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Communication services evolution

Status and challenges in the further evolution from VoLTE towards eXtended Reality Calling and other communication services in 6G.

1. Introduction

Summary

This white paper describes the evolution path and growing challenges of developing, maintaining and evolving a strategy for mobile network operators' communication services in a context of the lack of a clear roadmap for the industry and significant decline in the usage of voice calls by mobile customers.

3GPP and GSMA are actively engaged on delivering to the industry an evolution path for IMS services, voice and video calls, based on expected increase in availability of ViLTE services and the evolution to IMS Data Channel capabilities to add in-call interactivity capabilities.

However, both ViLTE and IMS Data Channel are challenged by the lack of universal support. Several years after being released, ViLTE is still not being supported natively in the main mobile OS ecosystems, representing a significant part of mobile customers. Consequently, the service has not been massively deployed in mobile networks and demand is low. IMS Data Channel, except in China, does not have significant support, current or planned, in the majority of smartphone and dialler vendors. With this situation, there are no commitments from operators in many regions to evolve their IMS networks and actively support ViLTE and IMS DC-based services.

In this context, the effort from 3GPP focusing on the standardization for conversational services in eXtended Reality (XR) services expected to be part of 6G (Rel. 21 onwards) could be challenged by a lack of industry support, leading to an uncertain ROI (return on investment) for operators and other stakeholders.

Furthermore, security and trustworthiness of 6G communication services provided by operator networks is expected to play into future proofing current voice and multimedia networks.

Without a clear path in the industry that enables operators identify a path to generate incremental revenue from evolved Comms services, the investments are compromised. Not only to embrace all these technologies, but also to continue maintaining existing voice services in 6G networks, considering declining voice traffic scenarios with up to 10% reduction year on year in some markets.

In addition, new service launches might require the upgrading of legacy IMS networks, causing considerable impact and relevant investments. In this case, the support of all stakeholders in the value chain for a future standards-based feature set on new Communications Services is essential, as it has been for RCS in the messaging space.

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Background and context

In the late 1990s it became clear that IP based voice was taking off over fixed networks and that SIP-based voice calls were going to become relevant. Although some parties proposed to move to SIP-based voice calling with 3GPP Release 4, many players in the ecosystem thought that it would be easier to keep with circuit switched (CS) voice in parallel with IP for data. When LTE was implemented with 3GPP Release 8, the first versions continued with this "backward-looking" view where voice was enabled using CS-fallback to an earlier generation network rather than supporting SIP based-based voice calling in LTE.

Once there was mass availability of LTE networks the need for a "native" voice service over LTE to avoid CS fallback issues became evident for the industry. Since LTE was already IP orientated, the option to deliver operator voice via IP Comms and IMS capabilities to the mobile space led to the development of IMS in 3GPP standards and the subsequent adoption of GSMA's specification for the Voice over LTE (VoLTE) service[5].

VoLTE addressed the migration to a Packet Switched (PS) only domain by leveraging on the capabilities of the IP Multimedia Subsystem (IMS) to offer voice and messaging services over LTE, and enabled inclusion of a set of communication services and additional service capabilities, thus enabling the migration away from legacy CS networks.

Furthermore, VoLTE provided customers with enhanced voice quality, reduced time taken to establish calls and the possibility of placing video calls.

To facilitate deployments, in 2010 GSMA published the first set of recommendations for a unified VoLTE profile: IR.92 IMS Profile for Voice and SMS[5]. This was complemented at the end of 2011 with the addition of Video services over IMS (referred as ViLTE), with GSMA IR.94 IMS Profile for Conversational Video Service[7]. Both services were delivered as GSMA Permanent Reference Documents. In 2019, and after several years of development, 3GPP published the first industry-wide specifications for 5G as part of 3GPP Release 15. The industry agreed on evolving VoLTE towards Voice over NR (VoNR), and GSMA released in 2020 a new set of requirements for ensuring industry interoperability around mobile Voice in 5G (NG.114 - IMS Profile for Voice, Video and Messaging over 5GS[8]).

However, the initial deployments of VoLTE services were quite complicated with slow adoption within the device ecosystem and multiple IMS profiles for service delivery. The standards for IMS and its usage within LTE networks were quite open, and the ways VoLTE was implemented in different MNOs were very heterogeneous. In recent years GSMA has worked on simplifying IMS implementations to address the heterogeneity and recent versions of IR.25 VoLTE Roaming Testing[16] have reduced the number of valid configurations for VoLTE.

