Remonetizing Voice with Next-Generation 5G Voice and Video Services

GlobalData Perspective on 5G New Calling

China unicom中国联通 ZTE

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Executive Summary

Mobile network operators (MNOs) are undergoing an unavoidable transition from circuit-switched voice to 4G VoLTE and 5G VoNR. While over-the-top (OTT) voice competition and regulatory requirements have made it very hard for MNOs to grow voice revenues, this network refresh coincides with 5G New Calling, which uses bonded data and video channels to create services that rival OTT applications in features and can beat them in quality of experience.

New Calling is based on IP Multimedia System (IMS) and the recently introduced IMS data channel. IMS is the longstanding multimedia framework that underlies VoLTE and VoNR, so it is technology that is already in every MNO's network.

The IMS data channel can be invoked when a voice/video call connection is made between two or more parties. The data channel is designed to support bonding of channels; this feature opens the door to a wide range of rich communications services. Voice call participants can use the data channel to share documents and screen content, execute avatars and provide augmented reality (AR) content. The bandwidth of the IMS data channel scales with the spectrum that is made available to the 5G dataflow, which can create significant advantages for high-bandwidth applications like augmented reality (AR) and virtual reality (VR).

5G New Calling will be the beginning of truly innovative, multimedia audio and video calling services that will work with artificial intelligence (AI) including conversational AI, AR/VR, avatars, and Internet of Things (IoT) telemetry. 5G New Calling has gone live in China and Singapore. Early feedback in China is very promising as a platform to embed voice and video capabilities in a wide range of industry use cases. 5G New Calling will generate a plethora of new use cases in consumer and business and many of these will be fused with AI functionality such as pattern recognition and conversational AI.

The Unavoidable Transition to VoLTE/VoNR

Mobile network operators (MNOs) are going through an inescapable voice network transition: All have either moved from circuit-switched (CS) voice to VoLTE/VoNR or will soon. This is inevitable due to CS networks going End of Life (EoL), the need to refarm CS spectrum to serve 4G and 5G bandwidth demands, and the greater efficiency of modern networks. Fortunately, this unavoidable capex coincides with new opportunities for voice monetization.

Since over-the-top voice, video, and messaging became popular, voice networks have not represented a revenue opportunity: current data plans offer more than enough data to cover the average volume of OTT voice calling. Due to the regulated nature of the mobile cellular business, however, MNOs must comply with emergency voice calling and geographic and/or population coverage requirements that are mandated in their licenses. This situation leaves them with higher costs than OTT voice, yet no appreciably greater revenue.

Voice on cellular mobile networks has evolved through two generations from 2G/3G circuit-switched calling to 4G Voice over LTE (VoLTE), and is now embarking on the third generation, Voice over New Radio (VoNR). The GSMA Intelligence forecasts that 70% of mobile voice connections will use either VoLTE and/or VoNR (Voice over New Radio) by 2030. As more and more 2G and/or 3G networks are shut down across the globe, and as 5G rollouts continue at a steady pace, VoLTE/VoNR coverage and adoption and coverage will also continue to expand accordingly.

Mobile Network Operators (MNOs) are at different stages of their network refresh with most having built out significant geographic and population coverage with their 4G LTE network. Most MNOs have now implemented Voice over LTE (VoLTE). For those MNOs that have implemented 5G Standalone (SA) they can move to Voice over New Radio (VoNR) and market the benefits of new added functionality, improved reliability, and better call quality, the latter made possible by new audio codecs that provide better clarity and fidelity.

2.1 IMS will continue as the Foundation for Voice and Video Services

Both VoLTE and VoNR rely on the IP Multimedia System (IMS) platform, which underpins 4G's Evolved Packet Core as well as the 5G Core. This common foundation means that money spent on VoLTE-based services is also partially an investment in 5G VoNR services.

IMS is a 3rd Generation Partnership Project (3GPP) reference architecture that was developed with the first 4G LTE specifications in 2009 with the goal of ensuring global interoperability and scalability of voice and video communication services built on the Internet Protocol (IP).

What makes IMS so attractive, especially in the 5G era, is that it can support a wide range of voice and video calling communications services including new, innovative and immersive services that can capitalize on the new technologies of AI and AR. IMS provides the following benefits:

- **Unified Communications Infrastructure**. Used by both VoLTE and VoNR which means it is a common, unified communications infrastructure for both LTE and 5G NR.
- **Cloud Deployment**. Can be implemented in the cloud and thus can support hypervisors and lightweight containers providing more dynamic applications.
- **Carrier-Grade**. Provides carrier-grade quality of service and reliability.
- **Internetworking between diverse devices.** Enables secure communications between diverse devices across diverse networks.
- **Roaming.** Delivers seamless, uninterrupted roaming.
- **Interface to Media Gateways.** Can be used for interfacing to Signaling Gateway (SGW) for fixed line SS7 connectivity, supports the Media Gateway Control Function (MGCF) for interoperability with the PSTN, and interfaces to the Media Resource Functions (MRF) which provides media-related services such as the playing of tones and digital announcements.
- **Single-number Solutions**. With IMS it is possible to create single-number solutions with support beyond smartphones such as smart watches, smart speakers, and multiple SIM/ eSIMs on the same device.
- **Anti-Fraud/Anti-Spam**. Prevention of nuisance and fraudulent calls can be carried out with IMS.
- **Converged Fixed/Mobile Access.** IMS can be used to build converged mobile and fixed access networks

It is the interoperability of IMS that enables operators to realize converged fixed and mobile networks and for voice/video calls to be connected between different operators even if they might be using different communication protocols.

