bjxintong.com.cn>

In June this year, China Broadnet made the first UHD video call using 5G New Calling. New features such as gesture- and voice-controlled emojis were proven viable, demonstrating the real-time multi-media interaction capabilities of 5G New Calling. Soon after, in August, Zhejiang Branch of China Telecom, together with Huawei and NetEase, made the first call via 5G New Calling in four languages and verified the visualized voice calling function and real-time translation services. In addition, Beijing Branch of China Mobile and Huawei witnessed the first call that was successfully connected using 5G New Calling on the live network. Furthermore, Henan Branch of China Mobile cooperated with Huawei to make the first international call via the commercial 5G New Calling network. It is safe to say that 5G New Calling has taken a great leap forward in capability development, service implementation, and market promotion.

Ceremony for establishing the 5GDNA VoNR+ work group

At the same time, the industry has also reaped the benefits of advances in key components of the industrial chain, including networks, terminals, chipsets, and AI-based applications. In terms of networks, China Mobile has built the world's largest VoLTE HD voice network with the most comprehensive service features, serving more than 70% of voice service users and carrying more than 75% traffic on their entire network. China Mobile has also started the construction of a network-wide 5G New Calling service system, with the aim to deliver the 5G New Calling capabilities across the entire network by the end of this year. In respect to terminals, UNISOC worked with China Mobile to complete the world's first end-to end testing on the basic capabilities of 5G New Calling and connect the first call based on them in February this year, signifying that 5G New Calling has shifted from network-based verification to terminal-side application. China Mobile also announced that they would launch the first batch of 5G mobile phones capable of IP multimedia subsystem (IMS) Data Channel (DC) based 5G New Calling this year. As for chips, UNISOC launched a turnkey terminal solution for 5G New Calling. With integrated chipsets and software platforms, the solution provides one-stop service capabilities, facilitating the development of the 5G New Calling ecosystem. And as for AI, iFLYTEK has developed seven core capabilities with their in-house generative language model SparkDesk. With these capabilities at the core, they can provide intelligent assistants during the calls, setting a benchmark of using upper-layer innovative applications to empower basic calling services.

The prosperity of the 5G New Calling industry cannot be achieved without the joint collaboration of the entire industry. To bolster the 5G New Calling industry, a collaboration initiative was officially launched by industry partners on June 4 this year, which includes the China Academy of Information and Communications Technology (CAICT), China Communications Standards Association (CCSA), China Association of Communications Enterprises (CACE), China Mobile, China Telecom, China Unicom, China Broadnet, Huawei, Xiaomi, UNISOC, iFLYTEK, and CommChina. The initiative calls upon global operators, network suppliers, terminal vendors, and industry partners to exchange thoughts, explore business models, promote network interconnection, develop standards for terminals and applications, and build a sound industry ecosystem. By doing the above, 5G New Calling will grow and create more value for users.

Embracing the Broad Prospects and Advancing into a Better Future

Currently, 45% of global operators have deployed VoLTE networks. As their 2G and 3G networks are gradually being phased out, circuit-switched voice services are evolving to VoLTE and will transition to 5G VoNR in the next few years. And their connotations will be further upgraded and expanded as more and more leading-edge technologies join in, such as AI and big data.

The world's first market with 1 billion 5G connections is expected to be seen in China by 2025. And by 2030, the number of 5G connections in China will grow to 1.6 billion, taking up nearly one-third of the world's total. A huge 5G New Calling market will stretch out in front of us. As more calling functions emerge, 5G New Calling shall become a trump card for operators to play, to expand users' view on the use of 5G.

Today, the technologies and markets that underpin the shift from audio and video calling to intelligent and interactive communications have been basically established. As operators accelerate their scaled deployments, 5G New Calling will soon be popularized with its ecosystem continually being enhanced, providing enriched service experiences to individual users, facilitating the digital transformation of a diverse range of industries, and accomplishing 5G's mission of changing our society.

Looking into the future, 5G will revamp real-time communications. All the players involved in the industry chain, including operators, equipment vendors, and terminal manufacturers, need to work together to explore new 5G voice service scenarios, open up new voice industry space, and discover new business models. With this in mind, the 5G VoNR+ work group will also strive to grow into a global cooperation platform under the guidance of the 5GDNA and gather more and more industry partners to jointly promote the large-scale implementation of 5G New Calling.

Editor | Sun Tian <suntian@bjxintong.com.cn>

Building the Next-Generation New Calling Network, Ushering in a New Era of Real-Time Communications

5G New Calling is a strategic product of China Mobile. As a pioneer in the New Calling industry, China Mobile has initiated the construction of the New Calling network for the first phase. By building platform products centered on calling, China Mobile aims to offer users an interactive, immersive experience anytime, anywhere, ushering in a new era of real-time communications.

Bian Yannan, Deputy General Manager of Planning and Construction Department at China Mobile

Looking back on the forty years of mobile communications development, ensuring high-quality voice services has continuously been an unwavering pursuit of operators. From the analog voice of the 1980s, digital voice of the 1990s, to the Internet of Everything (IoE) in the current 5G era, voice services have transitioned from wired to wireless, voice-only to voice plus video, and single-terminal to multi-terminal with full interactions, incrementally enhancing user experience along the way. The growth of voice services has also propelled users' terminals to evolve from cellular phones to smartphones and even an enriched array of devices.

Meeting User-Specific Communication Needs, New Calling Injects New Vitality into the Communications Field

In the age of 5G, there is an escalating desire for scenario-based and tailored communications. From individuals craving seamless and efficient collaboration, to the youth yearning for fun and unique experiences, to the elderly emphasizing affectionate and remote aid, and to the government and enterprise sectors stressing visible, secure, efficient, and real-time communications — these demands are setting loftier benchmarks, pushing forward the ongoing evolution of communication networks. Undoubtedly, the demand for scenario-based communications is the cornerstone propelling the advancement of real-time mobile communications.

To cater to users' demand for scenario-based communications, China Mobile, in collaboration with industry partners, has launched 5G New Calling. When contrasted with conventional communications, this novel approach amplifies audio-visual networks with ultra-high-definition (UHD), intelligence, and interactive capabilities. On top of this, 5G New Calling introduces fresh features, including emoticons, subtitles, translation, extended reality (XR), artificial intelligence (AI), and more, offering both individual and enterprise users a captivating and real-time interactive experience. Users can tailor their interactions in different communication scenarios by selecting suitable applications and overlaying various content types and settings, ensuring their conversations are personalized, intimate, and media-rich. Embracing the philosophy that "communication starts from the heart", 5G New Calling promises users a transformative and refreshing communication experience.

Leveraging Four Pivotal Technologies to Bolster the VoNR+ Architecture, Sculpting a Progressive New Calling Network

In terms of commercializing New Calling, a transformative

network architecture is imperative, marking the inception of an open, progressive network. To address this, China Mobile has ventured into reimagining the network blueprint and fortifying system functionalities, giving rise to the Voice over NR plus (VoNR+) technological architecture.

At the outset, the network functions (NFs) for implementing New Calling's capabilities were woven in, becoming the nexus of the communications framework. Subsequently, a New Calling media plane, synergized with AI, was integrated, bestowing the network with adept media processing capabilities. Concurrently, by fortifying the existing IP multimedia subsystem (IMS) network with enriched data channels, the voice network now boasts UHD, intelligence, and interactive prowess. Notably, the New Calling network's state-of-the-art capabilities have been extended to industry collaborators through uniform APIs, allowing developers to adeptly engage these APIs, driving innovation and unveiling a myriad of enriched service experiences for users.

The New Calling network architecture (VoNR+) is anchored on four pivotal technologies.

VoNR+ capability platform architecture: Southbound capability aggregation and northbound capability openness are two core features of this architecture. This technology mitigates the complexities and timelines associated with incubating new services, thus facilitating rapid deployment of innovative services.

One IMS network with three channels: Building on the foundational voice channel, this technology has intelligently augmented the video channel and introduced a new data channel. This data channel offers interactive abilities, such as sharing and tagging, empowering the network through innovative features, content, and applications to shape a renewed voice ecosystem.

AI capability platform: Incorporation of various AI technologies for image media processing enables deep and intricate processing of media and content, enhancing personalization and scenario-based interactions.

User-end applet architecture: Diverse application innovations have been fostered by decoupling communication and application capabilities while leveraging web technologies. With the synchronized collaboration between terminals and networks, and centering on native mobile dialers, a native service entry has been crafted. This allows every user to construct their distinctive mini programs, catalyzing a diversified and flourishing communication service landscape.

Crafting Strategic Products of 5G New Calling, Actively Stimulating the Maturity of the Industrial Ecosystem

China Mobile has positioned 5G New Calling as a distinctive 5G application, dedicating efforts to create a platform product centered on calling. In this year's "Two Sessions" interview, Yang Jie, Chairman of China Mobile, announced to the public that China Mobile will accelerate the development of 5G New Calling to offer users a more engaging video calling experience.

As a trailblazer in the New Calling industry, China Mobile collaborates with industry partners to actively innovate in areas including New Calling standards, networks, and terminals, pushing the industry chain to reach maturity.

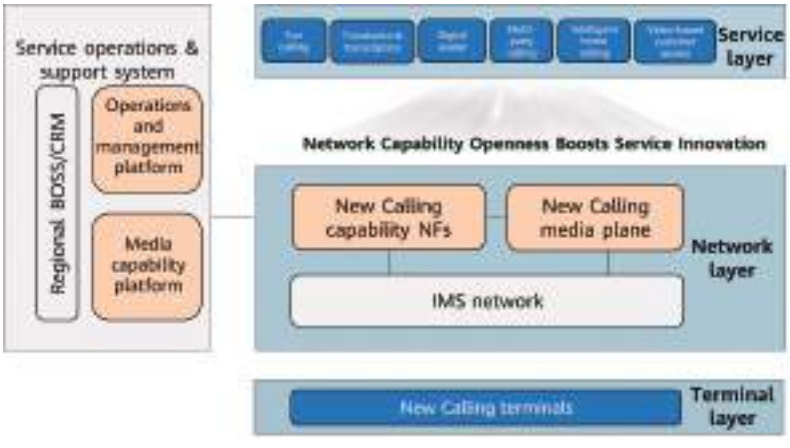


Figure 1 Network architecture for China Mobile's New Calling (VoNR+)

In reference to the standards, China Mobile has actively engaged in major national and international standards organizations such as the 3rd Generation Partnership Project (3GPP), China Communications Standards Association (CCSA), Global System for Mobile Communications Association (GSMA), and International Telecommunication Union (ITU), taking the lead in completing more than ten standards development projects at both national and international levels, while also asserting

Editor | Sun Tian <suntian@bjxintong.com.cn>

industry leadership through these standards.

In terms of networks, China Mobile was the first to define the VoNR+ target network architecture and typical service processes. In collaboration with industry partners, we have accelerated the R&D of network-side functions. At present, end-to-end field technical pilot verifications covering networks, services, terminals, and operations have been launched in Zhejiang, Jiangsu, Guangdong, and Hebei provinces. With over 6000 test cases accomplished, we have comprehensively verified the commercial capabilities at the network side.

On the terminal front, China Mobile has completed New Calling service testing for over 200 types of Voice over LTE (VoLTE) and VoNR terminals. For the new terminals capable of IMS Data Channel (DC), China Mobile, in conjunction with chipset and terminal manufacturers, has finalized in-lab verification and successfully made the first call on the live network.

In early 2023, China Mobile initiated beta tests in several provinces, focusing on features including fun calling, speech-to-text conversion, Chinese-English translation, and visualized voice calling. After six months of refining based on user feedback, 5G New Calling had been launched for pilot commercial use in provinces such as Zhejiang and Jiangsu in June.

In the second half of 2023, China Mobile formally began the construction of the New Calling network.

In terms of the New Calling network, relying on the cloud resource pool, the New Calling capability NFs will be deployed in an 8+X centralized, cloud-based manner following a hardware and software decoupled approach, enhancing platform capabilities and building a highly reliable, flexible, and agile cloud-based network. At the same time, the New Calling media plane will be deployed to various provinces to provide users with a superlative experience and minimal latency.

In terms of New Calling services, leveraging the abundant resources of China Mobile's cloud resource pool, the service application server (AS) will be deployed at the China Mobile Internet Base. In addition to introducing China Mobile's proprietary capabilities such as Lingxi, Jiutian, and XR, high-quality applications from partner companies will also be integrated, jointly creating an intelligent, flexible, and enriched service system.

Regarding the New Calling terminals, chipset manufacturers will provide IMS DC protocol stack capabilities, and China Mobile will offer a New Calling software development kit (SDK) and mini program application framework for terminal manufacturers to integrate. The entire project involves the construction of a New Calling network and the upgrade and renovation of the existing IMS network, aiming to provide network-wide New Calling service capabilities by the end of this year.

When the wind blows and the waves break, we will remain resolute, trimming our cloud-white sails to navigate the choppy seas and reaching our destination as one team. New Calling brings new opportunities, new developments, and a bright future.

The prosperity of the future New Calling industry requires the collaborative efforts and progression of the entire industry chain, including networks, terminals, chipsets, applications, content, and channels. China Mobile is eager to join hands with industry peers, build a consensus, and forge innovations. We strive to create an open, collaborative, and beneficial New Calling ecosystem. Together, let's shape a new environment for real-time communications in the 5G era and forge a bright future for New Calling.