In parallel, another key GSMA initiative, Rich Communication Suite (RCS), started in 2007 to drive evolution of messaging beyond SMS, complementing VoIP capabilities in IMS. GSMA released the first RCS specification in 2012 (RCC.07 - RCS Advanced Communications Services and Client Specification), but the adoption in the market has been even more complex than VoLTE due to the fragmented ecosystem and the complexity of aligning customer experiences between end devices and diallers. Eventually, RCS

was encouraged by regulation in Europe in 2023 as part of an effort to improve universal service availability for messaging over IP (see [14], [15]).

Each of these services had several constraints and dependencies when being implemented in devices that lead to long industry chains and service iteration periods, and ultimately to very slow service rollouts. In the meantime, operators' voice calls were being carried mostly through 2G or 3G Circuit Switch Fallback, and operator messaging services continued to use SMS. At the same time a growing number of Over-the-Top (OTT) voice and messaging services, delivered over any Internet IP-based connectivity and available to be installed on the user's device, started to appear and gain acceptance in the market.

After being deployed for many years, the shortcomings of new services over IMS network have gradually emerged and increasingly become pain points for operators. While the IMS networks themselves are mature, the transition to service-based architecture for 5G core networks, OAM systems, and subscription management has led to increased complexity in introducing these new services. The IMS core networks need to evolve to support service-based principles more natively.

Next Generation Calling

Next Generation Calling can be considered as innovative, user-friendly and convenient call enhancements and applications built making use of combinations of evolving networks and technologies such as Artificial Intelligence (AI) and Augmented Reality (AR). GSMA has worked with a number of operators to define and elaborate the concept of 5G New Calling in [12].

With Next Generation Calling, calls can evolve from pure voice and video communications to an ultra-high definition, intelligent, and interactive experience, with media and data interaction capabilities that can be seamlessly integrated to create rich, web technology-based applications, and transform a regular call into a more rewarding or more efficient communication channel.

The use of Next Generation Calling and standard web technologies allows for the development of a new ecosystem of small, mini-apps that can be downloaded and executed during a call, and can potentially be developed by operators, device manufacturers and third party developers, as part of an open ecosystem.

The GSMA proposal for 5G New Calling leverages on VoLTE, VoNR, ViLTE and mainly on IMS Data Channel, standardized by 3GPP since Rel. 16, and refined by GSMA on its Permanent Reference Document NG.134 "IMS Data Channel" and Official Document TS.66 "IMS data channel API specification".

A number of examples of Next Generation services are provided. These are provided as illustrative examples only and not as agreement to develop or launch any specific services.

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Consumer Next Generation Calling Examples

Smart Translation - enables a user to enjoy effective video communication with a contact that speaks a different language or may be hearing impaired. The smart translation service supports both voice transcription and real-time translation.

Augmented Reality Calling - designed to provide users with a fun, rich and interactive video call experience. AR Calling enables the user to include a virtual background, stickers and an avatar in a video call. This functionality is particularly likely to appeal to younger generations who enjoy sharing their presence and emotions.

Content Sharing - users can send each other photos, share their location, send files and business cards, and share screens.

Enterprise Next Generation Calling Examples

Enterprise Caller ID - provide new opportunities for enterprises to reach users. The service enables businesses to create exclusive and verified business cards that can be displayed when enterprise staff call users. The user's screen will display the enterprise's business card and call purpose, this enhances user trust, and improves the call completion rate.

Smart Customer Service - an upgrade of traditional telephone-based customer service. When a consumer dials a customer service on their IMS DC device, they will enter a smart customer service Mini-App. Rather than relying on traditional voice and keypad inputs, smart customer services provide a new interactive interface combined with human customer service. Users can choose different services within the menu, or they can connect to human agents and perform corresponding operations. An example of Smart Customer Service could be a Motor Insurance response service; Following an accident, a customer contacts their insurance company for remote damage assessment using the appropriate Mini-App and shares images of the incident damage in real-time from within the Mini-App.