2.2 The IMS Data Channel Is the Next Generation of Multimedia Communications

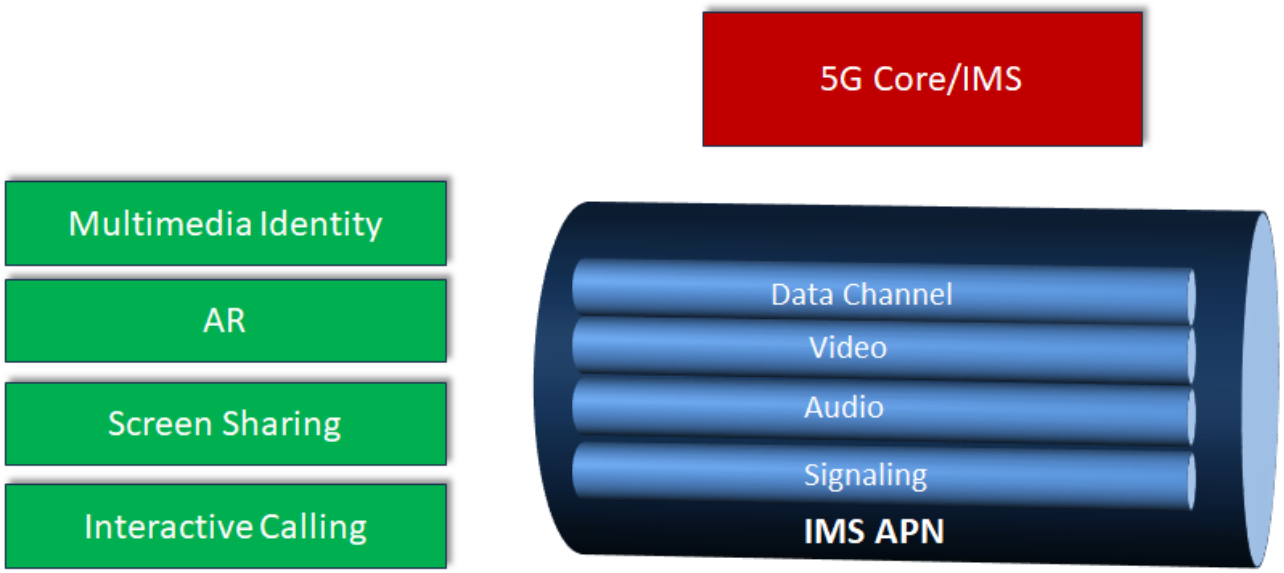
In late 2020, as part of 5G Release 16, the 3GPP added a powerful new feature called the IMS data channel. This data channel can be bonded with the voice channel and a video channel, delivering a variety of data and/or video services in sync with the voice channel. This enables integration with the native dialler, the ability to initiate multimedia services via a voice call, and to provide real-time services like automatic translation and transactions.

The additional capacity that the data channel offers means that AR and video will be able to be delivered with higher quality and fidelity in 5G implementations, but it will also be available in 4G implementations, albeit with higher latency and lower bandwidth. Thus, for MNOs that are still in

the early stages of their 5G roll-out, the data channel can be made available to 4G end users to do things like share screen content and watch video clips.

The data channel can be used in parallel with other media types such as audio and video in the Multimedia Telephone (MMTel) service (See Appendix for more details on the architecture of IMS). It does not require content to be formatted in a specific way, since it uses the WebRTC data channel protocol stack as specified by the World Wide Web (W3C) and in the Internet Engineering Task Force (IETF). The IMS data channel enables callers to share applications during voice calls, a feature that is potentially more powerful and advanced than OTT voice/video calling. When two users connect using a standard phone call under IMS, the IMS data channel can be invoked to share applications even if one party has not downloaded the application. This is a powerful feature that opens up the possibilities to unlimited number of B2B and B2C use; at the same time, the data channel creates opportunities for branding and marketing initiatives.

Figure 1: IMS Data Channel enables new B2B and B2C services



Source: 3GPP, GSMA 2021

5G New Calling Was Designed to Monetize This Refresh

3.1 What is 5G New Calling?

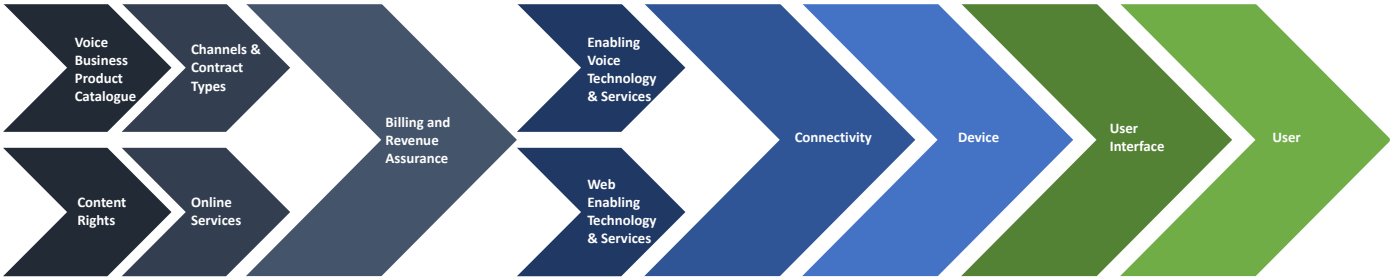
5G New Calling provides unprecedented capabilities for multimedia communications based on the IMS data channel in Rel-16 combined with enhanced video communications. MNOs that do not have the 5G Core or RAN deployed can start to offer New Calling via VoLTE using LTE's spectrum and bandwidth.