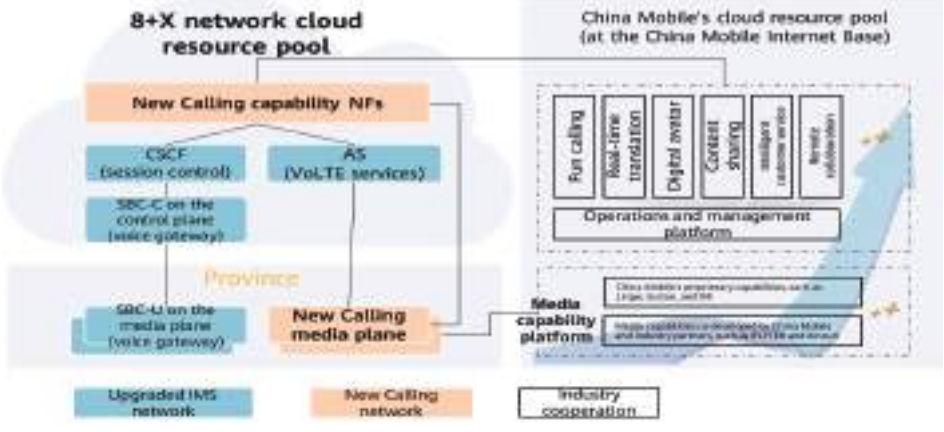


Figure 2 5G New Calling network deployment solution of China Mobile

Building a Highly Stable and Reliable 5G Signaling Network

Signaling, the language for communications between network elements (NEs), acts as the central nervous system of a communication network. Efficiently planning and managing signaling networks are imperative for ensuring efficient, reliable, and secure communications. Against the backdrop of accelerated 5G construction, operators should build a simple, efficient, stable, reliable, and secure signaling network capable of handling diverse services and stringent requirements. This commitment guarantees the highly stable operation of communication networks and improves operations and maintenance (O&M) efficiency.

Zhu Wenfeng, Reporter of CWW

Operators are expediting the construction of 5G networks, with the promise of high bandwidth, low latency, and extensive connectivity. The advent of 5G brings about service innovation, elevates user experiences, and enables more convenient and enjoyable lives for its users.

In practice, communication networks have become underlying infrastructure, with signaling serving as the central nervous system of these networks. However, several signaling storms have occurred globally, disrupting public communications and terminating services across sectors such as government and public services. This serves as motivates to strategically plan and build an organized and secure signaling network, ensuring reliable communications in the 5G era.

Challenges Faced by 5G Signaling Network Construction

Adapting to 5G networks, the signaling network faces the following challenges.

Challenge 1: Complex Network Architecture and Low O&M Efficiency

Throughout the development of 5G, new services are emerging and continuously varying, leading to a rise in the number of subsystems and connections being added to communication networks. These combined factors make network architecture increasingly complex.

For example, the HTTP/2 protocol used on 5G networks is based on text parsing, which is less efficient compared with traditional binary signaling protocols. As signaling traffic and the number of links on the 5G core network increase, the signaling network becomes disordered, complicating link troubleshooting and fault locating. In addition, various vendors are active participants in the cloud era and interpret communication protocols differently. These differences cause NE interconnection difficulties and hinder service rollout. The 2G, 3G, 4G, and 5G networks will coexist long into the future, and multiple subsystems will only further increase the complexity of the signaling network.

Challenge 2: Frequent Signaling Storms

In recent years, signaling storms have occurred frequently, exerting great pressure on global operator networks. Guaranteeing network reliability has consistently been a challenge the communications industry faces. For instance, as cloud-based network devices are layer-decoupled, network reliability reduces; the increase of 5G signaling packet length deteriorates system processing capability; and Service-

Editor | Zhu Wenfeng <zhuwenfeng@bjxintong.com.cn>

Based Architecture (SBA) still has shortcomings in real-time congestion management. Furthermore, the surge in new applications leads to an explosion in signaling traffic, burdening backend NEs, including those for user data storage, charging, and policy control, with unprecedented signaling pressure. Failures in these NEs disrupt services across the entire network.

Challenge 3: Diversified Signaling Security Protection Scenarios

In contrast to traditional communication networks, 5G networks evolved from closed architecture to open ones. Semi-open and fully open subsystems, as well as operators' internal networks, are divided into different security zones to fulfill isolation and differentiated management and control requirements. As service types increase, network architecture grows intricate and security protection scenarios become diverse. For instance, some security service providers discovered security vulnerabilities in 5G network slices, allowing attackers to snoop and manipulate user information in neighboring slices through terminals. Therefore, the secure management of signaling network partitions has become crucial in preventing service loss caused by network vulnerabilities. Balancing efficient service rollout without sacrificing security has become a top concern for the communications industry in network planning and construction.

Operators' Commitment to Building a Simple, Reliable, and Secure Signaling Network

We advocate the 2G to 5G range of fully-converged signaling network to address the challenges that signaling networks encounter. As a cross generational, fully converged signaling management center, this network features logical signaling NEs such as signaling transfer point (STP), mobile number portability (MNP), Diameter routing agent (DRA), Diameter edge agent (DEA), service communication proxy (SCP), binding support function (BSF), and security edge protection proxy (SEPP). Such fully-converged signaling network enables signaling convergence, analysis, protocol-compliant interworking, and traffic load balancing, preventing signaling surges and safeguarding signaling security. This simple, reliable, and secure signaling network promotes the success of 5G businesses.

3GPP defines four signaling communications models for 5G core networks: Models A, B, C, and D. Model D facilitates indirect communications between NEs, enabling the SCP to offer functions such as link establishment, route information acquisition, traffic forwarding and control, and load balancing.

Model D is optimal for 5G signaling networks. Compared with Models A and B, Model D reduces the number of links by up to 90%, balances the real-time loads of each office direction, and streamlines network connections. Compared with Model C, Model D further reduces subscription and notification messages exchanged between NEs, curbs network traffic loads, and centralizes signaling route management on the SCP, expediting NE deployment and service rollout.

Model D Simplifies Networks and Improves Efficiency

It's recommended to adopt Model D to simplify the signaling network to the maximum degree. The Model D-based signaling network converges enormous links by two orders of magnitude, greatly reducing real-time network connections and simplifying network architecture and O&M. The start-structured signaling network offers traffic visualization capabilities, generating real-time visualized control-plane traffic charts. O&M personnel can easily grasp global traffic overviews and partial message traces. Supported by intelligent analysis tools, the O&M center can monitor real-time traffic across each office direction and predict traffic patterns to pinpoint bottlenecks and mitigate potential risks promptly. Furthermore, the signaling network enables flexible adaptation and interconnection, markedly decreasing integration workload among NEs from different vendors and expediting NE and service rollout. Operators should construct a fully-converged signaling network spanning 2G to 5G, managing resource pools for signaling NEs of different generations to enhance O&M agility while economizing resources and operating expense (OPEX). The platform offers a unified lifecycle management interface, reducing the necessity for network migration and reconstruction and enhancing network stability.

High Resilience, Intelligent Flow Control, and Quick Fault Recovery Make Signaling Networks More Reliable

High service reliability stands as one of operators' most critical key performance indicators (KPIs) and forms the bedrock of the signaling network. In the all-cloud era, the reliability of the signaling network needs to be further enhanced, enabling the system to defend against the impact of signaling storms, sustain stable message processing and forwarding, and guarantee uninterrupted service operations.

As per recent statistics on signaling storms, 90% of faults occur in backend NEs, including those for user data storage, policy control, and charging. In such circumstances, signaling forwarding NEs must not only endure high traffic pressure but also adapt to the processing capabilities of backend database NEs to perform intelligent flow control and peak clipping on frontend traffic to safeguard backend NEs. Such a strategy guarantees service continuity throughout the entire network.

In extreme situations, such as network congestion, swift fault locating becomes imperative. In 2022, an operator encountered complete network downtime due to signaling storms. Their O&M team took two to three days to locate the fault, resulting in significant issues and losses for the public, government, and operator. Thus, the ability to swiftly demarcate faults and recover services is indispensable. With this capability, the signaling network can provide traffic visualization and intelligent analysis at critical moments to help the O&M center quickly identify exceptions and shorten fault locating and service recovery to minutes, minimizing losses.

Multi-Scenario Converged Protection Enables Secure and Trustworthy Signaling Networks

The signaling network is responsible for internal and external message exchanges and connections on telecommunication networks, thereby providing signaling security protection. Beyond meeting 3GPP and GSMA compliant standards, the signaling network adds the following incremental values to help operators in ensuring reliable communications across diverse service scenarios.

In 5G network architecture, the signaling network needs to inherit external signaling security protection capabilities in traditional roaming scenarios and provide security zone isolation and protection for operators' internal networks. The signaling network needs to support management and control functions such as topology hiding, access control, encrypted transmission, and signaling filtering. The security protection functions empower operators to counter external and internal threats and attacks effectively.

The fully-converged signaling network spanning 2G to 5G stands as the optimal solution for network evolution. The signaling network and firewalls should collaboratively protect multi-generation services, enabling cross-generation defense policies to be copied and shared to prevent incorrect or omitted configurations. In practice, the fully-converged firewall can provide multiple signaling attack defense patterns and share signature databases across the 2G to 5G range, realizing optimal signaling protection.

Furthermore, operators should launch a solution that integrates signaling NEs and firewalls for network security protection. Compared with external firewall solutions, this integrated approach facilitates protocol interface interconnection and firewall convergence, eliminating the need for traffic detours, trimming latency, expediting service rollout, and reducing delivery and O&M costs.

Outlook for 5G Signaling Network Construction

Signaling is playing a pivotal role in operators' communication networks. In the 5G era, a continuous influx of new applications escalates signaling traffic on communication networks exponentially. However, fragmented management results in frequent network reliability problems and security incidents, leading to service interruptions and huge compensation payouts. Thus, prioritizing the construction of signaling networks as foundational infrastructure becomes imperative. As network evolution proceeds, meticulously planning, constructing, and managing signaling networks are indispensable to sustain the stability and long-term development of new services across numerous industries.

Editor | Sun Tian <suntian@bjxintong.com.cn>

UNISOC Redefines Chipset Platforms for 5G New Calling, Pioneering Diverse, Real-Time Interaction and Communication Capabilities

Leveraging its cutting-edge 5G communication baseband solutions and comprehensive communication application development capabilities, UNISOC provides a one-stop turnkey solution for 5G New Calling — integrating both chipset and software platforms. The company not only rigorously standardizes technical specifications for the interfaces of New Calling terminals, laying the groundwork for embracing more terminal providers; but also remains committed to cultivating an open 5G New Calling ecosystem, offering users an enriched array of innovative calling services.

Han Liang, Huang Lei, Meng Xianmao, Liu Chunjie, He Yanli, UNISOC Technology Co., Ltd

As the cornerstone of mobile communication, the calling function has experienced successive waves of technological innovation. In the current landscape, marked by the burgeoning of intelligent terminal technologies and the ascendancy of 5G networks, the advent of 5G New Calling has revolutionized traditional calling by introducing multimedia convergence and interaction features. Committed to an open 5G New Calling ecosystem, the New Calling framework aims to enrich innovative calling services for users. With various mini programs allowed to run during calls, New Calling presents expansive and diversified application scenarios.

In these complex scenarios, chipsets and terminal solutions face challenges in providing consistent, stable capabilities while ensuring compatibility across an ever-expanding range of cross-disciplinary use-cases.

Developing the Critical Data Channel for a Novel 5G Application Ecosystem

Expanding upon the foundational Voice over LTE (VoLTE)/ Voice over NR (VoNR) architecture of traditional audio and video calling services, 5G New Calling heralds the innovative concept of the Data Channel (DC). The DC facilitates the real-time, interactive exchange of a diverse range of data, including texts, videos, files, and even virtual reality (VR)/

augmented reality (AR) elements. DC technology was first proposed in 2019, aiming to elevate VoLTE services by incorporating real-time interactive attributes that are designed for 5G. DC technology received a formal endorsement in 3GPP Release 16 and had its architectural framework further defined in Release 18 through the Next Generation Real Time Communication (NG_RTC) project.

Once the standards of the IP multimedia subsystem (IMS) DC were specified with 3GPP Release 16 TS 26.114, UNISOC has been keenly following the evolution of this technology, especially in terms of identifying key application scenarios and implementation methods. China Mobile released its VoNR+ platform framework and definitions for New Calling application scenarios in 2021, providing valuable references for applying this technology.

Outlined in China Mobile's 5G VoNR+ White Paper, a construction plan for the ecosystem platform defines the roles for various participating vendors. Chipset vendors provide the foundational capabilities for the DC, while software development kits (SDKs) offer operating environments for mini programs, and terminal vendors integrate these SDKs into their calling applications.

In addition, to better convert chipset-side DC capabilities into an enhanced user experience, UNISOC has adopted an innovative approach from the terminal solution perspective. The innovative New Calling chipset solution not only supports the development of chipset-side DC capabilities but also introduces a comprehensive, platform-level support capacity that ranges from chipsets to middleware and the upper layer of the overall framework.

One-Stop Turnkey Solution for 5G New Calling

The seminal upgrade that IMS DC technology offers to 5G calling functionalities is the facilitation of dynamic, real-time interactive features. Viewed through the lens of terminal functions, the essence of IMS DC lies in the seamless deployment of JavaScript (JS) mini programs on top of the calling interface. These are designed to synergize real-time interactions with low-latency, high-fidelity audio-visual media, presenting a pivotal challenge that both chipset and terminal solutions must adeptly address.

In addition to possessing cutting-edge 5G communication baseband solutions, UNISOC also boasts a comprehensive suite of Android system solutions and communication application development capabilities. Building on these strengths, UNISOC has delineated the scope of one-stop delivery for 5G New Calling. This encompasses adding DC control and media transport capabilities to protocol-defined software, providing an adaptive layer that conforms to operating system and operators' SDK interface specifications via middleware, and implementing a full-fledged solution involving SDK integration and mini program presentation in UNISOC's proprietary calling applications.

Earlier this year, UNISOC, in partnership with China Mobile and other collaborators, successfully completed the world's first end-to-end capability verification of 5G New Calling based on IMS DC technology. This groundbreaking feat was further accentuated by executing the world's inaugural 5G New Calling by natively DC-capable terminals on the live network in Hangzhou, China, fostering advancements in calling services and applications from both terminal and chipset perspectives.

