Voice Over Long Term Evolution Call Flow

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ABSTRACT

LTE is packet switched based technology, where in voice support is lagging. But circuit switching will support voice call. Combining circuit and packet switching is a technological challenge. Voice over Long Term Evolution (VoLTE) is nothing but integrating voice and data while calling. VoLTE is IP Multimedia Subsystem (IMS) based network [1] and is following 3rd Generation Partnership Project (3GPP) standard. In Evolved Packet Core (EPC), the voice features are not available, hence voice calls are not able to be processed. But IMS take with it the voice features like authentication, call control, etc., The key difference between VoLTE and Voice over Internet Protocol (VOIP) is, best energy service is provided, whereas VoLTE has the proficiency to guarantee end-to-end Quality of Service (QoS). The author mainly focuses on VoLTE call flow.

Keywords/ Index Term— IP Multimedia Subsystem, Quality of Service, Long Term Evolution, Latency

1. INTRODUCTION

Day by day internet data usage is surging at a fast rate. Mobile operators have to satisfy the needs of the customers by providing them with the internet data, at the same time with high bandwidth and with low latency [2]. Long Term Evolution (LTE) network technology is considered as an IP network. LTE operates on packet switched network technology, and hence voice is not supported. But voice calls must be provided to customers on packet switched LTE network. In order to perform this, VoLTE was introduced. It is a technology which provides voice and Short message service (SMS) on LTE. VoLTE is put into service by means of IMS. VoLTE is GSMA based technology [3].

VoLTE is mainly for supporting voice calls using LTE technology. Figure 1 shows the basic VoLTE architecture. From figure 1, the Application Server (AS) will handle the voice as an application. Serving Call Session Control Function (S-CSCF) will have number of interfaces for communicating with other entities. Proxy Call Session Control Function

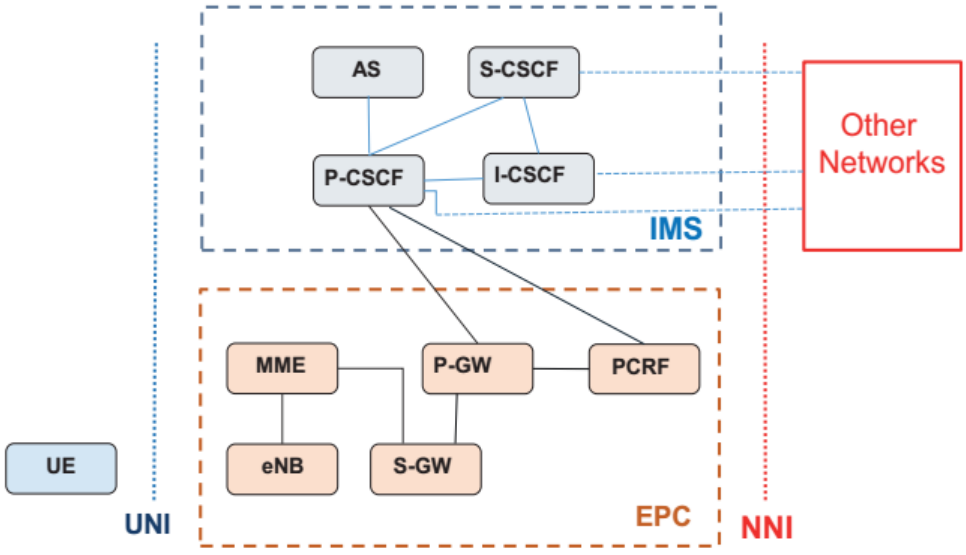

Fig – 1: basic VoLTE architecture

(P-CSCF) will act as proxy for user. Interrogating Call Session Control Function (I-CSCF) will be for forwarding a Session Initiation Protocol request to S-CSCF. Policy Changing and Rules Function (PCRF) is considered as an important element, since it is the one which is responsible for reliable operation of the VoLTE services. Table 1 shows the acronyms used in Figure 1.

TABLE-I

ACRONYMS USED IN FIGURE 1

MME	Mobility Management Entity
P-GW	Packet Data Gateway Network
S-GW	Serving Gateway
UE	User Equipment
eNB	Evolved NodeB
UNI	User to Network Interface
NNI	Network to Network Interface
IMS	IP Multimedia System
EPC	Evolved Packet Core

Compared to 3G Universal Mobile Telecommunications Service (UMTS), VoLTE will have thrice the capacity of data and voice [4]. VoLTE offers voice services along with many other services which includes, social media, video surfing and streaming. To provide all these to the user with high speed and quality, the network preferred is LTE. In LTE, IP Multimedia System (IMS) infrastructure is exploited for providing the exact framework. Figure 2 shows the combination of technologies in VoLTE [5].