Since the IMS data channel first appeared in the 3GPP standards process, operators have been experimenting with using it to enable new services. The earliest activity was in China, where MNOs implemented the 5G core and VoNR early on. As momentum increased, the GSMA and MNOs from around the world founded a New Calling track of the GSMA foundry in March 2023. The Foundry helps MNOs share best practices and new New Calling services to encourage quicker, more widespread adoption.

Data Channel Value Chain

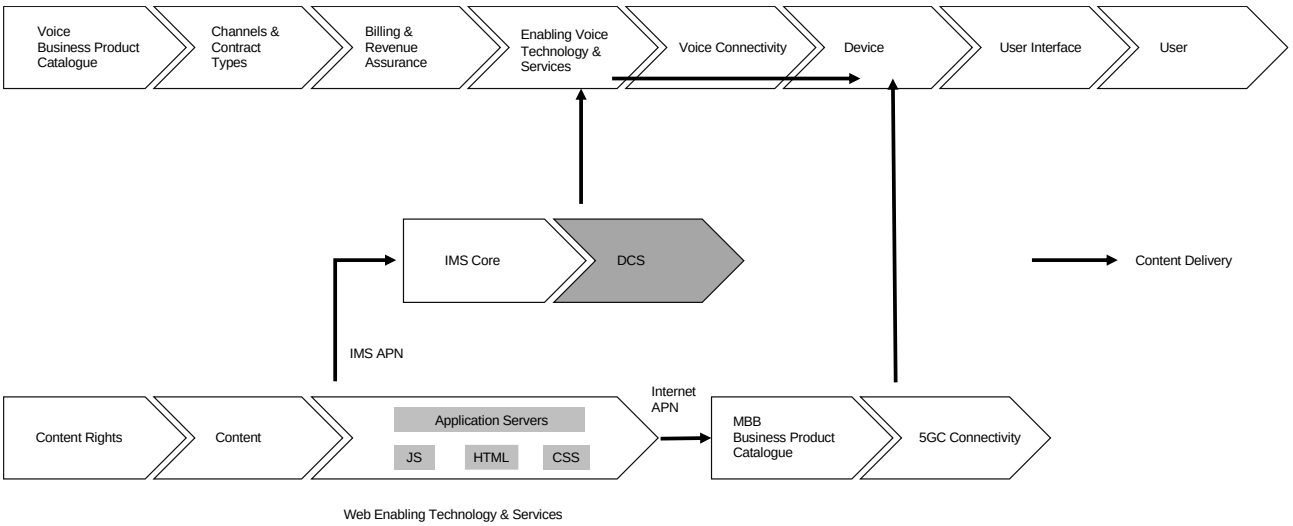
The IMS data channel offers a new content distribution mechanism which MNOs can leverage to sell wholesale to content providers. Figure 2 shows the IMS data channel value chain for businesses, while Figure 3 shows the value chain for MNOs. The key point here is that in the past, prior to the data channel, the provider value chain was based on the ownership of all the content as well as the processes used to deliver voice services. With the data channel, the value chain is extended to include apps and content that are delivered on-demand in real time.

Figure 2: Data Channel value chain for business



Source; GSMA, 2021

Figure 3: IMS data channel value chain for MNOs



Source; GSMA, 2021

According to the GSMA, ecosystem players will include:

- Data channel content owners
- Data channel content creators
- Data channel server providers
- Data channel content delivery
- Intermediaries
- Digital rights management/billing

In many cases, one company will perform more than one role, but to maximize revenue generation, the service chain should be connected by industry standard APIs and straightforward commercial relationships.

Value-added services based on the bonded video channel

The Data Channel Signal Function (DCSF) and new Media Function (MF) were proposed by the GSMA with much of the details left to the vendors to implement as they see fit. The MF executes IMS data channel media operations such as creation and closure of bootstrap data channel(s). These DCSF and MF were proposed by the GSMA. It is possible to enable existing 4G terminals to support some visual and advanced services such as intelligent translation and virtual background services. Long-term 5G, terminals will provide the best bandwidth in the data channel. MNOs that are still largely using VoLTE to provide voice services can get started with New Calling by introducing services built on the video channel as well as simple data channel-based services.

Value-added services based on the bonded data channel

5G New Calling is essentially a native technology that is embedded in the mobile phone without the need to download any application. 5G New Calling supports both VoNR and VoLTE. Terminals that support New Calling can also be used to provide interactive and immersive services such as intelligent customer services and AR.

The benefit to consumers is the emergence of new features such as multi-stream teleconferencing where a user equipment's (UE's) spatial sound can be transmitted to other participants in the call, XR conversational services, virtual avatars, content/screen sharing and other interactive services including voice transcription for people with hearing loss and intelligent translation services for business purposes. AI technology is extensively being used for pattern recognition and machine vision.

3.2 5G New Calling Features

Some of the applications of New Calling that we discuss in this paper could also theoretically be handled by OTT applications. Why, then, should MNOs invest in another layer of infrastructure that competes with capabilities that already exist?

The answer is at least fourfold:

- Not all New Calling use cases can be easily duplicated by over-the-top applications, especially those that involve close integration between data features and the increasing quality of carrier voice.
- The integration of data and video with native handset features like the dialler can create greater quality of experience than OTT applications.
- Implemented properly, New Calling can provide better performance than OTT applications that rely on a best-effort web model. Shorter setup times can get the user to the service more quickly, and the dedicated, bonded data channel can provide lower latency.
- Industry standards for 5G New Calling provide for seamless interoperability, making 5G New Calling globally available for 4G/5G users that are customers of different MNOs.