6G Outlook

With the latest breakthrough of new technologies, new services and network requirements emerge. The following key points set the direction for 6G voice.

- Scientific and Technological Innovation

Innovative technologies, such as artificial intelligence (AI) computing power networks and virtual environments, come into play and provide new opportunities and challenges for the development of real-time communication networks. In addition, multi-disciplinary convergent innovative technologies enable networks to support immersive interaction, intelligent communications, and ubiquitous connections.

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- Service Requirements

With global digitalization, users are posing more personalized requirements on communication networks. Future immersive communication will use the natural and accurate representations of auditory and visual information as well as multi-dimensional interactions to better meet those personalized requirements.

- Network Requirements

With increasing requirements on services, a future-proof and evolving IMS system shall ensure a seamless integration of new services. A simplified and evolving IMS system, empowering operators to meet the challenges of the future as for automated cloud native implementation is needed.

2. IP Communications evolution roadmap from Next Generation Calling to eXtended Reality Communications (XR COMs)

Next Generation calling services will integrate additional media types and data transfer capabilities on top of voice and video calls, allowing for real-time data interaction between callers and cloud-services, or between the parties engaged in each call.

Commercial implementation of Next Generation Calling services will rely on the development of a complete ecosystem around IMS Data Channel, including devices. This includes System-on-Chip (SoC) manufacturers, security profiles, mobile Operating Systems and device manufacturers and networks for the launch and operation of the services, and software developers working in coordination for development of content.

The user experience and development model of traditional call services is also expected to change, opening the space to engagement from third parties coming from web-based technologies.

The development of this ecosystem for the mobile industry is expected to take years and will require a firm push from all key stakeholders to accelerate the process. And while a critical mass in the market is being achieved, the demand for these services might remain low, and subsequently, investments from key stakeholders could be insufficient, or even compromised.

While the IMS DC ecosystem is developed, the launch of initial Next Generation Calling services is expected to happen leveraging on the ViLTE capability provided by available devices in the market, with small enhancements in existing core networks to improve the media processing capabilities. This way, users can enjoy a set of enhanced capabilities and innovative services that can be supported in the native diallers of devices without the need to download and install a separate client. Indeed, thanks to ViLTE, Busines-to-Business appealing use cases such as live translation or “light up the screen” where video content can be pushed to the end user could be commercialized. However, unlike VoLTE - ubiquitous nowadays, the support for ViLTE is still not universal -neither in devices nor in operator networks.

In a second phase, operators are expected to deploy real-time interactive services based on IMS Data Channel, requiring device, manufacturers and OS vendors to implement standards-based diallers

supporting the technology. IMS DC capability will allow for real-time data interaction between the cloud and user and between users. Whilst IMS DC channel B2C use cases are complex to build, operators foresee that new services could be easily tackled in the B2B and B2B2C segments.

Moving forward and leveraging on the media capabilities provided by IMS Data Channel, and the additional use cases, capabilities, codecs and service-based principles standardized in 3GPP Rel. 18 in March 2024, Next Generation Calling will allow evolution to standardized Augmented Reality (AR) Calling (with enriched virtual content or backgrounds complementing calls, for entertainment and/or business).

3GPP Rel.19, expected to be released in late 2025, is also working to standardize APIs exposing eMMTel capabilities to application and vertical service providers.

These evolutions will pave the way towards the standardization of interfaces, protocols and codecs leading to more immersive, real-time eXtended Reality communications (XR COMs) experiences for the next generation, 6G, from Rel.20 onwards. Projects like 6G-XR [13], backed by the European Union, are already prototyping XR communications over IMS networks.

3. Key device capabilities required

Standards and profiles

5G core networks and VoNR are being deployed in many regions, while GSM and 3G networks are being dismantled all around the world, making VoLTE the current de facto standard for voice communications and voice roaming. But this situation is not sufficient, and we cannot standstill. In order to evolve voice communications, several industry specifications need to be implemented in devices as follows:

Required Voice services

VoLTE: GSMA PRD IR.92 “IMS Profile for Voice and SMS” [5]

VoWiFi: GSMA PRD IR.51 “IMS Profile for Voice,
Video and SMS over untrusted Wi-Fi access” [6]

VoNR: GSMA PRD NG.114 “IMS Profile for Voice, Video and Messaging over 5GS” [8]

Required Video and Next Generation Calling services

ViLTE: GSMA PRD IR.94 “IR.94 IMS Profile for Conversational Video Service”, GSMA [7]

ViNR: GSMA PRD NG.114 “IMS Profile for Voice, Video and Messaging over 5GS”, GSMA [8]

IMS Data Channel: GSMA PRD NG.134 “IMS DC” [9] and GSMA TS.66 “IMS data channel API specification” [10]

These PRDs rely on underlying 3GPP standards focused on IMS protocols and interfaces (that include, but are not limited to, 3GPP specifications [1], [2], [3] and [4]).

