

# One Voice Profile : Enabling Voice and SMS services in LTE

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## **Abstract**

3GPP has worked with the IMS for almost ten years and there exist thousands of pages, in different specifications that cover IMS related functionalities. The 3GPP-specified IMS network is an access-independent IP connectivity that enables various types of multimedia services to end users using common Internet based protocols.

Voice over IMS profile also known as 'One Voice' is a well defined specification (Compliant to all 3GPP standards) providing Voice & SMS service across the LTE network using IMS. The scope of this document is to bring out several important aspects of this profile by addressing Radio & EPC feature sets, supplementary feature support for UE and potential challenges for this profile in the near future.

## Introduction

Long term evolution (LTE) along with WiMAX, is competing to be the fourth generation (4G) mobile technology of the future. LTE is a name given for the Third Generation Partnership Project's (3GPP) Release 8 specifications for mobile services that are just completing ratification for roll-out starting next year.

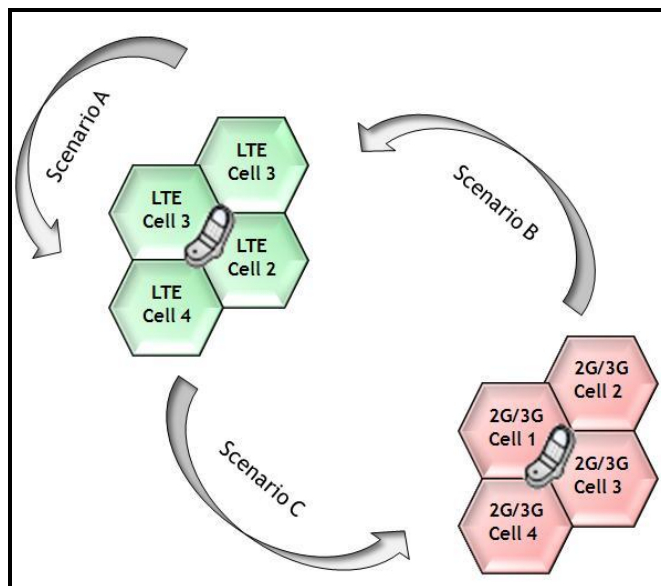
Most of the existing mobile technologies are using voice oriented switching schemes and LTE will be an exception with a complete IP based network. This will allow seamless inter-operation between mobile and fixed data networks, as both will then be based on Internet Protocol (IP), which specifies how packets should be structured and routed.

## Importance of Voice

Voice services have been the primary source of revenue for most mobile operators since 1950. Due to the recent popularity of GSM networks, over 4 billion people use voice services around the world. The majority of efforts in designing the EPS architecture and its procedure primarily target an efficient IP access service. Voice support through the LTE network was also a key focus of the 3GPP-LTE technical group from the start.

Radio access (E-UTRAN) in LTE has been designed to be optimized for IP based services, which means that LTE has no support for dedicated channels optimized for voice calls. LTE is all pure 'IP' (or) 'packet-only' access with no connection to the circuit-switched service, which is different from its predecessors such as GSM, WCDMA & CDMA.

There are three possible scenarios for the voice service with LTE network:



**Figure 1: LTE UE call movement**

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**Scenario A.** Voice call is established in LTE coverage (cell) and the user is not going to move outside this coverage for the duration of the call. In this scenario true Voice over LTE solution are suggested. Please refer figure 1.

**Scenario B.** Voice call is established outside LTE coverage (cell). This call could be established using circuit-switched access i.e., GSM. Depending on the solution, the call could be converted into a SIP call and handled by IMS system (or) it can be a traditional circuit switched call by the MSC and handled in LTE area.

**Scenario C.** Voice call is established in LTE coverage and during the call the user moves out of LTE coverage. This can either be handled as packet handover between the LTE and other 3GPP/non-3GPP systems (or) Single Radio Voice call Continuity SRVCC (solution by 3GPP) can be allowed.

In all of the above cases, each scenario starting from Circuit switched fall back (CSFB), SRVCC and other Voice over LTE has its own unique characteristics and benefits. However, in this paper we are attempting to present the technical details and challenges of Voice over IMS option (One voice) profile.