Taken together, these features can provide MNOs an experience advantage over OTT services that they have not had before.

New Calling requires no device-side client

The IMS data channel enables callers to share applications during voice calls, a feature that is potentially more powerful and advanced than OTT voice/video calling. When two users connect using a standard phone call under IMS, the IMS data channel can be invoked to share applications even if one party has not downloaded the application. The beauty of the data channel is that the more spectrum that is available, the more bandwidth can be allocated to the IMS data channel. For example, as operators add mmWave to their network, the IMS data channel bandwidth can increase proportionally.

This means that bandwidth-intense applications such as Augmented Reality have a path to scale in terms of performance and bandwidth. Multiple data channels can be mapped together or bonded to provide more and more bandwidth. Applications can be stored in the cloud and execution of the applications can also take place in the cloud. Data applications are delivered to the user equipment (UE) terminal using HTML and JavaScript in an open architecture.

End-to-end solutions

End-to-end solutions can integrate with VoLTE/VoNR (New Calling) over IMS, EPC and/or 5G Core. Standalone 5G Core is the future direction to a more advanced suite of potentially new and exciting multimedia services. MNOs and application developers can use the 5G Core NEF (Network Exposure Function) and IMS to integrate or embed VoNR (New Calling) into applications.

Enabling the ecosystem through capability exposure

Programmability of the 5G New Calling service via the NEF and IMS APIs makes it possible for MNOs to introduce new and exciting multimedia services such as screen content sharing, push-to-talk, and bundled services with smart home and broadband connectivity services. With the introduction of the IVAS codec in 3GPP Release 18, it will be possible to go even further with services such as transmitting the 3D spatial sound experience of a participant in a teleconferencing call.

Conversational AI, AR, and avatars

Generative AI based in the cloud can be integrated on a SaaS basis into apps and services. The additional access to bandwidth that the IMS data channel provides will make avatars and embedded AR feasible with 5G New Calling. Conversational AI, AR and avatars can all be combined to create innovative services ranging from real-time translation to animations triggered by the conversation.

The cloud-based nature of New Calling presents an additional advantage for devices with tight form factor and limited battery power such as smart glasses. In this case, New Calling-enabled voice commands could become a defining part of the smart glass experience.

Provision of unified and integrated solutions

Integrated solutions can be built using the 5G Core APIs and the Network Exposure Function, IMS (including the MMTel) APIs, and other application functions.

5G New Calling in Practice

4.1 Consumer versus Business Scenarios

Customer service

Customer service can be enhanced by offering customers visual support on the mobile phone screens. Conversational AI can also be deployed to screen calls and help direct to the next available and suitable service agent.

Business

5G New Calling can enable enterprises to optimize the work process, improve work efficiency, and create higher economic and social benefits through enhanced business features, multimedia calling cards, business shorthand, intelligent translation, and document sharing. 5G New Calling can also be used to develop internal company calling services complete with biometrics.

Customers can call a business to place an order for a product or service, for example, and the menu will be displayed on the user's screen when the call is connected; the customer service hotline can be fully automated but if the business believes they still need to make a human available to answer more complex requests, then a representative button can be displayed on the user's screen. By adding conversational AI to the mix, the service can become very efficient with the AI answering questions. For example, when ordering seasonal seafood, the restaurant might prefer to offer quotes on the spot rather than posting it on a website.

An early example of a New Calling service is automotive assurance: after an accident, a customer can call the insurance company and upload images of the damage from the site as directed by the representative, rather than going through multiple iterations of the process after the fact.

Government Citizen Services

5G New Calling has substantial potential in augmenting citizen services. For example, in cities with a significant migrant population, GenAI-enabled simultaneous translation services can be offered. There are multiple ways to implement such a solution – real-time and semi-real-time. Both callers would be able to select the translation text that appears on their screen. This type of service would also be very handy for taxi cabs, where today the taxi driver sometimes needs to call someone in the radio dispatcher's office to assist in understanding the passenger's requested destination.

Daily Life

Examples of daily consumer services that can impact daily life are detection of scam and fraudulent calls, advanced caller ID, and enhanced cybersecurity. In terms of Caller ID, 5G New Calling will enable a number of features such as caller name or caller logos added by the network to numbers that it knows belong to that caller. Another use case is being able to share information on meeting locations on a map or attaching photos or a video clip showing how to go to the location.

Fun Calls and Gaming

Phone and video calls can be spruced up with virtual avatars and AR features. Multiplayer gaming and online gaming are another class of use cases where 5G New Calling with data channel can be very useful in enhancing the interaction experience.

AR can be introduced into various consumer scenarios. For example, consumer calls can be augmented with XR data, enabling the user to share an app such as ping pong with AR glasses or AR bowling.

Consumers can also call their smart home hub to control IoT devices such as 360-degree surveillance cameras and home robots. In this case the New Calling data channel is used for real-time remote control and visual feedback.

4.2 Target Segments

Consumer

Scam call detection and filtering. 5G New Calling will enable Caller ID that is more informational as described earlier and over time MNOs will also consider offering a verification service to replace the typical message that one receives nowadays when an unknown number calls such as “Suspected suspicious or malicious caller”.