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Provisioning of operator settings in devices

While the support for the underlying standards might be available on devices, the mobile network operators are currently unable to guarantee that the services are made available to their customers because of fragmented device support. Networks and devices currently do not automatically negotiate or provision the necessary parameters to register the devices on the IMS domain of each operator, nor to set up specific VoLTE, VoWiFi, VoNR, RCS or IMS DC services. This is irrespective of the subscription provisioning that happens through either physical SIM cards or eSIM profiles. This challenge leads to the need for non-standardized approaches for provisioning operator setting in devices.

As the number of operators keeps growing, the process of provisioning devices becomes much more complex. GSMA has for several years tried to facilitate the process of settings interchange between operators, OS and device vendors, via TS.32 Technical Adaptation of Devices through Late Customisation and GSMA PRD TS.36, Devices Settings Database specification. The GSMA Network Setting Exchange (NSX) currently provides a capability to support both TS.32 and TS.36.

However, while this process might work well for some vendors and network operators and might work well for new device models being placed on the market, it does not guarantee properly the provisioning of settings for a previously installed base of devices when a service is launched, or when a device being sold in one operator channel migrates to a different network operator.

For this reason, processes allowing for an automatic and centralized discovery and retrieval of configuration settings, not only in the factory, but also during the lifecycle of the devices, should be implemented in a standardized and non-discriminatory way.

Certification requirements

For an effective deployment of these technologies, an exhaustive, open and industry-wide certification scheme should be available to test that device implementations are compliant with all the standards and profiles specifications implemented. This certification should focus not only on conformance testing with test systems, but also on test scenarios with real network implementations as well as on security aspects (field trials or interoperability testing).

To achieve a seamless interoperability, test specifications for conformance and field trials should be developed for with each published standard, implemented on test laboratories, tested during development phase, and the compliance maintained to the supported technologies through all the lifecycle of the devices.

And, specifically for IMS services, this should also include the remote provisioning of configuration settings for any operator submitting their settings to a centralized database – unless mandatory protocols to provision the settings directly from the networks are established.

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4. Key network capabilities required

Considering the characteristics of 6G new services, such as immersion, intelligence, multi-mode, the IMS network evolution also needs to support a highly adaptable plug-in media architecture, to enable rapid deployment of new media capabilities and services.

New voice services should support computing offload from the devices to the network to allow for lightweight form factors, e.g. AR glasses, with limited battery capacity, and enable advance AI services such as intelligent personal assistants.

Ubiquitous support for simpler devices, including more performant access and management capabilities, is another key aspect to be considered.

Furthermore, the basic 6G voice capabilities should be available at the time of 6G deployment.

5. A proposed approach to IP Communications in 6G

There are several use cases being considered for the evolution of voice and video communication services for the next generation (6G) of mobile services, leveraging in some cases the expected evolution of Artificial Intelligence (AI), Machine Learning (ML) and Telco Edge technologies. Some of the most relevant ones are:

· **Holographic communications**, where one party -or both parties- in the call is captured and transmitted in real-time as a photorealistic, dynamic 3D model. AI can help modify in real-time the model adding filters or virtual elements (i.e. hats, glasses, clothing, hair styles…) leading to eXtended Reality (XR) experiences.

· **Virtual remote assistants**, mostly for B2B business, allowing companies to present a virtual, interactive voice-driven assistant to address questions, concerns or business processes with customers.

· **Personal AI assistant**, that is the virtual AI assistant located in operator network with user's consent and can provide various communication services and support for individual users based on user requirements or intention. It interacts with users through voice, video, text, gestures or other modalities, and provides timely information, suggestions, or executes corresponding tasks, such as information feedback about weather, suggestions for hotels and flights.