## About One Voice Initiative

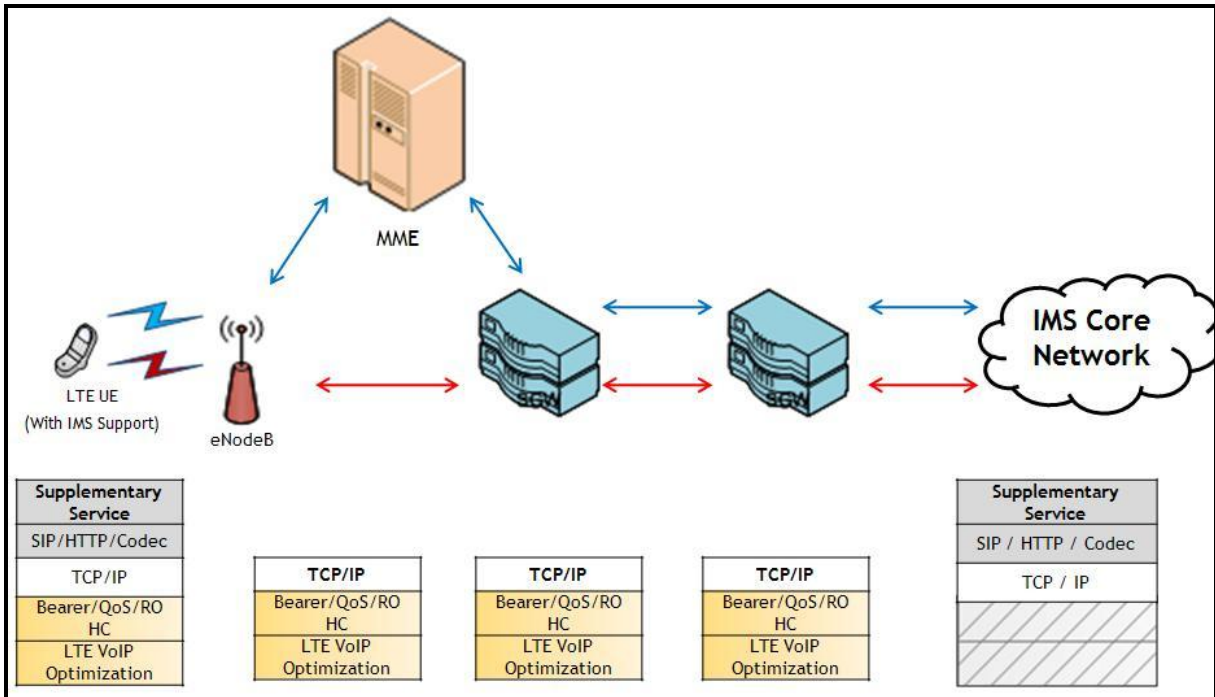
This is an initiative aiming to achieve and unify industry agreement to implement Voice and SMS over the existing 3GPP Release 8 LTE standards. 3GPP specified IMS network is an access-independent and standard-based IP connectivity for Voice and multimedia service. The One Voice initiative formed to help industry secure a common standardized IMS voice solution, also defines a common recommended option when multiple options exist for single functionality.

One voice specification has been raised by AT&T, Orange, Telefonica, TeliaSonera, Verizon, Vodafone, Alcatel-Lucent, Ericsson, Nokia Siemens Networks, Nokia, Samsung and Sony Ericsson.

## Radio & Packet Core Feature Support

Before moving onto the voice over IMS profile establishment, it is important to understand the possible mandatory functionalities that LTE network (eNodeB, SGW/PGW) and UE should possess:

- LTE UE shall support generic IMS functions such as Registration, Authentication (part from EPS authentication), Addressing and other SIP procedures for the voice establishment.
- SRB1 + SRB2 + 4 x AM DRB + 1 x UM DRB (for UE)
- SRB1 + SRB2 + 2 x AM DRB + 1 x UM DRB (for eNodeB)
- ROHC framework for compression & decompression of IPv4 & IPv6 packets between UE and eNodeB
- UE shall request the PDN type to be IPv4v6. UE will prefer to IPv6 address than IPv4
- RTP profile support including RTCP implementation.
- The UE and the other IMS entities that terminate the user plane shall support the AMR speech codec as per 3GPP specification
- DRX mode support is mandatory for both UE and eNodeB for better battery efficiency
- Qos Class identifier - QCI value 1, 5, 8/9 should be supported for better voice and other IMS data traffic
- The UE and packet core shall support the procedures for P-CSCF discovery via EPS
- RF performance for UE and eNodeB are as per the 3GPP specification



**Figure 2: LTE UE call establishment (IMS support)**

## Voice Establishment via IMS

A default bearer can be created when the UE creates a connection to the PDN. A standardised QCI value of five will be used for IMS SIP signalling with the default bearer at that time.