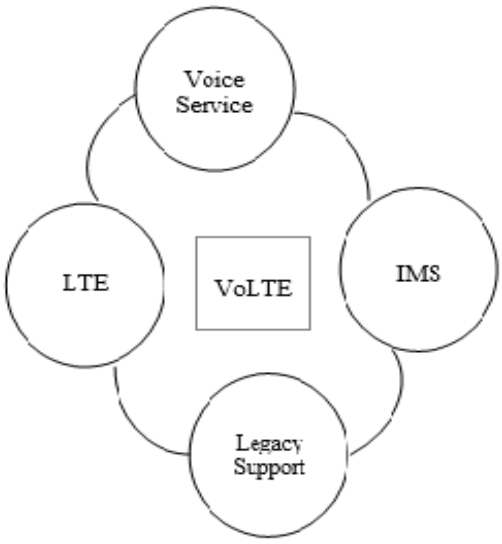

Fig – 2: VoLTE and other technologies

2. VoLTE CALL FLOW

VoLTE is categorized into two standards: i) IMS and ii) LTE. Both IMS and LTE does not depend on each. But VoLTE combines both, with the help of non-Guaranteed Bit Rate (GBR) value. For VoIP calls, the IMS is considered as the master controller on LTE Network. The IMS network gives instruction to LTE network by means of Session Initiation Protocol (SIP). After this the call connections are established with suitable Quality of Service (QoS). But in VoLTE, the scenario is different. Here, the IMS will be directing the LTE network for the necessary QOS, thereby the voice call gets initiated. Also the completion of the call is also notified by IMS. As soon as the user turn on his smartphone that is VoLTE enabled, the device first establishes a connection to LTE network. Two Evolved Packet Switch (EPS) bearers are assigned. First one is for non-GBR QoS Class Identifier (QCI) value 5 (for SIP signaling this value 5 is needed). The second is for the non-GBR QoS Class Identifier (QCI) value ranging from 5- 9. Due to this two bearer approach the smartphone can communicate with both IMS and LTE. Figure 3 shows the call flow in VoLTE [6].

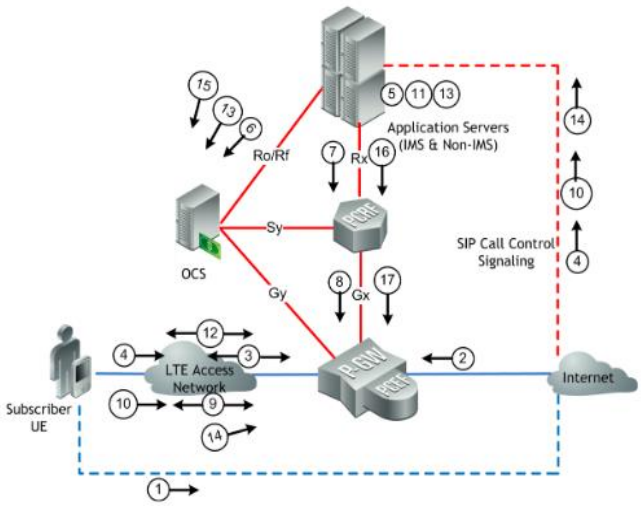

Fig – 3: Call Flow in VoLTE Source: [6]

The step by step VoLTE call flow is explained as follows:

1. The subscriber wishes to make a VoIP call
2. A Packet Data Network Gateway (P-GW) which is offering connection to IMS is identified by LTE
3. A Default bearer is established by LTE for the purpose of SIP from UE to the respective P-GW. For the SIP

signalling, the default EPS bearer is connected with a QCI value of 5.

4. Session Initiation Protocol *invite* message is sent to IMS. A Session Description Protocol (SDP) will carry the required Quality of service (QoS). The LTE network does not know the message content.
5. From the Session Initiation Protocol, the necessary QoS is been extracted by the IMS network.
6. Credit Control Request is sent by the IMS network to the Ro Interface.
7. The IMS network then sends the QoS required by the Rx interface
8. The PCRF forwards the Gx interface to Policy and Charging Enforcement.
9. A dedicated bearer is established by the request received from P-GW to the smartphone.
10. To the IMS network is sent a SIP UPDATE message.
11. Now a call is established by the IMS network.
12. The call packets flow in bidirectional.
13. The IMS network ask for credit all through the call. If no credit, the call is cancelled and a message is sent to smartphone. The call will be terminated if the credit expires on call.
14. As soon as the call is terminated, a SIP "BYE" message is sent to the IMS network.
15. The IMS network on sending a request for termination, will stop charging the meter and the billing records are collected.
16. As soon as the call is terminated, PCRF will be informed by IMS.
17. The PCRF asks PCEF to terminate the billing and cut down the call.

3. FUTURE OF VoLTE

VoLTE is now in the market and the future technology relies on Network functions virtualization (NFV) [7]. With this NFV technology, one can create virtual elements in the cloud. The elements used will be EPC and IMS. For this to happen a mechanism called Software Defined Networking (SDN) is used. With this SDN, the necessary VoLTE architecture is created. This will also the operators to automate the subscribers access validation. Thus by virtualizing IMS, VoLTE`s cost will be reduced enormously. The future also relies on Heterogeneous Networks (HetNets). Here the cells used are of various sizes. We can achieve high spectral efficiency if the interference in small cells are controlled.

4. CONCLUSIONS

In voice communication, VoLTE is considered the future on all wireless networks, whether wireless users need it or not. There will be benefits to consumers in the long run. The key contribution of this paper is regarding to VoLTE call flow. The author also emphasis on VoLTE future technology called Network functions virtualization.

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