The pioneering initiative in delivering chipset-based 5G New Calling, coupled with the flawless debut across all service scenarios in the pilot phase, has exerted a significant influence on the refinement of the overall technical system for New Calling. These pivotal strides have laid a robust

Editor | Sun Tian <suntian@bjxintong.com.cn>

foundation, streamlining the pathway for terminal vendors to integrate seamlessly with UNISOC's advanced chipset solutions for forthcoming deployments.

First, establishment of the foundation for IMS DC capabilities. The cornerstone of UNISOC's 5G New Calling solution lies in the addition of IMS DC functionalities to the chipsets. From a technological framework standpoint, this involves a twofold approach. First, augmenting the inherent IMS protocol stack within the existing communication baseband chipsets with DC negotiation capabilities on the control plane. Second, adding an IMS DC media transport protocol stack on the user plane.

To sufficiently cater to the diverse service scenarios for New Calling, mini programs will initiate the request for various types of Bootstrap Data Channel (BDC) and Application Data Channel (ADC) combinations. Certain scenarios require concurrent support for multiple mini programs, setting an elevated standard for the IMS protocol stack beyond the conventional negotiation processes. To meet the requirements of current and future service scenarios, the implementation of the IMS DC negotiation capabilities has undergone several rounds of optimization, culminating in a solution that satisfies the prerequisites of all service scenarios evaluated during the pilot phase.

Regarding the IMS DC media transport protocol stack, given the need for direct interaction between media data and Android application SDKs within the overarching technological framework, a native service approach has been finalized for implementation within the operating system to ensure the bandwidth and solution portability. From an execution standpoint, the Stream Control Transmission Protocol (SCTP) and Datagram Transport Layer Security (DTLS) used in the IMS DC media transport protocol stack are built upon existing mainstream open-source solutions. The framework also anticipates future expansion capabilities for Real-time Transport Protocol (RTP) based data transmission, ensuring compatibility and ease of configuration. This futureproofs the solution for adapting to newer versions of New Calling and other application scenarios in years to come.

Second, integration of the New Calling SDKs and presentation of service functionalities. In accordance with the technology framework for New Calling services as defined by China Mobile, the New Calling SDKs serve to furnish operating environments as well as requisite service interfaces for JS mini programs specifically designed for New Calling applications. Furthermore, the terminals are also engineered to incorporate the SDKs into the calling applications, complying with China Mobile's unified interface standards. During the implementation process, this has been categorized into two distinct segments: the application programming interfaces (APIs) for basic IMS DC capabilities and the APIs for video calling. The former provides IMS DC media transmission and control interfaces for the SDKs, while the latter focuses primarily on video media interaction services such as fun calling and remote assistance.

Continual Innovation to Meet the Expanding Application Scenarios in the Future

VoNR+ is poised to serve as the gateway for 5G innovative services, underpinning the continual introduction of groundbreaking 5G application scenarios by operators, Internet service providers, and enterprises. As we look to the future, major sectors such as finance, government, manufacturing, and healthcare will increasingly demand more diverse communication scenarios. This in turn will place heightened requirements on chipset functionalities. Cross-platform compatibility of IMS DC is becoming increasingly crucial, driven by varying demands across sectors and different product systems and forms. The flourishing development of extended reality (XR) communications will continually enhance the real-time media capabilities of IMS DC and 5G chipsets.

UNISOC will concentrate on bolstering and showcasing features related to real-time interaction and high-definition media exchange, while continuously fine-tuning the 5G New Calling solution. In the future, UNISOC will maintain a persistent focus on the development and progression of real-time communication technologies, notably IMS DC, with a commitment to ongoing innovation. This will serve to perpetually rejuvenate the essential functionality of calling, creating an elevated communication experience for users.

Research and Practices of VoNR+ Network Architecture

By overlaying data channels onto 5G Voice over NR (VoNR) networks, Voice over NR plus (VoNR+) enables a unified, open network architecture with a capability platform of multimedia real-time communications. This type of open architecture can be harnessed to hasten the development and deployment of innovative services. In addition to existing high-definition (HD) audio and video services, VoNR+ can provide users with more abundant real-time interaction services, heralding a brand-new era of omnimedia real-time communications.

Bai Xueqian, Song Yue, Zhang Jianyin, Wei Bin, China Mobile Research Institute

Audio and video-based multimedia real-time communications in the 5G era makes up one of the core services of operators. As an indispensable, basic service, it fulfills the basic communication needs of roughly 8 billion people around the world. At present, contiguous 5G network coverage is being moderately achieved, and 5G VoNR HD calling services have been put into commercial use. And the requirements for multimedia real-time communications services and technologies are closely relevant to network architecture transformation. Thanks to 5G and 5G-Advanced, its large bandwidth and low latency features provide a solid network foundation for the upgrade of HD audio and video communications. As network capabilities are further enhanced, multimedia real-time communications is being consolidated with the features of ultra-HD (UHD), interactivity, immersiveness, and openness.

Existing Voice over LTE (VoLTE) and VoNR networks offer only basic voice and video calling capabilities and are unable to meet the requirements for interactive, real-time communications. Against this backdrop, China Mobile proposed a brand-new VoNR+ network architecture that complies with the IP multimedia subsystem (IMS) data channel technical standards defined by the 3rd Generation Partnership Project (3GPP). This network architecture introduces data channels and intelligent media processing capabilities to provide abundant UHD, interactive, intelligent calling services to users. In addition, with this architecture, network capabilities can be exposed to third-party calling applications, thereby building a multi-dimensional, interactive real-time communications ecosystem.

As an enhancement of VoNR, VoNR+ leverages data channels to achieve real-time data transmission in parallel with voice and video, laying a core network capability foundation for interactive, immersive calling services. The IMS data channel is a core technology that contributes to the real-time communications and service ecosystem of VoNR+. Its technical standards have been formulated by industrial organizations around the world, including 3GPP, Global System for Mobile Communications Association (GSMA), International Telecommunication Union-Telecommunication Standardization Sector (ITU-T), and China Communications Standards Association (CCSA). By combining the real-time communications network architecture and IMS data channel, VoNR+ significantly enhances existing calling capabilities, propelling the innovative convergence between the conventional audio/video capabilities and new media,

Editor | Mei Yaxin <myx@bjxintong.com.cn>

overcoming the barriers of conventional communications models, and ushering in a brand-new omnimedia era of real-time communications between people, between people and things, and between things.

VoNR+ Network Architecture

As illustrated in figure 1, the VoNR+ network architecture consists of a foundation layer, capability layer, service enabling layer, and a unified media plane. Based on the foundation layer, the capability layer provides network capabilities for innovative services developed by operators, third parties, and vertical sectors at the service enabling layer. Furthermore, by leveraging the unified media plane, media capabilities are becoming more flexible and scalable, making it possible to meet the increasingly diversified requirements of multimedia real-time communications services.

● Foundation layer: This layer is the underlying voice network that encompasses basic network elements. It provides functions such as media control, call control, event notification, and protocol adaptation for both conventional voice and video calling services and VoNR+ multimedia real-time communications services.

● Capability layer: In addition to providing basic voice and video calling capabilities, this layer boasts capabilities such as real-time interaction, real-time sharing, and remote control by means of the IMS data channel. In this way, a more diversified user experience can be delivered, for example, with remote operations additionally supported.

● Service enabling layer: By exposing service capabilities, this layer provides orchestration engines, scenario-specific engines, and resource management and scheduling. As such, more vertical industries can use operators' voice and video calling services as well as their data channels. Moreover, this layer serves as a unified service management portal, supporting diversified application ecosystems, such as operators' innovative applications, third-party applications, and industrial applications. This in turn, attracts more industrial partners to participate, maximizing the value of operator networks.

● Unified media plane: As new communications media such as augmented reality (AR) and virtual reality (VR) emerge, the network side must be capable of processing media more flexibly and providing more efficient media routing. The unified media plane is intended to address 5G-Advanced service requirements. In addition to supporting conventional media capabilities such as voice and video calling, announcement playback, and conferencing, this plane is able to transmit AR/VR media elements and file data through the data channel. Furthermore, it provides functions such as

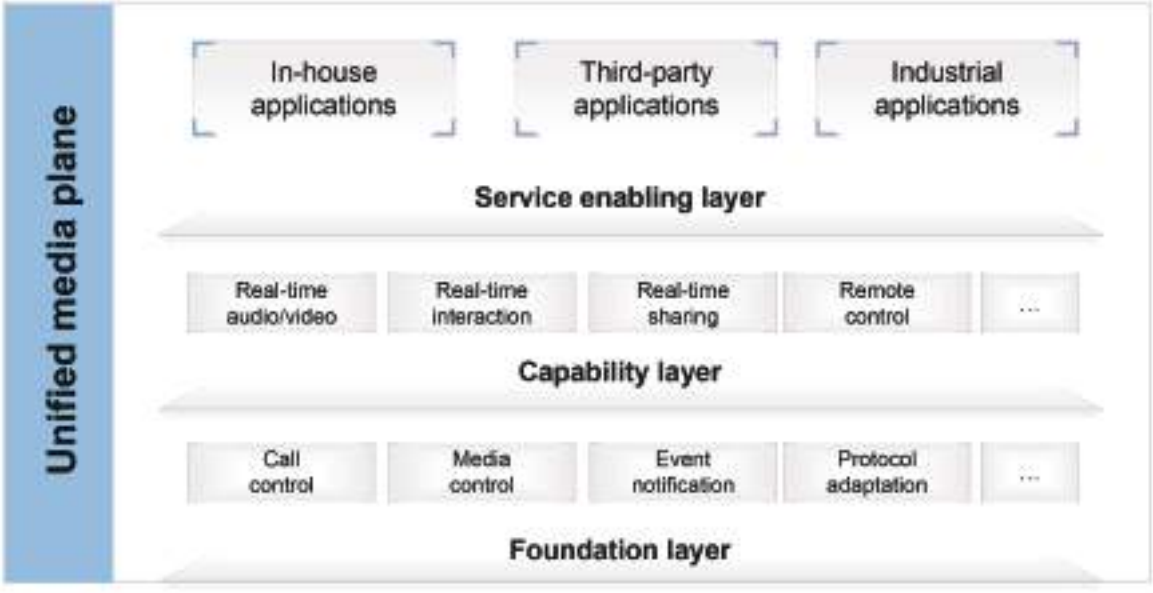


Figure 1 VoNR+ network architecture

Figure 2 IMS data channel

media synthesis, rendering, and unified media management, allowing quick rollout of new VoNR+ services.

Key Technical Capabilities of VoNR+

Unlike the existing voice network architecture, VoNR+ aims at developing operators' voice networks into real-time communications networks that are able to provide on-demand, scalable network capabilities and innovative services. To meet the requirements of interactive calling services, the VoNR+ network architecture has been launched. It upgrades network capabilities and helps operators build a new ecosystem for real-time communications.

Data Channel

3GPP TS 26.114 Release 16 defines WebRTC data channel technical standards, and the 3GPP Release 18 NG_RTC project further formulates the IMS data channel and its key technical standards. The data channel technology and IMS networks are then innovatively combined in a standardized manner.

The innovative IMS data channel is added on top of existing IMS voice and video channels to transmit data of any type in parallel with voice and video information.

As illustrated in figure 2, the IMS data channel is built on the voice networks. Based on native calling capabilities, the VoNR+ network can perform unified authentication, session management, and quality of service (QoS) control.

In addition, by working with the generic web capabilities of terminals, the VoNR+ network can meet the requirements of services that require strong interactions. The IMS data channel can be classified into the following:

- Bootstrap data channel: Terminals obtain application lists and download applications via this channel.

- Application data channel: Terminals transmit application data and exchange dynamic service data in real time via this channel.

Intelligent Media Plane

A VoNR+ network provides a media plane that is separated from the control plane. This media plane provides interactive media capabilities based on video and data channels. It is capable of:

- Data channel access: As an anchor point of data channel media resources, the media plane establishes data channels bound for terminals and exchanges media data with terminals via these channels, as instructed by the control plane.

- Media forwarding: The media plane forwards media streams via voice, video, and data channels between terminals and between terminals and conventional media devices.

- Basic audio and video processing: The media plane provides basic capabilities such as audio and video playback, audio conferencing, and video conferencing.

Editor | MMei Yaxin <myx@bjxintong.com.cn>

● AR media processing: The media plane provides new media capabilities such as AR annotation and AR media rendering on demand to help VoNR+ applications deliver an immersive, true-to-life experience.

● AI processing: The media plane provides functions such as speech recognition, gesture recognition, and speech synthesis.

Service-Oriented Session Control

The VoLTE network adopts the H.248 protocol to control the media plane. This adoption, however, is unable to meet the requirements of new media capabilities. The VoNR+ network innovatively introduces the Hypertext Transfer Protocol Version 2 (HTTP/2) service-oriented architecture at the IMS session media control layer. Under this architecture, the unified media plane negotiates with the control plane through service-oriented media plane interfaces to reserve, create, and forward data channel media resources. This enables media capabilities to be more flexible and scalable, meeting the foreseeable diversified requirements of VoNR+ services in the future.

Outlook and Initiatives

VoNR+ ushers in a brand-new era of multimedia, interactive, real-time communications. It realizes a significant leap from audiovisual communication to full-sensing communication. In terms of standardization practices, China Mobile has preliminarily formed a standardization system — in aspects of service requirements, network architecture, signaling process, and interface protocols — in industry organizations such as 3GPP, GSMA, ITU-T, and CCSA. Additionally, China Mobile has formulated multiple enterprise standards to specify the technical, device, and interface requirements of VoNR+, effectively promoting the industry to reach a consensus and facilitating the implementation of VoNR+ in products.