Video calling with AR, Smart Glasses. New Calling via the IMS data channel provides multiple opportunities to integrate with AR and Smart Glasses. The industry is busy enhancing the latest version of Smart Glasses and in several years AR-enabled Smart Glasses will emerge once all the engineering challenges around battery life, heat dissipation along the rim of the glasses and computational capacity are further improved. With Smart Glasses verbal commands can be used to navigate the internet and search for information or even fill out on-line forms.

Bundling with wearables and Smart Glasses. MNOs will have plenty of opportunities to tailor service offering around Smart Glasses and wearable in the future. The New Calling capabilities will make the wearables and Smart Glasses more potent.

Enterprise

Real-time translation. Real-time translation and transcription are services with a lot of pent-up demand in business and in consumer scenarios. In some markets like China today, there are hardware devices that sell for around US$450 that do real-time translation. This is a service that is ideal for the cloud and for 5G New Calling with the data channel.

Contact centers. Contact centers can improve productivity with conversational AI as a front end to handle incoming calls to determine the best person to resolve the inquiry, improving the productivity per seat. Moreover, high quality, reliability and clarity of the voice call in 5G New Calling will be a prerequisite for contact centers.

Automotive. The combination of conversation AI and 5G New Calling has wide potential in connected car scenarios involving navigation, car maintenance and roadside emergency.

Healthcare. Wearables can also be equipped with software that understand keywords for in-home hospital patients, athletes, and first responders. An example might be an emergency call button for patients at home. The emergency call button would provide authentication through face recognition, GPS location and other nearby setting to validate that the emergency call is a genuine call for assistance.

Voice interaction with machinery and remote customer service. Older machines can be retrofitted with advanced voice capabilities. For instance, a production engineer on a factory floor can "talk" to the machines connected in a 5G private network to get status reports or to give instructions to machines. In the early days of VoLTE there was an example often spoken about in the remote parts of Australia where smart meter manufacturers realized that in remote locations it might be hard to technicians to call back to the office for assistance in analyzing a technical problem so what was done was to build VoLTE into the smart meter mother board and thus enable technicians to utilize the "internal" smart meter network to place calls.

Home

Holographic and VR calling. Advanced wearable devices such as Holographic project or VR headsets can be implemented with New Calling and potentially combined with various cloud services. These are premium services but are important to show consumer what the future will look like.

Healthcare. This is an area that has huge potential with the ageing population of many developed countries globally. The ability to ask for a prescription refill, consult with the doctor and so forth will be greatly enhanced with the IMS data channel providing a much better customer experience.

Home Control. In the home setting, it will be possible to integrate appliance control, air conditioning control and other smart home services with New Calling and Voice over WiFi.

4.3 Building the MNO Roadmap: What Capabilities Will be Ready When?

As MNOs build out their roadmap for voice and video calling there are a number of considerations to consider summarized below.

Path to VoNR and 5G Data Channel

VoNR, which requires 5G Standalone, provides advanced codecs superior to the codecs (e.g., AMR-WB, EVS) used in VoLTE. Some 5G New Calling services are also available with VoLTE, for example real-time translation and caller avatars. The 5G Core and RAN will enable much larger amounts of bandwidth that can be used in the data channel, opening the door to AR and advanced video services. 5G MNOs that have been relying exclusively on VoLTE EPS Fallback will be able to move customers over to VoNR and for a few years will need to keep the VoLTE EPS fallback in place until the 5G coverage has reached geographic and population coverage targets. As the 5G SA network coverage matures, MNOs will then be ready to start to offer more 5G New Calling services with the VoNR voice channel.

Timeline for 5G New Calling Enabled Devices

GlobalData expects that devices that support Rel-16 features of IMS will start to be available from 2024. In 2025/26 3GPP Release 18 will go live, and this will introduce the next level-up IVAS codecs.

New and innovative services such as AR during calls generally will need new UE that supports the data channel. For 4G LTE devices which do not support the data channel some applications are still possible such as placing avatars on the screen. In the event the MNO has determined that more bandwidth will lead to more market opportunities the operator can consider deploying mmWave.

IMS and 5G Core Programmability

MNOs will want to understand how to utilize the IMS APIs to assist or direct future integrated application development for both consumer and enterprise services. The MNO might want to consider establishing an internal team or partner with SIs to develop integrated applications that embed 5G New Calling. There is a plethora of potential use cases in the enterprise space ranging from manufacturing, law enforcement, mobile and remote healthcare, automotive, machinery, public transportation, and wholesale transport.

Integrate AI technologies where it can enhance the business performance of specific services

AI technologies including conversational AI can provide critical toolsets to integrate and deliver intelligent voice-enabled applications and services.

Data Channel-based Service Timeline

MNOs will need to offer from start a basic set of New Calling services that apply to businesses, government/smart city and consumers. The more advanced services such as AR apps that are shared between callers would best be advised as phase 2 rollout. There are multiple business sub-sectors that would fine the new calling concept very appealing including food delivery services, locksmith and plumber services, emergency roadside automobile service and law enforcement and first responder support.

4.4 Deployment Modes and Service Capabilities

Ideas for Deploying NEs

Considering the actual situation of IMS networks and DC terminals/chips, it is recommended to gradually deploy 5G New Callings in three stages, in sync with market demand, user habits and industry development.

Phase 1: Using the video solution to deploy 5G New Calling, the MNO only needs to create a new set of core network elements to experience the 5G New Calling service, meeting the need for rapid business rollout.

Phase 2: Use the Data Channel solution to deploy 5G New Callings, requiring the IMS network to support DC capabilities. Users can fully experience the 5G New Calling service by replacing DC terminals, and gradually establish new business models.