·**GenAI-based services**, that can react to customers' requests with audio, image or video content generated on real time and presented via capabilities such as ViLTE or IMS Data Channel. For example, it can generate information related to the call content, such as pictures, video clips and animations of different styles, as required by the user. It assists users in expressing their intentions and enriches the expressiveness of the language to improve the interest and efficiency of communication.

But regardless of the specific use case being implemented, 6G should allow operators to gain control of the availability and configuration of standards-based voice -and also video and Next Generation Calling- services in all commercialized devices connected to their networks, lowering the barriers that prevent

the activation of these services, without compromising the capability of device and OS vendors to deploy other additional voice, video or real-time communication services.

The wide distribution of smartphones -and simpler feature phones makes them the best possible tool for emergency services, not just for users reporting emergencies via voice calls to 112, 911, 999, 000 or other emergency numbers, but also for public authorities alerting the population in the case of major risks or events. This requires operators to maintain voice services that rely nowadays on IP Communications and IMS networks.

However, the revenues from standard voice services keep declining for mobile operators. Voice MoUs (minutes of use) keep lowering in many regions year after year, as the preference of customers shifts to other services (messaging, social networks or other proprietary voice and video services).

If operators are required to maintain these standards-based voice services -and the associated networks-, they should also be allowed to evolve them to enriched proposals, that can help on the monetization of the required investments and maintenance of the networks. Furthermore, without such an approach, end customers will not benefit from service universality for what will become the new means to communicate tomorrow. Meeting these needs would imply guaranteeing that all the mobile industry -and not just the operators- get equally involved on making these new standards-based services available to customers.

Only when all new devices are required to deploy these services in a universal way can critical mass for the deployment of new IP Communications services can be achieved. Following a voluntary adherence scheme to some of these standards has proven to be inefficient. Either slow or, if there is not a clear business return, even a complete blocker.

Furthermore, automatic configuration of voice, video and Next Generation Calling services from the network side, in a standard way, should be considered to facilitate processes for the whole mobile industry.

A guarantee of service security must be given for operators as well as for customers. The integrity of the Apps and the Users/Providers must be ensured. The prevention of service misuse should be taken seriously and addressed by appropriate control mechanisms.

Finally, certification processes and test specifications for all the mandatory requirements should be implemented, to guarantee a proper interoperability between devices and networks from the first moment a device is activated on a mobile network.

6. Conclusion and key takeaways

The evolution of voice services towards Next Generation Calling, and later to AR and XR calling is being actively considered and discussed in 3GPP and GSMA.

However, without support from all the stakeholders in the industry value chain, making these services effectively available to mobile customers remains a clear challenge, as operators cannot control the

roadmap of services being implemented in mobile devices, that are placed in the market, in many cases, outside of operator-controlled or influenced channels.

With these uncertainties, it is likely that neither device vendors invest proactively on making new voice services available, nor mobile operators commit to the development of new services, without a clear indication that customers will be effectively able to access them. In addition, existing voice services keep a declining usage trend.

In order to mitigate this complex situation, this whitepaper identifies six major topics:

1- In order to maintain and invest in communications networks, standards-based voice services need to remain profitable, which implies **being allowed to generate additional revenue streams from new services, such as Next Generation Calling, Augmented/eXtended reality (AR/XR) communications** and other new communication services in 6G such as AI assistant for B2B, B2C and C2C scenarios, Gen-AI based services**.**

2.- New generation of voice services **should eliminate existing barriers, such as voluntary adoption and complex service provisioning** that prevent universal availability of new, and also CAPEX/OPEX-efficient, standards-based voice services across the complete mobile industry value chain.

3.- To create a successful ecosystem, **IMS Data Channel adoption is essential and should be universally adopted,** for voice-oriented devices, **across all stakeholders in the service value chain**.

4. It is important to guarantee **quality, privacy and security of applications for Next Generation Calling services**, including secure mini-apps over secure network mechanisms and highly trusted and secure multi operator interoperability.

5.- **Certification can play a crucial role** guaranteeing the availability, security and interoperability of these services across the whole mobile industry.

6. - New generations of voice network should **support rapid service rollout**, and AI-friendly framework to support a diversity of 6G services, such as AI-native capability.

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