Since 2022, China Mobile has partnered with telecom companies such as Huawei, ZTE, and Vivo to carry out VoNR+ network pilot verification across multiple provinces in China, and is proactively promoting the commercial use of the first batch of VoNR+ services.

The growth of the VoNR+ industry depends on the maturity of IMS data channel standards and the development of network devices, terminals, and chips. To gather momentum for VoNR+, efforts from all parties in the industry are urgently required, and their collaboration will help continuously enrich multimedia service types, explore business models, and build up an open, cooperative, and robust ecosystem, maximizing network value.

"1+3+N" Based New Calling Enhances Service Innovation and Heralds a New Era for Calling

The advent of 5G brings high bandwidth and low latency, significantly improving network computing power. On this basis, 5G New Calling promotes the transition of voice and video calling to ultra-high-definition (UHD), intelligent, and interactive communication. 5G New Calling fully harnesses the network computing power and bandwidth resources, with the assistance of artificial intelligence (AI) technologies, to open up network capabilities to industries and provide users with universal intelligent communication experiences on operators' global interworking networks.

Chen Haiyong, President of the CS&IMS Domain of Huawei Cloud Core Network Product Line

The communication network has evolved from softswitch to 4G Voice over LTE (VoLTE), improving video capabilities on basic voice networks. In the 5G era, both computing power and bandwidth have been significantly improved, paving the way for the emergence of New Calling services, with enriched multimedia elements and more diverse and immersive calling experiences.

Defining "1+3+N" Architecture for New Calling in the 5G Era

Based on the 5G network architecture, New Calling introduces various forms of multimedia content, builds terminal-network collaboration capabilities, and adds data channels on top of existing voice and video channels on IP multimedia subsystem (IMS) networks, achieving format-agnostic data interaction between terminals and networks.

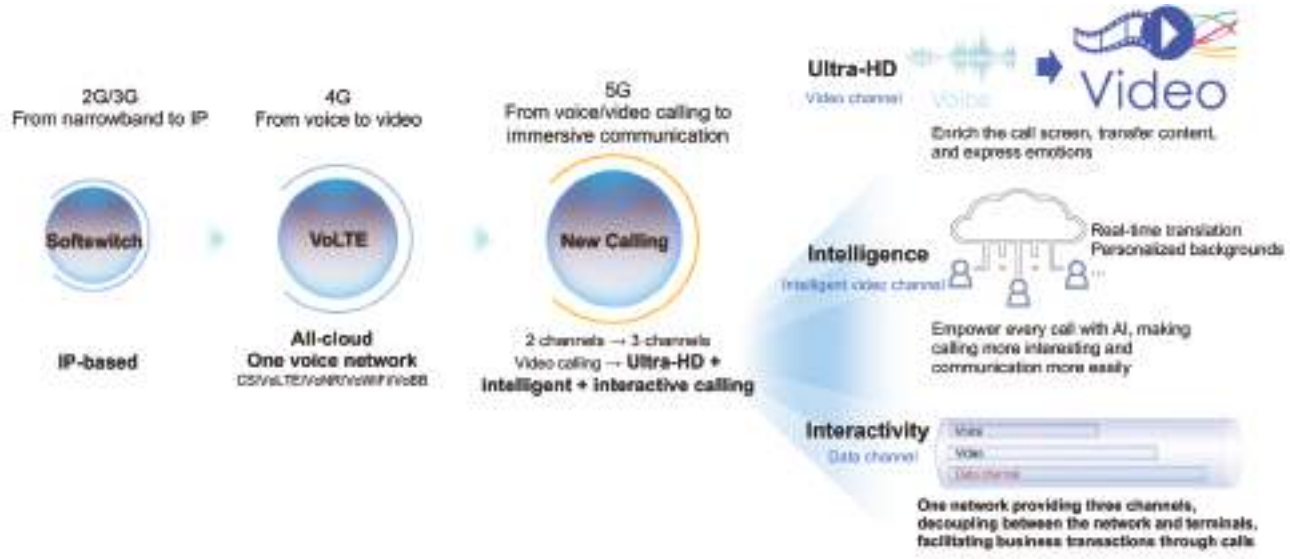
"1+3+N" architecture for New Calling provides voice, video, and data channels based on a fully converged IMS network to implement UHD, intelligent, and interactive capabilities and enable a variety of differentiated innovative services for individuals and industries, thereby elevating users' calling experiences. What's more, the New Calling network will flexibly open up network capabilities for various interaction scenarios in the future, empowering diverse industries and stimulating service innovation.

Enhanced IMS Basic Network

Operator networks differ from over the top (OTT) networks in terms of their dedicated bearers, anytime, anywhere accessibility, and quality of service (QoS) assurance capabilities that lay a foundation for high definition (HD) and low latency in voice, video, and data services. Besides, voice networks are continuously evolving to 5G New Calling networks while the sunsetting of traditional 2G/3G networks. All these combined factors pose challenges to basic voice networks in terms of complexity, reliability, and stability.

Huawei has innovatively proposed the Single Voice Core solution. This solution provides real-time calling services for 2G to 5G and fixed-line subscribers on a simplified and efficient converged core network. The Single Voice

Editor | Mei Yaxin <myx@bjxintong.com.cn>



New Calling leverages one network with three channels

Core solution opens basic network capabilities through application programming interfaces (APIs) for innovative New Calling services, which greatly simplifies network architecture and sustains high service stability and reliability.

Enhanced Media Technologies

New Calling continuously builds capabilities on the media plane in terms of ultra-fast innovation, ultimate performance, and superlative experiences. The New Calling media engine integrates intelligent models and image and video processing algorithms to achieve network-native intelligent in-depth processing. In addition, the New Calling media engine supports graphical processing unit (GPU)/neural network processing unit (NPU) heterogeneous hardware and acceleration capabilities, promoting UHD, intelligent, and interactive media innovation.

- UHD: With enhanced network capabilities, the network side can use adaptive bandwidth prediction and adjustment algorithms to adjust voice and video transmission rates promptly and accurately, improving the voice and video call quality. In the future, supported by AI-assisted codec and image quality enhancement technologies, New Calling will offer users a voice and video experience that far exceeds native VoLTE/Voice over NR (VoNR).

- Intelligent: New Calling introduces AI capabilities to the network side to provide brand-new services such as virtual avatars, background replacement, and real-time translation for various terminals, elevating user experiences on the entire network. In addition, AI computing power is moved from terminals to networks, effectively reducing the power consumption of terminals. Thanks to powerful computing power, networks can implement complex AI functions that terminals are incapable of doing. For example, high-precision background segmentation draws support of model compression methods such as quantization, distillation, and pruning to implement high-concurrency inference, so as to support concurrent calling services on a large scale. Strengthened by enhanced voice and video channels on the network side, New Calling lowers requirements on terminal models and performance, breaks barriers between vertical applications, and provides global users with universal intelligent communication and social experiences.

- Interactive: The New Calling network architecture is overlaid with data channels upon voice and video channels. Therefore, terminals can automatically detect and download New Calling mini programs from the network side and display their content on web pages, achieving terminal-network collaborated data interaction through data channels. Users can set and operate various functions on the New

Calling mini programs. The mini program architecture features outstanding scalability, which greatly enriches calling services.

Capability Openness Architecture Oriented Towards Service Innovation

The New Calling service enabling platform aggregates five types of interactive capabilities, including real-time voice, real-time video, real-time data interaction, real-time extended reality (XR), and real-time AI, on the southbound network. And the platform uses northbound standard APIs to implement capability aggregation, encapsulation, openness, and sharing, enabling various applications to invoke New Calling capabilities and quickly innovate services.

To meet service innovation requirements, New Calling uses brand-new network architecture with networks and services separated. In contrast to traditional siloed service innovation, New Calling can reuse common capabilities for multiple services, which avoids reinventing the wheel. Plus, the New Calling architecture supports high stability and reliability of core network components and varying of service network elements (NEs).

As a breakthrough in the calling industry, New Calling has been positioned as an ecosystem-oriented platform product since its inception. It enables operators to transition their business model from traditional voice operations to video and content operations, heralding a new dawn for the calling industry.

Developing service and content ecosystems is the key to success of New Calling. For individuals, New Calling can provide better and richer content, improving their calling experiences. For example, drawing on AI Generated Content (AIGC), New Calling can enable users to create virtual avatars during video calls, so as to protect privacy while expressing their personalities. For industry, New Calling opens up network capabilities to enterprises, such as for finance and insurance, transportation and logistics, and call centers, to stimulate industry application innovation and improve calling efficiency, ultimately achieving lower costs and higher efficiency.

New Calling introduces diversified content sources, such as partner-generated content (PGC), user-generated content (UGC), and AIGC, through standard northbound open APIs, enriching the New Calling content ecosystem. Additionally, New Calling, assisted by AI capabilities, creates native super computing power and media technologies on the network side to achieve better content processing effects. New Calling mini programs are provided to enable terminals to display a variety of excellent content and allow users to personalize content, perform interactions, and express their personalities, aiming to streamline end-to-end content operations.

Leveraging Technologies for Networks to Continuously Evolve to 5.5G/6G

The 5G era is bringing about technological change. For instance, AIGC for generating text, sound, image, and video is maturing, as well as Generative Pre-trained Transformer 4 (GPT-4) representing natural language models. General-purpose AI is gradually becoming a reality. The development of new technologies will effectively reduce the costs of digital character applications and improve immersive user experiences.

New Calling technologies will continue to evolve in the future. Innovative services such as digital characters and digital assistants will be added to communications between people, achieving a transition from voice and video communications to digital character communications and then multi-model communications. Furthermore, speech-to-text conversion will be provided to convert voice, digital characters, expressions, and body actions to text. All of these new technologies such as AI and XR will make full use of powerful computing power, ultra-high bandwidth, and ultra-low latency of networks, to greatly improve the communication experience and efficiency. Supported by these new technologies, New Calling will allow users to break down communication barriers and benefit from technology advancements, ultimately ushering in a new era for calling.

Editor | Mei Yaxin <myx@bjxintong.com.cn>

AI Creates Innovations in Basic Calling Services, Making New Calling a Must-Have for 5G Users

iFLYTEK has developed seven core capabilities with its cognitive model SparkDesk. With such powerful capabilities at the core, iFLYTEK provides intelligent assistants during 5G New Calling, setting a benchmark for the use of upper-layer innovative applications to empower basic calling services. This helps make the cognitive model a must-have for 5G.

Liu Pingping, General Manager of the New Calling Product Line, iFLYTEK

Over the past four years since the commercial launch of 5G, China has made remarkable strides in information and communications technologies, breathing new life into the entire industry chain. Meanwhile, China's major operators have invested heavily in 5G development. According to the proposal of the Development Planning of the Information and Telecommunications Industry under the 14th Five-Year Plan issued by the Ministry of Industry and Information Technology of China, the number of 5G base stations covering every ten thousand people is expected to increase to 26 in 2025, which will be three times the current number.

In contrast, the majority of users are still trying to figure out what 5G can do for them, unaware of its full potential. It is worth noting that users' habits have not significantly changed compared with those in the 4G era and consequently, 5G networks are not fully utilized under such limited demand. One of the key reasons for this is that 5G upper-layer applications are not thriving. This requires breakthroughs by innovating must-have 5G applications.

AI Enables Barrier-free Communication

iFLYTEK entered the communications field at the early stage of its development and established strategic partnerships with China's three major telecoms operators. Over the years, iFLYTEK has carried out in-depth cooperation with these operators in fields such as smart home, rural construction, smart cloud network, and smart communications.

In May 2021, extreme weather hit the ultramarathon that was being held in Baiyin city, Gansu, China, leading to death of some runners, including a severely hearing-impaired runner. It later turned out that the runner who was hard of hearing could not even use his phone to seek help. This incident aroused iFLYTEK's profound thinking. iFLYTEK actively contacted the China Disabled Persons' Federation and started research on the daily communication habits and requirements of people with disabilities in order to design products that can assist them in daily communication.

Among the various requirements, video calling with sign language stood out and naturally became the most urgent and complex one to develop. People with severe hearing impairments rely on sign language for communication, but most of their social contacts, including family members, friends, and service institution personnel, usually do not have a good command of sign language. So, how can we help them communicate smoothly during video calls? AI is the answer. Specifically, AI-empowered technologies recognize the sign language used by the hearing impaired as text, and then convert the text into voice and play it to those with normal hearing during a conversation. When the person with normal hearing speaks, the voice is converted into text and presented to the hearing impaired on their device.

The above process takes calling to an entirely new level, making it more than just a simple two-way conversation. AI can also be introduced to process multiple types of information such as voice, video, and text. This discovery unveils the possibilities of the products originally designed for people with disabilities. Such products can be used for every individual by leveraging the elements that are ignored or taken for granted.

Owning to its rich technology and experience, iFLYTEK released a number of communications applications, such as live subtitling, dialect conversion, and multilingual translation. It also worked with China Disabled Persons' Federation and the three major telecoms operators to launch the Accessibility Intelligent Communications Partner Program in January 2022. During the Beijing 2022 Winter Paralympics, iFLYTEK, together with China Mobile and Huawei, launched 5G New Calling, which further facilitated scientific and technological innovation in the communications industry.

5G New Calling Delivers Better Calling Services

Integrating AI into 5G communications networks is inevitable because it helps users enjoy convenient services brought by innovative AI applications with just one smartphone. Such convergence and innovation can also bring new opportunities for the communications industry. This also tallies with China's new infrastructure plan.

To achieve this goal, iFLYTEK has built a "product+system+ecosystem" application matrix to explore more 5G New Calling services.