Phase 3: Use the DC solution to deploy 5G New Calling, which requires the IMS network to support AI/XR capabilities and introduce endogenous intelligence mechanisms to further experience new immersive services and promote the transformation to intelligent computing networks.

4.5 ZTE 5G New Calling Solution

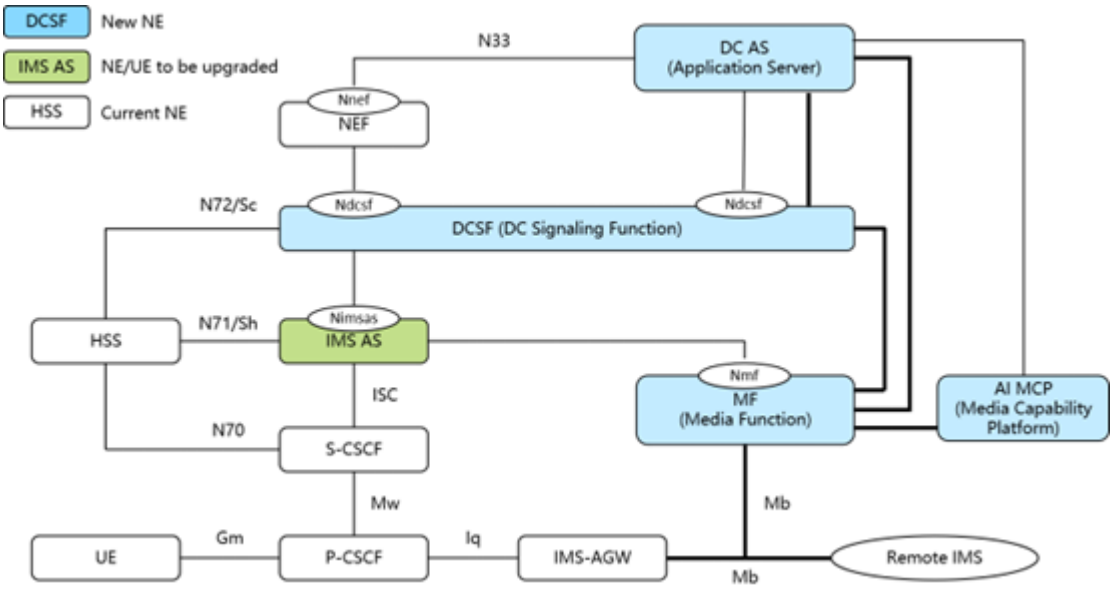
The ZTE 5G New Calling solution is based on the existing IMS core network architecture and adds Data Channel (DC) capabilities defined by 3GPP TS26.114 to enables diversified interactive and immersive services through new DC terminals. TS26.114 introduces the EVS codec for super-wideband audio. DC terminals (i.e., the UE) such as smartphones or other intelligent wearables and IoT devices that have been designed to support the IMS DC.

ZTE's 5G New Calling solution is based on cloud-native architecture and introduces the following 5G New Calling network elements (NE):

- **DCSF (Data Channel Signaling Function)**: Provides DC AS access management, call event subscription, processing and reporting, as well as MF's media operation capabilities, processes user ordering information of the operation and management platform, and selects AI MCP according to user location.
- **IMS AS (Application Server)**: Based on IMS audio and video call processing, it completes functions such as call event reporting, network resource control, and DC control.
- **MF (Media Function):** Provides DC access and application data distribution functions for 5G New Callings, and also supports media processing functions such as conferencing, translation, and rendering.
- **DC AS (Data Channel Application Server)**: implements business logic by interacting with DCSF, instructing the AI MCP to perform the media processing functions required for the business.
- **AI MCP:** Provides AI processing capabilities for audio and video media, such as real-time translation, voice-to-text conversion, voice/image recognition and action recognition, etc.

The ZTE 5G New Calling solution also supports the use of transitional video solutions, which directly utilize traditional video call capabilities to implement some interactive and immersive services through existing video terminals. These can evolve smoothly to IMS DC solutions in the future, as shown in Figure 4. The new NEs combined with the upgrade to the IMS Application Server make it possible to support existing video terminals with some interactive/immersive services.

Figure 4: ZTE 5G New Calling Network architecture (video solution)



Source: ZTE, 2024.

The main services that the ZTE IMS DC solution has currently implemented include:

- Intelligent translation (voice transcription, real-time translation, voice assistant);
- Fun calls (background replacement, voice emoticon rain, gesture animation, graffiti/stickers);
- Digital people (virtual avatars, digital images);
- B2C enhanced business (content sharing, screen sharing);
- B2B enhanced services (intelligent customer service, electronic whiteboard, multi-party calls);
- B2H enhanced services (smart door locks, smart desk lamps, smart cameras, smart large screens).

The main services that the video solution can currently implement include:

- Barrier-free communication (voice translation and real-time translation)
- Fun calls (background replacement, avatar replacement, voice expression, and gesture motion)
- Lighting the screen
- Business stenography
- Video insertion

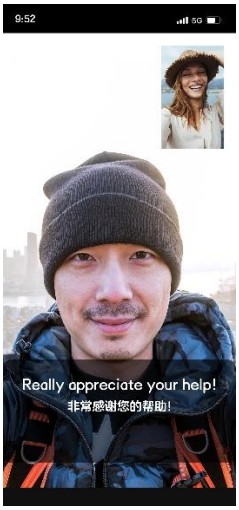
4.6 China Unicom's 5G New Calling Experience

China Unicom has started the first stage of 5G New Calling based on ZTE's video solution and the operator plans to offer more services, in phase 2, based ZTE's data channel solution. China Unicom's typical 5G New Calling services include gesture effect, voice emoticon, intelligent translation, electronic whiteboard, visual menu, content sharing, etc.