For an IMS session request for a Conversational Voice call (either originating or terminating), a dedicated bearer for IMS based voice shall be created utilising interaction with dynamic PCC. The network shall initiate the creation of a dedicated bearer to transport the voice media. The dedicated bearer for Conversational Voice shall utilise the standardised QCI value of one, the network shall not create more than one dedicated bearer for voice media. Therefore, the UE and network shall be able to multiplex the media streams from multiple concurrent voice sessions. A single bearer is used to multiplex the media streams from multiple concurrent voice sessions; this is necessary in some supplementary services (e.g. CW, CONF).

If the PDN connectivity between a UE and the network is lost, the network shall terminate all ongoing SIP sessions related to this UE. When the UE regains PDN connectivity, the UE shall perform a new initial registration to IMS.

If the SIP signalling bearer is lost, then the UE shall re-establish the PDN connection. This will trigger the network initiating a new SIP bearer in combination with the PDN connection establishment. After the SIP bearer is established, the UE shall perform a new initial registration to the IMS core in case the IP address changed or the IMS registration expired during the absence of IP connectivity.

With both PGW and P-CSCF in the V-PLMN, LTE UE's with One voice profile can support IMS roaming for endless voice communication.

## Supplementary Features Support

The below supplementary features are available to the end user (LTE UE) if IMS is used for the Voice communication.

- IMS Emergency Call
- Originating Identification Presentation
- Originating Identification Restriction
- Terminating Identification Presentation
- Terminating Identification Restriction
- Communication Diversion Unconditional
- Communication Diversion on not Logged
- Communication Diversion on Busy
- Communication Diversion on not Reachable
- Communication Diversion on No Reply 3
- Communication Hold
- Message Waiting Indication
- May support the SMS-over-IP
- Communication Waiting
- Barring of All Incoming Calls
- Barring of All Outgoing Calls
- Barring of Outgoing International Calls (\*)
- Barring of Incoming Calls - When Roaming 3GPP TS Ad-Hoc Multi Party Conference

Configuration of the Supplementary service between LTE-UE and IMS core happens via XCAP support.

One Voice UEs and network deployment shall support emergency services in the IMS domain. Main profile has been designed to support IMS roaming with both P-CSCF and PGW in the visited network

**Note:** (\*) Indicates that it's a 3GPP Release 9 feature and not mandatory for Release 8.

## Challenges

One voice profile might face many challenges before it starts. The following are a few possibilities:-

- IMS core network presence across the globe is limited compared to packet and circuit switch networks
- Biggest challenge for the One Voice is that the entire profile is IMS centric and thus it makes interoperability between the IMS mobile very slow
- IMS network implementation and interoperability might take significant amount of time
- IMS handset market penetration is significantly low. Many handset vendors might be interested to work with IMS specification but it's unlikely to catch on quickly in the market.
- Business case for mobile operators to deploy IMS is still unclear without clarity on profitable revenue streams

## **Conclusion**

One Voice profile will become necessary in the future when IMS infrastructures are widely deployed and functional by the operators. In the near future, when LTE comes to emerging markets, voice and sms are going to be critical parameters for the success of the technology, so there could likely be an intermediate solution for Voice over LTE.

## Abbreviation

3GPP	3rd Generation Partnership Project
4G	Fourth Generation
CW	Communication Waiting
DRX	Discontinuous Reception
eNB	eNodeB
IMS	IP Multimedia Subsystem
IPv4	Internet Protocol Version 4
LTE	Long Term Evolution
P-CSCF	Proxy - Call Session Control Function
PDN	Packet Data Network
QCI	Quality of Service Class Indicator
SRVCC	Single Radio Voice Call Continuity

## Reference

One Voice; Voice over IMS profile -V1.0.0
3GPP TS 23.167: "IP Multimedia Subsystem (IMS) emergency sessions"
3GPP TS 23.221: "Architectural requirements"
3GPP TS 23.401: "General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio
Access Network (E-UTRAN) access"
3GPP TS 24.301: "Non-Access-Stratum (NAS) protocol for Evolved Packet System (EPS); Stage 3"
3GPP TS 36.101: "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception"
3GPP TS 36.323: "Evolved Universal Terrestrial Radio Access (E-UTRA); Packet Data Convergence Protocol (PDCP) specification"
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### About the author



Arunkumar Prabhakaran has an almost a decade of experience in the Telecom vertical. Primarily involved in design, implementation and management of software products in wireline & wireless telecom space. He has been associated with L&T Infotech - Product Engineering Service since 2006. Listening to music, watching television and internet surfing are his favourite hobbies.

### About L&T Infotech

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