First, iFLYTEK introduces various AI technologies to make more applications available to 5G users. After all, the more 5G applications, the more the users will stick to the applications. From "barrier-relieved" to "barrier-free", iFLYTEK has developed applications including speech-to-text conversion, and multi-language and multi-dialect translation, bridged the communication gap for individuals and enterprises by providing information services and

Editor | Mei Yaxin <myx@bjxintong.com.cn>

industry applications, as well as improved user experiences by developing social applications such as voice-controlled emojis, voice-controlled gift giving, and voice-based gaming.

Second, iFLYTEK has accumulated experiences in software and hardware products concerning translation, education, and office. On the grounds of these experiences, it keeps delving into practical products that are favorable for users. For example, when people from different cultures communicate through a video call with Smart Translator, a single word, if not translated properly, may bring misunderstandings. Since Smart Translator is deemed as generative AI that may not be 100% accurate, semantic AI emerges and is applied into the Smart Translator. With this technology, the word that confuses the listener will be captured precisely and highlighted, prompting the speaker to change it. This innovation makes a huge difference when making video calls using Smart Translator.

On top of that, iFLYTEK remains enthusiastic to the application portfolios of New Calling. As global operators have launched varied value-added services, application portfolios drive the upgrade and iteration of value-added services relevant to calling, making it even more feasible for users. For example, when a user misses a call, the portfolio of "Miss Call Alert (MCA)+Communication Assistant (CA)" enables the user to receive an alert message and call back right away with innovative New Calling features, such as real-time transcription and fun calling.

The aforementioned applications and portfolios in 5G New Calling are mainly innovations in software. iFLYTEK has been exploring innovations in hardware as well. At the beginning of 2023, iFLYTEK and China Mobile Internet debuted a call with New Calling services enabled between the iFLYTEK Dual-Screen Translator and mobile phone. Furthermore, iFLYTEK is exploring the application of auto transcription into iFLYBUDS, further enriching the ecosystem of New Calling and diversifying the communications service industry.

SparkDesk Empowers New Calling

After the various breakthroughs in artificial general intelligence (AGI) at the end of 2022, 5G applications such as New Calling took advantage of this new technology and now have greater impetus to move forward. To respond AGI, iFLYTEK launched SparkDesk in May this year, showcasing seven key capabilities, including text generation, language understanding, knowledge Q&A, logical reasoning, math, coding, and multi-model input. With the assistance of 1+N product strategy (one universal cognitive intelligence model and N industry dedicated models), SparkDesk has been applied to education, office, cars, digital employees, and much more.

Specifically, SparkDesk turbocharges 5G New Calling in two aspects.

One is human-human dialog. Underpinned by SparkDesk, 5G New Calling can automatically generate dialog minutes and extract a to-do list based on the call content, reducing the work after a typical business call. SparkDesk also serves as an intelligent assistant during calls. It can present laws and regulations during a business conversation, recommend travel destinations and restaurants during a small chat, or remind users to bring an umbrella, making all these minor but frequent decision-makings easier and more efficient.

The other is human-machine dialog. Leveraging the capability of processing dialog text, SparkDesk can function as an intelligent secretary to answer calls, analyze the call content, and extract the caller's intent, helping users quickly catch the key points of a call. What's more, SparkDesk can guide users' next move based on dialog content. In particular, when a user receives a travel marketing call, SparkDesk determines whether it is fitting and provides even more options, opening up more opportunities for intelligent services.

With spouting intelligence, SparkDesk is right at hand to give answers. The key of New Calling lies in "dialog", that is, "chat", which happens to be one of the application scenarios of the large language model. SparkDesk will continue to enable 5G New Calling applications, further boosting it as a must-have in daily life.

IVAS: Newest Versatile 3D Voice and Audio Codec for 5G

The IVAS codec is capable of low-delay coding and rendering for voice and audio, and can be used for stereo or immersive voice and audio communication on a 5G network.

Wang Zhe, Media Standards and Codec Department at Huawei 2012 Lab

Shortly after the standardization of enhanced voice services (EVS) in September 2017, the 3GPP SA4 committee launched a program to develop Intelligent and Integrated Voice Value Added Service (IVAS), a 3D video and audio codec standard operating at multiple modes and multiple bitrates. After almost six years of development, the program's codec was selected by SA4 in August 2023 during the SA4#125 meeting in Goteborg, Sweden. This paper provides a high-level overview of the selected codec technology and some of its targeted services.

IVAS Codec

The IVAS codec is a framework for low-delay speech and audio coding and rendering targeting services with interactive stereo or immersive audio communication. It comprises an encoder, a decoder, a renderer and several auxiliary functions associated with the support of stereo and immersive audio formats beyond EVS mono coding. The IVAS meets all of the technical requirements outlined by 3GPP.

The IVAS codec is an extension of the 3GPP EVS codec; it provides full and bit exact EVS codec functionality for mono speech/audio signal input.

Encoding and decoding of stereo and immersive audio formats such as multi-channel audio, scene-based audio (Ambisonics), metadata-assisted spatial audio (MASA), object-based audio (ISM).

Voice activity detection/discontinuous transmission/comfort noise generation for rate efficient stereo and immersive conversational voice transmissions.

Error concealment mechanisms to combat the effects of transmission errors and lost packets. Jitter buffer management is also provided.

The IVAS codec operates on 20-ms audio frames. In addition, rendering is possible with 5-ms granularity.

Support for bit rate switching upon command.

Stereo and immersive audio coding at the following discrete bit rates [kbit/s]: 13.2, 16.4, 24.4, 32, 48, 64, 80, 96, 128, 160, 192, 256, 384, and 512.

The input signals of the IVAS codec are audio signals such as mono, stereo, objects, multichannel, ambisonics, MASA, combination of objects and MASA or the combination of objects and SBA. In the case of objects or MASA, metadata

Editor | Mei Yaxin <myx@bjxintong.com.cn>

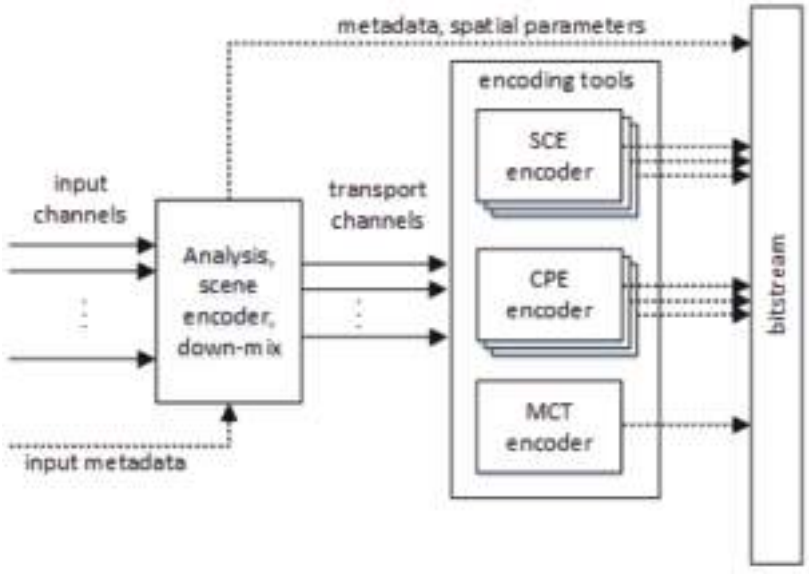


Figure 1 Encoder data flow from input data to IVAS bitstream

also needs to be entered. The encoder analyzes the scene, derives the spatial audio parameters, and downmixes the input channels into transport channels which are subsequently processed by the encoding tools. These tools comprise Single Channel Elements (SCE comprising one core coder), Channel Pair Elements (CPE comprising two core-coders), and Multichannel Coding Tool (MCT comprising a joint coding of multiple core-coders) while core-coder is inherited from the EVS codec with additional flexibility and variable bitrate. The data flows for IVAS encoding is as shown in Figure 1.

The decoder of IVAS codec processes the received bitstream and outputs the audio channels in one of the following formats: mono, stereo, objects, multichannel, FOA, HOA2, HOA3, loudspeaker rendering, binaural rendering, binaural rendering with a room effect. The data flows for IVAS decoding is as shown in Figure 2.

Typical Services that IVAS Codec Enables

Thanks to its low delay characteristic, IVAS codec will enable interactive/ conversational services with an immersive user experience that has not been offered until now. The following are two examples.

One is immersive audio call with experience sharing.A speech/audio call is established between two participants, A and B using IVAS in mono EVS mode; During the call, participant A with immersive audio capture capability wishes to share the experience (atmosphere/ambience) with participant B; Through simple configuration adjustments, a spatial sound scene is transmitted from participant A to participant B, and the reconstructed audio scene is provided to the participant B, enriching their call experience.

Another is immersive remote class or conference. The immersive and focused remote class/conference participation scenario is preferable to have for the following functions: multiple participants connected with various devices; stereo/ multiple channel rendering or binaural rendering; 3 degrees of freedom (DoF) speaker/presenter(s), which can only change orientation in a virtual classroom, the position being fixed; 6DoF speaker/presenter, able to change both position and orientation in the virtual classroom.

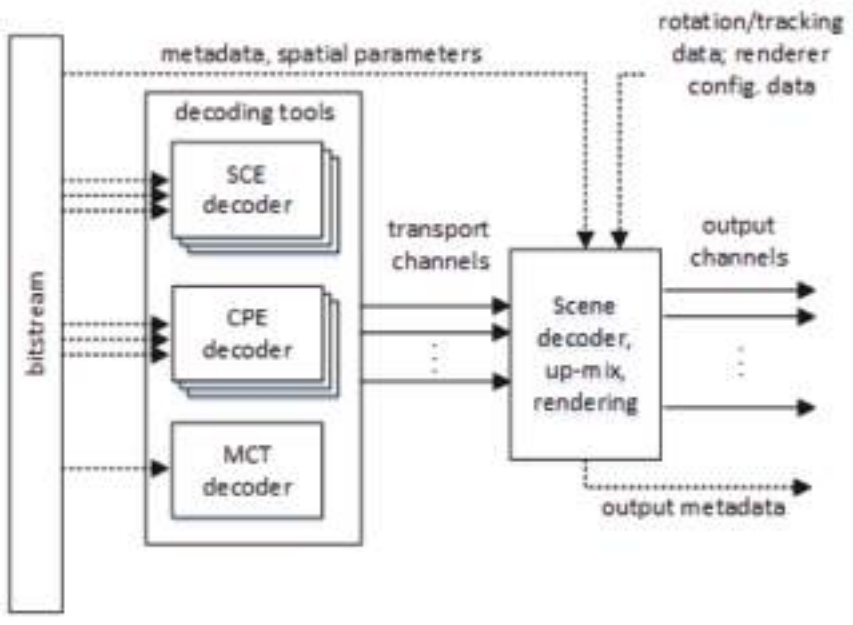


Figure 2 Decoder data flow from IVAS bit stream to output data

In this usage scenario, a teacher/presenter and one or more students/participants may move freely in the physical environment, but the students/participants can only interact as 3DoF speakers with predefined positions in the virtual classroom. These predefined positions in a virtual classroom are similar to the seats in a physical classroom, which is arranged by the teacher/presenter. Although students/participants can choose the positions they want to sit in the class/conference-room, they are unable to move to different positions once the class/conference begins. A teacher/presenter may interact as a 6DoF speaker moving within the boundaries of the virtual class-/conference-room. The usage scenario aims to enhance the immersion of the remote class/conference and improve the students/participants' attention and interest in learning/participation for a certain long time period.

IVAS Codec Features and Future Plan

With its multi-mode operation plus the support of multiple bitrates for each mode, the voice/audio quality delivered by IVAS covers a wide range and is subject to characterization tests that must be performed before IVAS standard is ratified.

In general, with higher operating bitrates, the voice/audio qualities tend to be transparent or close to it; while in the mid-range bitrates, optimal and balanced operations are achieved; and even under severe and demanding network conditions minimum service qualities are maintained with low bitrates.

By September 2023, the higher-level committee of 3GPP SA approved the selection of IVAS codec by SA4 for it to be official. By Q4 2023, SA4 will prepare the characterization tests and work on the specifications of the IVAS codec standard. By Q1 2024, SA4 needs to finish the fixed-point code development of the selected IVAS codec, and launch the characterization tests. SA4 then requires SA to approve some of the relevant specifications. By Q2 2024, SA4 and SA will then need to approve the characterization test results, and the rest of the complete specification set which will mark the completion of the IVAS codec standard development.

Editor | Zhen Qinglan <zhenqinglan@bjxintong.com.cn>

Zain Kuwait Forges the Path for Voice Communication Evolution

As one of the leading telecom operators in the MENA region, Zain Kuwait has always been at the forefront of innovation. It is one of the first operators globally to launch 5G Voice over NR (VoNR) services. In 2023, Zain Kuwait proposed a proof of concept (PoC) plan for 5G New Calling, aiming to be the first operator to realize 5G New Calling services in Middle East.

Zain, Kuwait

Phone calls are the most common type of communication method between individuals in Kuwait, despite today's technological advances. Time and time again, mobile network operators' voice business has proven to be both indispensable and of unique social value. And with 5G New Calling, connections offered by Zain Kuwait will become faster, providing more intelligent and advanced capabilities, increasing efficiency and opening up more business opportunities.

Zain Kuwait Is One of the First Operators Globally to Launch 5G VoNR Services

As one of the leading telecom operators in the MENA region, Zain Kuwait has always been at the forefront of innovation. Zain is also the first operator to launch commercial 5G Standalone (SA) services in Middle East. In 5G era, SA is recognized as future-oriented, since only by SA technology, the 5G network could reach its full potential by creating a unique ecosystem for applications that harness both fast speeds and low latency. Zain's 5G development leads the Kuwait telecom market, and its business success is the result of its overall strategic objective to provide first-class 5G services for users in Kuwait.