Figure 5: 5G New Calling service from China Unicom

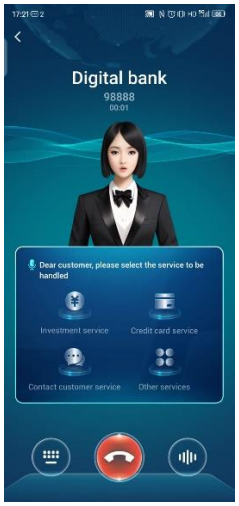
gesture effect

voice emoticon

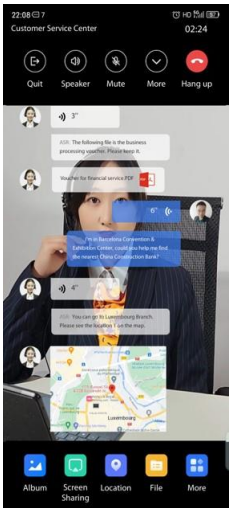


intelligent translation

electronic whiteboard



visual menu



content sharing

Source: China Unicom, 2023.

Appendix: IMS Primer

Figure 6 shows an overview of the IMS network architecture and interface to the 4G Evolved Packet Core (EPC). As we discus below, IMS supports both LTE and 5G NR. VoLTE works by initiating an IP session and transports the voice call over IP radio bearer of LTE using Session Initiating Protocol (SIP). SIP is a signaling protocol used for initiating, maintaining, and terminating communication sessions that include voice, video and messaging applications. SIP is also used in fixed Internet telephony, in private IP telephone systems, as well as mobile phone calling over LTE (VoLTE).

The session border controller (SBC) consists of the Multimedia Telephony Server (MMTel) and three Control Session Control Functions (CSCF). The SBC acts as a router between a network and carrier service, enabling only authorized sessions to pass through the connection point or border. The SBC monitors the quality of service (QoS) status for all sessions, ensuring that Voice over IP calls are executed properly as well as ensuring that emergency calls are prioritized and delivered.

The MMTel Provides Rich Communications Services (RCS) such as call forwarding and call barring. The 4G Evolved Packet Core (EPC) provides IP flow and bearer management needed by MMTel while the 4G RAN provides the data radio bearers.

The Call Session Control Function (CSCF) provides the central control function in the IMS Core Network to set up, establish, modify, and tear down multimedia sessions. The CSCF comprises three functions: I-CSCF, S-CSCF and P-CSCF. The Proxy-CSCF (P-CSCF) is a SIP proxy that is the first point of contact for user equipment (UE) in any mobile network. All SIP traffic to and from the user equipment must go through the P-CSCF. The P-CSCF function maintains state information as a stateful SIP-Proxy server and supports 1+1 redundancy with a backup instance. It also provides full transcoding support for AMR/AMR-WB (Adaptive Multi-Rate/Adaptive Multi-Rate Wideband) which is the voice codec used in VoLTE; the P-CSCF provides this on a separated RTP (Real-Time Protocol) channel.

RTP is used for streaming audio and video over the IP network RTP is used extensively in both 3GPP and non-3GPP networks, with a prime example being the transport of voice packets between MGWs (Media Gateways).

The S-CSCF is responsible for conducting both registration and session control for the registered UE's sessions. It functions as a registrar and enables the network location information of the UE to be available at the HSS. The S-CSCF will thus make a determination to allow or deny service to the UE.

The Interrogating Call Session Control Function (I-CSCF) is used by IMS for roaming and enables requests to be routed to the correct S-CSCF since there can be more than one S-CSCF within a network. The I-CSCF interrogates the HSS to obtain the address of the relevant S-CSCF to process the SIP initiation request.

Figure 6: VoLTE and IP Multimedia System (IMS) network architecture

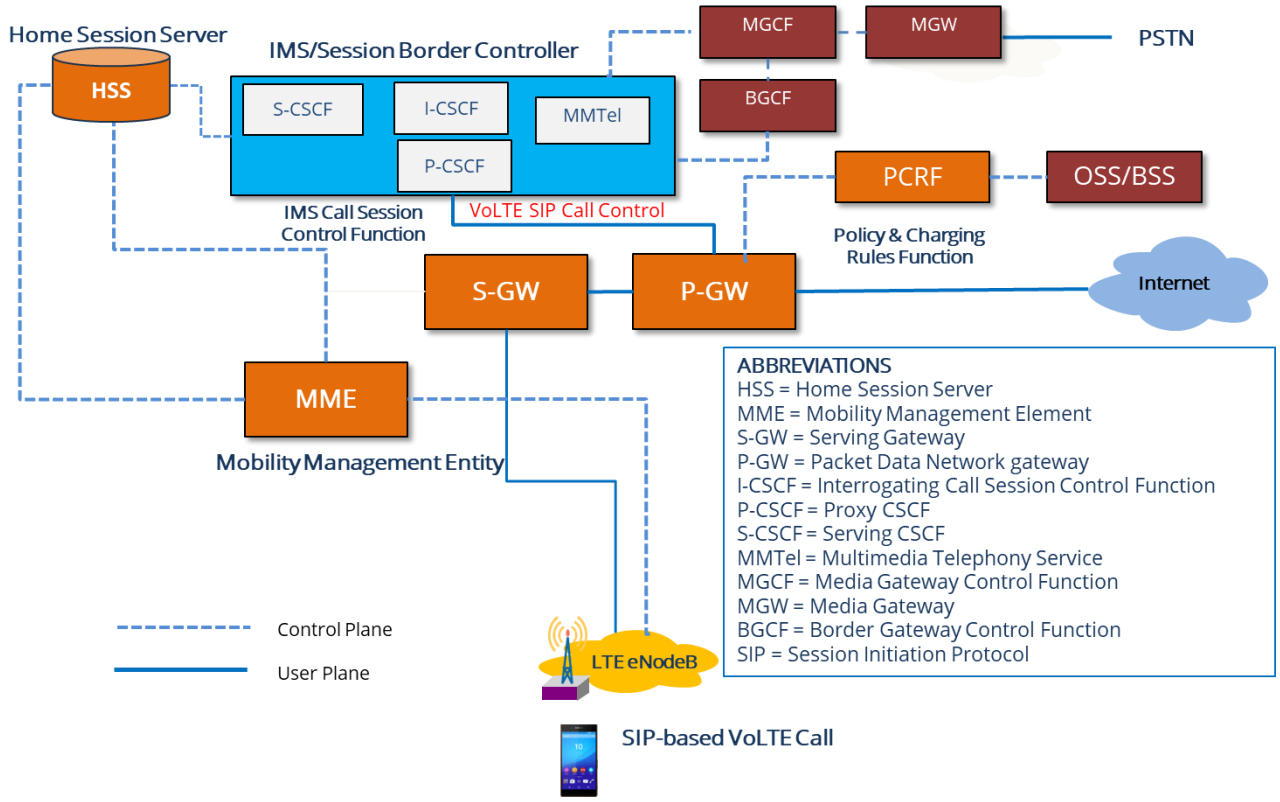
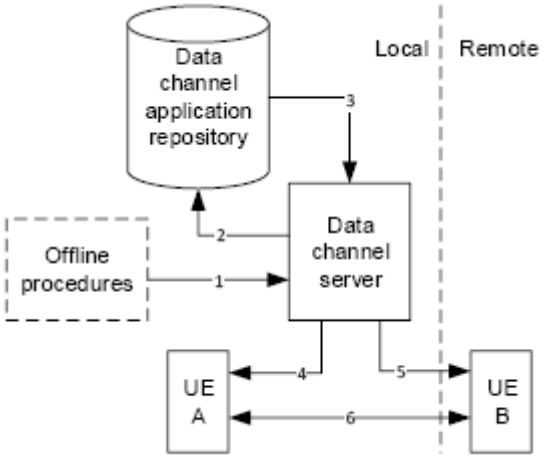


Figure 7 shows the logical architecture of the IMS data channel described in Release 16. The Data Channel Server (DCS) is a new IMS function setup for 5G. Applications can be stored in the cloud and execution of the applications can also take place in the cloud. Data applications are delivered to the UE terminal using HTML and JavaScript in an open architecture.

Figure 7: Architecture of the Data Channel



Source: Release 16 3GPP TS 26.114 (2020).

Glossary of Terms

ACRONYM	Meaning	Description
3GPP	3rd Generation Partnership project	This is the global specification organization for cellular technologies from 2G to 5G and beyond.
AMF	Access & Mobility Management Function	
BGCF	Border Gateway Control Function	
eNB	eNodeB	LTE basestation
CSFB	Circuit Switched Fallback	
EPC	Evolved Packet Core	
EPS	Evolved Packet System	
gNB	gNodeB	5G New Radio basestation
HSS	Home Session Server	5G Core component
I-CSCF	Interrogating Call Session Control Function	IMS component
MGCF	Media Gateway Control Function	
MGW	Media Gateway	
MME	Mobility Management Element	
MMTel	Multimedia Telephony	IMS component
NEF	Network Exposure Function	
NG-eNB	Next Generation eNB	Enhanced eNB for Dual connectivity with 5G NR in Non-Standalone configuration
P-CSCF	Proxy Call Session Control Function	IMS component
P-GW	Packet Gateway	4G EPC component
S-CSCF	Serving Call Session Control Function	IMS component
S-GW	Serving Gateway	4G EPC component
SIP	Session Initiation Protocol	
SRVCC	Single Radio Voice Call Continuity	
UPF	User Plane Function	
VoLTE	Voice over LTE	
VoNR	Voice over New Radio	

About GlobalData

GlobalData is a leading provider of data, analytics, and insights on the world's largest industries. In an increasingly fast-moving, complex, and uncertain world, it has never been harder for organizations and decision makers to predict and navigate the future. This is why GlobalData's mission is to help our clients to decode the future and profit from faster, more informed decisions. As a leading information services company, thousands of clients rely on GlobalData for trusted, timely, and actionable intelligence. Our solutions are designed to provide a daily edge to professionals within corporations, financial institutions, professional services, and government agencies.

Unique Data

We continuously update and enrich 50+ terabytes of unique data to provide an unbiased, authoritative view of the sectors, markets, and companies offering growth opportunities across the world's largest industries.

Expert Analysis

We leverage the collective expertise of over 2,000 in-house industry analysts, data scientists, and journalists, as well as a global community of industry professionals, to provide decision-makers with timely, actionable insight.

Innovative Solutions

We help you work smarter and faster by giving you access to powerful analytics and customizable workflow tools tailored to your role, alongside direct access to our expert community of analysts.

One Platform

We have a single taxonomy across all of our data assets and integrate our capabilities into a single platform – giving you easy access to a complete, dynamic, and comparable view of the world's largest industries.