In 2022, Zain Kuwait announced the launch of voice and video over 5G services. This makes Zain the first telecom operator globally to launch Voice over 5G (Vo5G) and Video over NR (ViNR) services with nationwide coverage. Services were promoted with top of the line Samsung phones and activated with no additional charge, on a par with Zain's brand of service innovation, customer dedication and value promotion.

There are three main values for launching VoNR services.

Simultaneous voice calls and 5G data services. If there is no VoNR under 5G SA, when users make a phone call, the UE will initiate an Evolved Packet System Fallback (EPS FB) to fall back to Long Term Evolution (LTE) networks to use Voice over LTE (VoLTE) services. EPS FB is only a transitional voice solution from VoLTE to VoNR.

Improved voice quality with high-definition plus (HD+). Since VoNR introduced enhanced voice services (EVS) as its default codec, the voice quality is significantly improved.

Improved video calling quality. Since ViNR introduced H.265 as its default video codec, the video call quality is significantly improved.

Zain Kuwait launched voice and video over 5G services

The revolutionary voice and video technology gave Zain's users an unparalleled experience. It allows them to enjoy voice calls and ultra-fast 5G data services simultaneously, improving video and voice quality with HD+ by using compatible smartphones. After extensive testing in order to assess the readiness of its network, Zain has commercially launched this service with the objective to operate at the highest level.

Zain Kuwait Shines the Spotlight on the Middle East by Introducing Transformative 5G New Calling Services

Since Zain Kuwait always focuses on innovative communication product development, after their commercial launch of VoNR services, Zain made another choice to select 5G New Calling as the next target. And in 2023, Zain Kuwait proposed a PoC plan for 5G New Calling, aiming to be the first operator to realize 5G New Calling services in Middle East.

5G New Calling is an enhanced communication service that integrates ultra HD video calling, intelligent calling, and interactive calling capabilities into traditional phone call services. This service can be operated and controlled by telecom operators and provides capability interfaces to third-party industrial companies, which will help operators benefit from both consumer and business markets.

In order to better cooperate with GSMA and other operators, Zain Kuwait joined the 5G New Calling project in the GSMA Foundry, and will lead the innovative technology development of 5G New Calling.

There are several steps to evolve to 5G New Calling networks. In 2023, Zain will launch the first phase that includes deploying new network elements and utilizing existing video call capability that supports VoLTE and VoNR type of devices, so as to benefit a wide range of people who are using smartphones that support video calls. 5G New Calling services will significantly upgrade users' services and then enrich their experiences.

Zain Kuwait's New Calling PoC includes the following three use cases, and all of them are included in the first phase of 5G New Calling.

Intelligent Translation

Kuwait welcomes tourists from all over the world. The country has a population of around 4.5 million, while the

Editor | Zhen Qinglan <zhenqinglan@bjxintong.com.cn>

GSMA Foundry — Real-Time Translation

number of international tourists can be nearly double that. In 2019 alone, the country received 8.5 million visitors, speaking over 20 different languages. Considering such a diverse range of visitors, this has posed a strong demand for translation services for tourists visiting Kuwait. In line with the New Kuwait 2035 Vision, aiming to repurpose, modernize, and redevelop the existing tourism facilities to provide new world-class experiences for visitors, Kuwait Zain proposes the Intelligent Translation service for tourists visiting Kuwait. When a visitor calls the local service departments for help, language barriers will no longer exist with the help of Intelligent Translation.

Visible Menu

The Visible Menu service can greatly improve service efficiency for business users such as small and medium enterprise (SME) call-centers in Kuwait. Currently, after a call is established, the user has to go through outdated interactive voice response systems and go through the inconvenience of managing different languages and a complex navigation tree. With Visible Menu, all the service options can be visualized on the screen, and users can access the services via a simple touch, thus saving on time and increasing satisfaction. In Kuwait, Visible Menu will perfectly address the requirements of numerous business users, for example, banking services, utility services, and travel agencies.

Lighting Up Screen

Kuwait has a predominantly young population: as of June 2022, the percentage of those aged 24 years and under constitutes about 51.8%. Lighting Up Screen gives the opportunity for the new generation to show their personality during a voice call. They can configure personal avatars for themselves, or even provide personalized animations. For companies, commercial advertisements can be provided during service calls to showcase their business.

Mentioned services will encourage users' communication behaviors to evolve from voice calling to video calling, while offering new opportunities for application developers to benefit from telecommunication's open capabilities. Third-party companies and developers could provide an enormous amount of new innovative and creative services running on top of Kuwait Zain's New Calling platform, bringing in more capabilities to enrich users' communication experiences.

VoNR and 5G New Calling are not only positive but also meaningful choices for Kuwait Zain. In conclusion, Kuwait's consumers, businesses, and the Middle East's telecom industry are poised to benefit greatly from Zain Kuwait's investment into new voice technologies.

Strengthening New Calling for a Bright Future in the 5G Era

China Telecom is committed to building an open, beneficial, and collaborative 5G New Calling ecosystem and promoting the construction of the New Calling service platform. We will improve the design of the overall network and the service operations system. At well-planned phases, we will propel New Calling to reach its maturity and push forward the sustainable development of the calling industry.

Zhou Wenjun, General Manager of the Value-added Service Operation Center at China Telecom

Behind the technological revolution taking place all around the world, 5G is without a doubt one of the key drivers. Accelerating rapidly with one technological breakthrough after another, 5G continues to add impetus to the growth and innovation of mobile communications services, with New Calling being a noticeable product born out of this. New Calling not only provides the basic calling services required by every individual user and enterprise, fulfilling the core duties of operators; but also successfully transforms the calling experience to a multi-media, visualized, and interactive one by providing augmented services and applications such as ultra-high-definition (UHD) calling, real-time translation, fun calling, intelligent customer services, and remote assistance. All of the above functions have turned many heads, including almost all global industry stakeholders, as they recognized this chance to stake their claim on the calling market.

New Calling brings industry players together. Thanks to their joint efforts, New Calling has been well promoted in terms of technical standards, network construction, and service development. We believe that as more and more industry chain vendors and ecosystem partners come in, we can take New Calling to new heights together, further advancing the way people live and work.

Broad Prospect of New Calling

As one of the important applications in the 5G era, New Calling is expected to chart new waters in the blue ocean of both the enterprise and individual markets.

Leveraging cutting-edge 5G network technologies, New Calling can facilitate communications and collaboration inside enterprises, significantly improving work efficiency. In addition, New Calling can help transform enterprises' service models and the way in which enterprises are linked to their customers. With abundant types of services, such as remote conferencing, collaborative office, video customer service, and intelligent marketing, New Calling can provide enterprises with more convenient, satisfactory communication experiences, helping them strengthen their competitiveness.

For individuals, New Calling unlocks a more intelligent and convenient way of communicating. With its UHD video calling services, individuals can talk with their families and friends face to face anytime, anywhere, enjoying a seamless, immersive communication experience. And the experience can even be further enriched via the combination of calling and front-edge technologies, such as artificial intelligence (AI), multilingual translation, and augmented reality (AR).

Editor | Zhen Qinglan <zhenqinglan@bjxintong.com.cn>

Fast-Tracking the Development of New Calling

As a main force for building China into a network power and digital nation and a pioneer for maintaining national cybersecurity, China Telecom has invested significant resources into implementing its Cloudification & Digital Transformation strategy, as well as accelerating 5G network construction and upgrading the telecom service infrastructure. As early as 2022, China Telecom had beta-tested the first batch of service capabilities for New Calling in Jiangsu province.

In addition to extensive practices, China Telecom is also committed to standardizing the implementation of New Calling. Apart from continuously polishing our standards for terminals, networks, and platforms, we also proactively participate in the formulation of national, international, and industry standards initiated by industry organizations such as the China Communications Standards Association (CCSA), 3rd Generation Partnership Project (3GPP), and Global System for Mobile Communications Association (GSMA). This paves the way for promoting New Calling services.

In the future, China Telecom will continue to strengthen the New Calling service platform, optimize overall network planning, and improve the service operations system, so as to provide stable, high-quality services to users and develop the New Calling services at well-planned steps.

Building a Sustainable New Calling Ecosystem Through Wide Collaboration

To build a sustainable New Calling industry, operators around the world must team up, and work closely with other industry stakeholders, including platform organizations and particularly chipset and terminal vendors. Here we call on all industry parties to join hands, to push the terminal capabilities to grow and better adapt to New Calling services. We also hope that more partners can join us to inject new vitality for the New Calling industry to thrive.

China Telecom is focused on building an open, beneficial, and collaborative New Calling ecosystem. Through resource sharing and open cooperation, China Telecom hopes to elevate network construction, technological research, and application innovation to new levels together with industry partners, propelling the healthy development of services and the industry of New Calling.

China Telecom also attaches great importance to the concerted coordination and standards alignment among different parties in the industry chain. Specifically, we will focus on the following aspects:

Unifying industry standards: China Telecom will work with industry partners to further standardize network upgrades, platform construction, and service development, with the aim to align service capabilities among different industry players and deliver a consistent user experience.

Clarifying terminal capability requirements: China Telecom will continue being engaged in establishing a comprehensive terminal certification system that encompasses terminal capability specifications, application running environment standards, and unified third-party developer interfaces, accelerating the development of the terminal industry chain and laying a solid foundation for the prosperity of the New Calling ecosystem.

Strengthening and interconnecting operators' platforms: China Telecom will continue to upgrade the capabilities of the network infrastructure, expand network coverage, and further improve the interworking among platforms of different operators, so as to provide a smoother service experience to New Calling users.

Advancing application innovation: China Telecom will further delve into and extract users' requirements for New Calling, and expedite the development of new products, new models, and new capabilities to cater to these requirements, continuously contributing to the stable development of China's digital economy.

China Telecom believes that only through industry collaboration, can we push New Calling to go faster and reach further. We are willing to join forces with all industry partners to promote a consensus, address challenges, and grow together. Together, let's map out the future of New Calling.

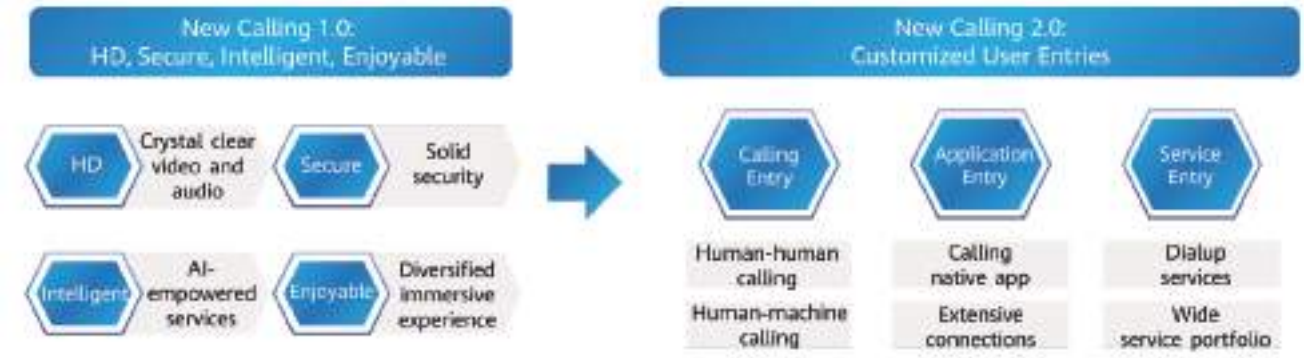
New Calling: Building a New Ecosystem and Setting Sail for a New Blue Ocean

Booming communications technologies fuel continuous transformation of calling services. With the development of 5G, communications are no longer restricted between humans. Convergent communications link humans, and also humans and machines in all scenarios. In years to come, we'll witness how metaverse communications will lead us into a new era of unprecedented immersive communications. Communications will continue to expand and develop indefinitely.

Jia Zhiqiang, Chang Jian, Ma Baojun, Cao Xun, China Unicom Online Information Technology Co., Ltd.

From primitive symbols in ancient times to highly developed digital communications today, information transmission has always been an important part of human civilization. The increasing demands on sharing knowledge, exchanging ideas, and conveying feelings drive humans to create a variety of tools and technologies to break communication barriers and achieve more effective information transmission.

Editor | Zhen Qinglan <zhenqinglan@bjxintong.com.cn>



China Unicom Leads 5G New Calling 1.0 to 2.0

Innovation Is Mandatory for Communications

In the past century, communication methods have undergone evolutionary changes along with the rapid development of science and technology. From audio and video calling, intelligent communications, to human-machine and metaverse communications, communications continue to bring new service experience to users.

Audio calling: Audio calling is the starting point of modern communications. When telephones were invented, people were surprised to hear their friends' voice from afar without being able to physically see them. Audio calling breaks through space limitations and makes information exchange fast and simple.

Video calling: Video calling is more than simple transmission of voice. Compared with audio calling, it provides a more intuitive way of communication. Users can not only hear each other, but also see each other's expressions and backgrounds, making the communication more authentic and vivid.

Intelligent calling: Artificial intelligence (AI) technologies bring more possibilities to communications, improving communication efficiency and quality, providing people with more convenient, diversified, and immersive communication experiences. For instance, AI-empowered intelligent voice assistant and real-time translation services facilitate communication between users from different countries and with distinct cultural backgrounds.

Human-machine calling: Nowadays, all things are connected, and communications are no longer restricted between humans. Convergent communications link humans, and also humans and machines in all scenarios. This brand-new multi-dimensional communications model expands our communication scope and brings an unprecedented convenient and intelligent experience.

Metaverse communications: In the future, metaverse communications will usher us into an immersive virtual world that merges digital and physical entities. In this world, users can cross physical distances and interact with each other as if they were in the same place.

China Unicom Leads 5G New Calling 1.0 to 2.0

The wide application of 5G technologies gradually broadens the possibilities of future life. Especially when 5G technologies are combined with AI and extended reality (XR), communication boundaries are further expanded.

In 2022, China Unicom developed the network as a service (NaaS) architecture dedicated for New Calling and launched 5G New Calling 1.0. 5G New Calling 1.0 comprises eight applications that are characterized as high definition (HD), secure, intelligent, and enjoyable.

One year later, China Unicom upgraded 5G New Calling 1.0 to 2.0. 5G New Calling 2.0 leverages operator-specific Electronic Program Guide (EPG) as an entry to connect humans and machines.

Novel Communications Concept

5G New Calling 2.0 proposes a brand-new communications

concept. Without 5G New Calling 2.0, the dial pads of all users are rigid and basically the same. 5G New Calling 2.0 allows users to customize their own dial pads to access diverse services. In addition, 5G New Calling 2.0 integrates multiple interaction modes, including visualized interaction, screen touch interaction, and voice interaction, making communication simpler, more convenient, and more user-friendly.

Connecting Humans and Machines

Future communications are not limited to human-to-human, but extensively available between humans and machines, such as cameras, smart speakers, smart households, and vehicles. By simply dialing several digits on their phones, users can access their desired applications or services, greatly improving communication efficiency.

Communication as a Service

5G New Calling 2.0 breaks through traditional communications concepts and combines communications technologies with life services to build a brand-new and highly integrated communications ecosystem. Users only need to use their dial pads to access services such as video customer service, intelligent surveillance, video conference, shopping express, food ordering express, and live broadcast.

These innovations bring great convenience to users' daily life. For example, when a user wants to purchase a product but has doubts about it, the user can directly obtain an instant answer through the video customer service. Similarly, when the user is out and wants to monitor the situation at home, the intelligent surveillance system can provide real-time information. Shopping and food ordering provide users with a one-stop shopping and food ordering experience. This communication model will also bring huge opportunities for enterprises. Enterprises can interact with customers more effectively and provide more user-friendly and accurate services.

5G New Calling greatly improves user experience and opens up a brand-new development trend for communications technologies to support more user-friendly and intelligent services.

Evolving to Metaverse Communication

China Unicom has conducted in-depth research on the metaverse platform and has preliminarily integrated metaverse and 5G New Calling 2.0. By leveraging metaverse communications, users can enter a virtual conference room during a call or take a city walk in the metaverse world.

The initial phase of 5G New Calling 2.0 consists of six functions: Video Call, Channel, Surveillance, Mall, Vlog, and Metaverse. These functions enable video calling in all scenarios, brand-new interaction modes, and one-click metaverse space, reinterpreting the essence of New Calling 1.0.

In this highly interconnected era, rapid information transmission has become an engine that drives socioeconomic development, inspiring people to continuously seek new ways to break through communication barriers and achieve wider and far-reaching communication and connections. From audio and video calls to metaverse communications, communications development is not only a technological advancement, but also represents the progression of society. We can expect that with the continuous innovation of technologies, communication methods will become more diversified, intelligent, and immersive, bringing more possibilities and surprises.

Editor | Zhen Qinglan <zhenqinglan@bjxintong.com.cn>

From Voice-Only Calling to Interactive Communications, New Calling Heralds a New Dawn for the Calling Industry

China Broadnet actively participated in the construction of the world's largest co-developed and shared 5G network, and released a white paper on 5G New Calling, aiming to establish a brand-new convergent multimedia service platform and transform voice-only calling into interactive communications. By promoting the implementation of 5G New Calling and service innovation, China Broadnet will continue to provide users with superlative calling experiences.

Li Shuang, Deputy Director of the Technology Department of China Broadnet

Thanks to the co-construction and sharing pattern, China Broadnet built the world's largest 5G network covering 31 provinces in China in the past year. This 5G network leverages one cloud and is constructed in an intensive manner, which contributes to rapid service innovation, efficient operations, and centralized O&M.

Constructing a Decent 5G Network to Bolster Rapid Service Innovation

In terms of service innovation, each province can develop their own distinctive services, and these services can be replicated virally across the nation once they are rolled out. Plus, the service rollout process is manageable and controllable on the centralized cloud. As regards to efficient operations, the co-construction and sharing pattern allows the network to use unified standards and products, which helps improve operations efficiency and stimulates rapid user development. With centralized O&M, the scattered provincial networks can be maintained in a unified manner, and concerted efforts can be made on service innovation.

As 5G continues its meteoric rise, a plethora of smart terminals are emerging, and intelligence technologies such as Generative Pre-trained Transformer (GPT) are also advancing exponentially. Real-time communications, as a core offering of operators, will be endowed with the abilities to converge a wide range of services and create new value in new service scenarios.

China Broadnet places technological innovation as a key component of its business strategy. Pillared by the flexible network capabilities, China Broadnet scales up its efforts to promote cutting-edge 5G technologies. At the early stage of 5G network deployment in 2022, China Broadnet had released the ultra-high definition (UHD) video calling service, providing users with superior calling experiences. Based on video calling, value-added multimedia services, such as video ringback tones, are

being developed. In China, there are 1.5 billion video ringback tones played each day.

Today, calling continues to remain the most reliable communication method and has great potential to grow into a mobile multimedia operations platform. Imagine if images, videos, and other types of data information can be transferred during calls, users can do much more beyond simple communications. For instance, they can show their avatars and receive multimedia content, such as advertisements, public welfare publicity videos, and even call-related auxiliary information. In this way, the call screen turns into a convergent multimedia service platform, and data of any type can be transferred in parallel with voice and video during calls. It is without question that this type of call transformation can bring tremendous economic and social value.

Building a 5G New Calling Platform to Shift the Business Model from Voice-Only to Content Operations

In order to upgrade the business model from traditional communication capability operations to content and application operations and offer differentiated 5G services to users, China Broadnet, together with industry partners, built a 5G New Calling platform.

In terms of network architecture, China Broadnet overlaid data channels upon the existing Voice over LTE (VoLTE) and Voice over NR (VoNR) networks. By combining interaction capabilities with techniques such as intelligence and extended reality (XR), China Broadnet built a New Calling service enabling platform to enable interactive, immersive communications and fast service innovation.

In terms of service scenarios, China Broadnet designed an array of New Calling services for both individuals and enterprises, including avatar-based video calling, intelligent translation, fun video calling, intelligent customer support, and digital characters. Take intelligent translation as an example. This service provides speech-to-text conversion in addition to language translation, which allows hearing-impaired individuals to break down communication barriers and benefit from technology advancements, adding significant social value.

Another example is digital characters. With digital characters, users can create virtual avatars that represent themselves and can even mimic their facial expressions. During calls, users can present the avatars to the other party to express their personalities. This will further consolidate calling services, attract more users, and bring new business value.

By introducing data channels, 5G New Calling combines IMS-based real-time communications with data applications and leverages terminal capabilities such as cameras and sensors to enable a brand-new mobile Internet service model for operators. Based on intelligence capabilities and augmented reality (AR)/ virtual reality (VR) techniques, 5G New Calling also empowers remote assistance to help users reduce communication costs. By interworking with third-party applications, the 5G New Calling platform can be developed into a new ecosystem similar to those formed by mobile Internet apps and mini programs. This will give rise to considerable business opportunities and help operators transition their business model from traditional communication capability operations to content and application operations.

To build a sound New Calling ecosystem, operators need to open the platform capabilities to developers and industry partners so that they can explore more new service scenarios, enrich digital content, upgrade user experiences, and unlock the full market potential. China Broadnet will make constant efforts to build a brand-new convergent multimedia service platform and transform calling from voice-only to interactive communications.

Accelerating the Implementation of 5G New Calling and Promoting Industry Prosperity

China Broadnet has positioned 5G New Calling as a unique 5G service and aims to turn calling into a platform product. During the World Telecommunication and Information

Editor | Zhen Qinglan <zhenqinglan@bjxintong.com.cn>

Society Day (WTISD) this year, China Broadnet and industry partners released a white paper on 5G New Calling. Drawing on the latest industry development progress, this white paper describes the market value, standards system, network architecture, deployment solution, and terminal requirements of 5G New Calling and provides guidance on how to develop high-quality 5G New Calling services. It also calls for industry partners to create more service scenarios and promote the industry development.

Figure 1 China Broadnet's Xu Da making the first call using 5G New Calling during MWC Shanghai 2023

To accelerate the implementation of 5G New Calling, China Broadnet, together with Huawei and other industry partners, started 5G New Calling trials in April this year. At MWC Shanghai 2023, Xu Da, China Broadnet's 5G Chief Strategy Officer, and Jiang Long, Secretary and Chairman of Jiangsu Broadcasting Cable Information Network Corporation Limited (JSCN), made the first call using 5G New Calling on June 28. New features such as gesture- and voice-controlled emojis were seen for the first time, demonstrating the powerful real-time interaction capability of 5G New Calling (as shown in Figure 1). In addition, at the New Calling exhibition booth, users invited by China Broadnet experienced a wide range of New Calling service functions, such as avatar-based video calling, intelligent translation, and fun video calling, elevating calling services to a whole new stage. JSCN plans to launch and beta-test a full series of New Calling services before the end of the year. With these innovative services, JSCN will transform its voice-only calling services into a communication product that offers strong interaction capabilities.

The sustainable development of 5G New Calling requires concerted efforts of the entire industry chain. China Broadnet hopes that industry partners can pull together and build a solid industry ecosystem encompassing everything from the standards system to terminal APIs and northbound platform APIs.

In terms of the standards system, it is expected that standards and industry organizations such as 3GPP, GSMA, and China Communications Standards Association (CCSA) can promote the standardization of the architecture, interfaces, and service flows of 5G New Calling and unify the international and industry standards for interworking between 5G New Calling services of different operators.

In terms of terminal APIs, GSMA is aiming to launch open-source projects to standardize terminal APIs, attract developers from various fields to develop 5G New Calling mini programs, and continuously promote service innovation.

In terms of northbound platform APIs, standards organizations and projects such as 3GPP and CAMARA are hoped to unify northbound platform APIs, ensuring that enterprise customers can build 5G New Calling network capabilities into their own service flows, so as to improve service efficiency and upgrade service experiences.

Additionally, the prosperity of the 5G New Calling ecosystem requires support of terminal and chip vendors. China Broadnet will collaborate with concerned parties to commercialize terminals that natively support 5G New Calling on a large scale. The development of 5G New Calling requires the joint efforts of all parties in the industry chain. With more partners working together to build a sound 5G New Calling ecosystem, more new services can be developed, ultimately achieving greater shared success.

5G New Calling Empowers an Intelligent Asian Games, Opening a New Era of Communications

The Zhejiang Branch of China Mobile (China Mobile Zhejiang) works with Huawei and industry partners to provide innovative 5G New Calling services such as real-time translation, fun video calling, and auto transcription. These services bring brand-new experiences to users, enable a technology-driven intelligent Asian Games, and open a new world of possibilities for communication.

Tang Xin, Deputy General Manager of Market Operation Dept., China Mobile Zhejiang

In today's world, more and more digitally savvy users are seeking new ways to express themselves. Such a trend is also being reflected in the calling industry. The success of the video ringback tone service shows that a large number of individual users are willing to pay for personalized content that better expresses themselves.

Calling Services Need to Evolve Continuously to Satisfy Users' Ever-changing Demands

As for enterprise users, a myriad of businesses today still opt for conventional voice calling services to reach consumers, which hinders efficient information sharing and interaction. Moreover, conventional voice calling has been dwarfed by advanced communication technology and cannot help enterprises reduce costs and improve efficiency.

Under this context, China Mobile Zhejiang posed the following questions: How can we satisfy the increasing user requirements? In particular, as operators roll out 5G and continue to move ahead towards 5.5G, what are some of the ways to enhance user experience through the ever-advancing technologies?

Building a Benchmark for the 5G New Calling Industry and Enhancing User Loyalty

In recent years, China Mobile Zhejiang has pioneered high-quality development, advancing 5G development, and building a digital intelligent society. 5G New Calling has emerged thanks to the development of 5G and has been added to China Mobile's "8+5" user experience strategy, in order to help breathe new air into the calling experience and raise brand awareness.

Together with Huawei and other industry partners, China Mobile Zhejiang has launched multiple new services based on 5G New Calling, such as real-time translation, fun video calling, and auto transcription, bringing new communication experiences to users. In addition, China Mobile Zhejiang has gradually deployed strategies for product design, marketing, and user development of 5G New Calling and plans to commercialize and further popularize it.

China Mobile Zhejiang has also taken the lead in verifying the end-to-end network architecture and service scenarios for 5G New Calling. Specifically, China Mobile Zhejiang and Huawei formulated the service test specifications, overall

Editor | Zhen Qinglan <zhenqinglan@bjxintong.com.cn>

Figure 1 Remote maintenance

technical requirements, as well as the specifications for the Voice over NR (VoNR)+ capability NEs, the VoNR+ media plane, and the Voice over LTE (VoLTE) multimedia telephony service (MMTel) platform. Adhering to the principle of "successful service use and optimal user experience", they jointly completed tests in nearly 300 scenarios, and have solved 10 problems affecting the service experience and made 5 major technical improvements throughout the process.

At the beginning of 2023, China Mobile Zhejiang initiated an experience activity, inviting users to experience innovative 5G New Calling services while collecting feedback for further improvement.

Delivering More Appealing and Useful Calling Services to Individual Users

For individual users, China Mobile Zhejiang will provide diverse services including fun video calling and real-time translation. By delivering more interesting and useful video calling services with more powerful and intelligent audio and video processing capabilities on the network side, such services will enhance the loyalty of voice service users and create new value.

Fun video calling: It enables callers to use virtual images to try on different outfits, which is achieved by synthesizing video streams on the network side. Users can also use gesture and voice commands to add fun facial expressions generated by the system to convey their emotions. For example, parents can use virtual images and funny expressions to engage with their kids while on a video call. Another option is for friends or partners to send cute images and facial expressions to display their emotions.

Real-time translation: This function can be used to take over a translation device. With real-time translation, a user can talk via video with another user who speaks a different language, and what they say will be recognized, translated, and displayed on the device screen.

Speech-to-text conversion: This feature can perform speech-to-text conversion and closed captioning during the call using a large font, facilitating communication for the elderly or hard of hearing individuals.

Auto transcription: This service can provide a transcript of the call and save it to text format. It is of great help for business people, so that any key point will not be missed.

Helping Industry Users Enhance Communication Efficiency with 5G New Calling

For industry users, China Mobile Zhejiang leverages its technological advantages through the IMS Data Channel, to offer them visible and interactive 5G New Calling services. After obtaining trusted certification from operators, government and enterprise customers can customize services on the 5G New Calling platform based on the atomic communication capabilities provided by the operator. They can integrate different 5G New

Figure 2 Chinese-Korean real-time translation

Calling services to their service system, such as video conferencing, visual menus, and remote augmented reality (AR) assistance. In this way, they can better connect to their customers through the calling process, which will greatly enhance service efficiency.

For instance, 5G New Calling remote AR assistance (as shown in Figure 1) can be used for home broadband maintenance. A user with a broadband issue can communicate with a service engineer through a VoLTE/VoNR-based video call. The engineer can mark the device and failure point and instruct the user to rectify the issue based on the object tracking and AR marking feature. This function offers a much more efficient option for network maintenance, compared with simply voice/video calling and traditional appointment and door-to-door service processes.

5G New Calling Empowers Intelligent and Technology-driven Asian Games

The 19th Asian Games was held in Hangzhou, Zhejiang from September 23 to October 8, 2023. In preparation for one of Asia's biggest sports events, China Mobile Zhejiang launched the Asian Games version of 5G New Calling services in May 2023, offering multiple innovative features such as real-time translation and fun video calling. It has also introduced Asian Games elements to these features, and will bring brand 5G New Calling experiences for this event.

In September 2023, this unique Asian Games version of 5G New Calling services were made available to all China Mobile users. As a gift to the upcoming sports event, 5G New Calling services will offer all users in Zhejiang province as well as national and international visitors a novel communication experience, through which they can feel the allure of the intelligent and technology-driven Asian Games.

The real-time translation feature crafted for the Asian Games (as shown in Figure 2) supports translation between multiple major languages such as English, Korean, Japanese, Russian, Arabic, and Chinese. This aids in bridging the linguistic gap, facilitating barrier-free communication between visitors who speak different languages, and promoting international cultural exchanges.

China Mobile Zhejiang also introduced an Asia Games version for fun video calling. This allows users to enjoy sports-related fun during video calls and experience the passion of the Asian Games. For instance, during a video call, a user can summon the Asian Games mascots - Chenchen, Congcong, and Lianlian, by using specific keywords. Saying "Come on, Asian Games!" will display the image of the mascot Congcong onto the screen, making the call more engaging and playful.

5G New Calling: Ushering in a New Era of Communication

As a cornerstone of next-generation communication solutions, 5G New Calling is experiencing rapid growth, which hinges on the technological and business efforts of all parties in the entire industry chain. China Mobile Zhejiang will continuously collaborate with industry chain partners on the commercial design and user experience of intelligent video calling, contributing more to a robust and prosperous ecosystem.

As the interactive video calling ecosystem matures, China Mobile Zhejiang will gradually transform 5G New Calling into a comprehensive information service product serving tens of millions of users. Through these innovative calling capabilities, we hope to reshape the market and empower a wide range of industries with extensive communication capabilities.

We also hope to join efforts with more partners, to promote the upgrade of calling services, to construct and refine the industry ecosystem, to tap into the new value of voice services, and to usher in a new era of communication.

Editor | Sun Tian <suntian@bjxintong.com.cn>

New Calling Underpins Industry Digitalization and Makes Remote Claim Settlement More Efficient

As a leading automobile insurance information service provider in China, Jingyou Technology has joined hands with Huawei to integrate 5G New Calling into the insurance service process. The cooperation model solves numerous problems during claim settlement, such as difficult traffic-driving for insurance companies, excessive operation steps for customers, and unstable video calling quality. This enables more customers to enjoy rapid and efficient claim settlement services.

Feng Han, Executive Director of Jingyou Technology

Communication capabilities have played an important role in a variety of industries for decades, affecting many areas of people's lives and work, and also playing an irreplaceable role in conventional industry sectors such as automobile insurance. With the gradual development of communication capabilities, the service mode, level, and quality of the automobile insurance industry have undergone tremendous changes.

Innovative Applications and Multiple Automobile Insurance Patents

As 3G/4G and smart mobile terminals proliferate, automobile insurance claims are handled on mobile devices instead of on paper with cameras on site, facilitating claim settlement for customers and significantly reducing insurance companies' costs. The prevalence of mini programs and the capabilities of audio and video communication bring customers a novel claim settlement experience in a new online claim settlement mode with zero contact with insurance personnel. In addition, this new mode realized significant social value during the COVID-19 pandemic, reaching another milestone for settling claims.

Founded in 1993, Jingyou Technology is dedicated to enterprise-level intelligent application services. Through in-depth research on technologies such as big data, cloud computing, and AI, Jingyou Technology provides comprehensive information technology solutions for insurance, automobile, and government and other related

industries. As a national high-tech enterprise with specialized services, refined management, characterized technique, and high innovation content, Jingyou Technology actively invests in the application of products and innovative technologies. Jingyou currently owns more than 50 patents for automobile insurance-related system products and more than 400 software copyrights. The company has also been certified by the ISO 9001 quality management system, ISO20000 information technology service management system, ISO27001 information security management system, CMMI3 (capability maturity model integration), and China's level-3 information security protection. Jingyou Technology operates services with data and information security at the highest standard, maintains the trust of customers and partners, adheres to the spirit of dedication, innovation, and professional services, and wins recognition from customers.

Since its inception, Jingyou Technology has helped more than 40 insurance companies implement the digital transformation of claim settlement management and nearly 30 of those insurance companies have already achieved online transformation of claim settlement services, by virtue of their more than 20 years of accumulation of claim settlement, services, and data advantages. Now, Jingyou has become one of the leaders in the wave of insurtech development.

5G Video Claim Settlement Based on New Calling

Due to the continuous development of services, the current online claim settlement service can no longer meet the rapid growth of requirements for online service and customer experience. The insurance companies have encountered bottlenecks in terms of traffic-driving mode, service carrier, and the online processing of services.

The launch of the 5G New Calling solution implements the native Voice over LTE (VoLTE)/ Voice over NR (VoNR) video capability of mobile phones and solves numerous problems during claim settlement, such as difficult traffic-driving, excessive operation steps for customers, and unstable video calling quality.

Based on 5G New Calling, Jingyou Technology and Huawei jointly present the 5G video claim settlement service.

When a vehicle owner reports an accident by phone, the communication channel can be switched to a video call. The vehicle owner and customer service personnel can quickly reach a consensus on the accident and severity in a timely manner, improving claim settlement efficiency and saving the vehicle owner's time.

The 5G video claim settlement service introduces a large number of leading technologies to the original platform, supports rich communication capabilities, and significantly improves customer experience. To be specific, the 5G video claim settlement service supports a variety of functions, including:

Face-to-face calls, multi-party calls, and video business cards; AI capabilities for service innovation (AR marking, graphic guidance, and real-time subtitles); enhanced video quality (1280 x 720 HD real-time video calling and dedicated low-bit-rate image quality enhancement); image super-resolution (2560 x 1440); real-time low-light enhancement (detail restoration in dark regions without overexposure or noise); network adaptation, dynamic FIR/PLI, and weak network defense capabilities (up to 80% packet loss tolerance for voice services and 30% packet loss tolerance for video services); real-time voice quality inspection, intent recognition, and emotion recognition; content review in the video compression domain (better service compliance and more efficient and ultimate customer experience); availability on mainstream mobile phone models in the market and in-depth interconnection with the three major operators in 31 provinces in China to reach customers with one click.

Optimal Online Customer Experience

The 5G video claim settlement service eliminates multiple operation steps and provides one-click access, which is more stable, reliable, and user-friendly, compared with conventional video claim settlement. It is built for online claim settlement and provides optimal customer experience.

Easier to use: Just like making a call on a mobile phone, the service is on the way just after a one-click access. There is no need to download any app, open any mini program, or add friends.

Editor | Sun Tian <suntian@bjxintong.com.cn>

More stable communication: The network transmission rate is faster, and there is almost no waiting for call connection. The end-to-end millisecond-level network delay provides ultra-HD video calls. The stable network transmission ensures no interruption for incoming calls and more stable video call quality.

Better compatibility: Both 5G mobile phone users and 4G mobile phone users can enjoy the convenience of this service.

After the 5G video claim settlement service was launched, it has shortened the time from accident reporting to the first video connection establishment. That is, it has shortened the time for contacting customers, adding WeCom, and opening mini programs.

Customer service personnel can make video calls directly to customers without complex operations, improving the service experience.

In the original video claim settlement mode, when customer service personnel call customers through fixed-line phones and guide customers to make video calls, most customers complain that they do not know how to operate it and require an onsite survey instead. After the 5G video claim settlement service is used, customer service personnel can make outgoing calls on computers instead of fixed-line phones. Ongoing video calls will not be interrupted by incoming voice calls. This greatly improves the call completion rate and service stability.

Compared with the conventional methods, customer service personnel are more willing to make 5G video calls. The video connection success rate initiated by the 5G video claim settlement service is 13.29% higher than that in the non-5G methods. After the 5G video claim settlement service was piloted in an insurance company for one month, it had completed a total of 3890 video claim settlement cases, with a penetration rate of 71%.

The 5G video claim settlement service also greatly shortens the video connection establishment duration. The average video connection establishment duration from case reporting to the first successful establishment is shortened to 1/3 of the original time.

In the future, Jingyou Technology will take AI+5G communication as a link to make full use of its advantages in technology and application implementation, promote digital technology innovation, boost a new technology revolution, and improve 5G video image quality and cross-platform compatibility through AI applications. By doing so, Jingyou Technology is committed to bringing customers more valuable products, offering customers ultimate services, and composing a better technological future with its customers.

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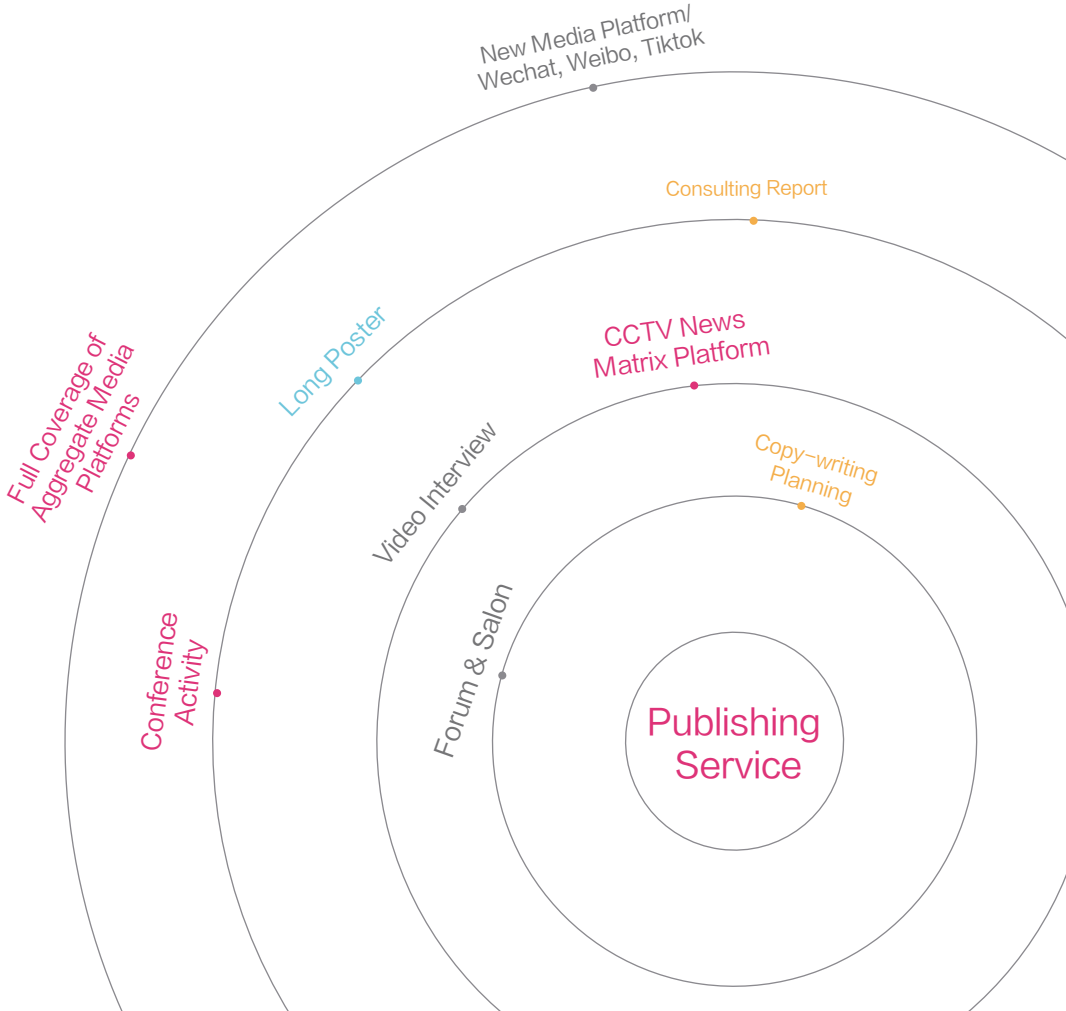

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