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Analysis of Methods to Transmission Voice in LTE Networks

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ABSTRACT*: The LTE network transmission issue of telephone traffic is of particular importance. LTE standard is designed for the transmission of packet traffic, so it does not implement the service circuit-switched telephony. But namely voice traffic gives to mobile operators the most of income. In this paper proposed Comparative analysis of solutions of voice in LTE.*

***KEYWORDS** – LTE, CSFB, SRVCC, traffic , voice* **.**

I. INTRODUCTION

Due to the growing interest in mobile broadband Internet access, mobile network operators and manufacturers of equipments came to the conclusion that it is time to develop a next-generation technology to meet the needs of users. One of these technologies to solve urgent problems is the technology of the fourth generation (LTE), providing even greater data transfer rates (and, consequently, improve the quality of services offered by the user) at a total cost reduction in the operation of telecommunications equipment. The application of LTE technology enables operators to reduce capital and operating costs, lower the total cost of network ownership, to expand its capabilities in the area of convergence of services and technologies, increase revenue from data services. LTE network support Multicast Broadcast Single Frequency Network (MBSFN), which allows the introduction of such services such as mobile TV and opposed DVB-H. Unlike common reality 3G, LTE-technology networks has increased capacity and more efficient use of the frequency spectrum and the minimum time delay.

II. TRANSMISSION VOICE IN LTE NETWORKS

It is known [3], the quality of voice communications in data networks is determined by the parameters of the delivery of voice packets. Voice packet delivery parameters affect intelligibility, distortion, the delay of the voice signal, the volume, the presence of echoes. This is even more the quality of voice services in data networks affects the use of wireless technology.

Unfortunately, at the present time mobile wireless data communication system in many cases do not satisfy requirements in quality voice service, which is due to the actual operating conditions (and in many conditions of radio wave propagation). The main factors that reduce the quality of mobile wireless data transmission systems are multipath, likely shading, radio propagation characteristics in urban areas, growth in the number of active subscribers, steady complication electromagnetic environment (natural and artificial interference). Poses additional problems and mobility.

Factors affecting the quality of IP-telephony, include:

- delay in the delivery of the package;
- jitter (delay variation);
- network bandwidth;
- probability of packet loss;
- the necessary bandwidth.

According to the materials of the company IXIA [4] for a voice in networks LTE: one-way delay packet - less than 150 ms, jitter - less than 30 ms, the necessary bandwidth - 21 -320 kbit / s

Thus, in a mobile wireless network access to operators standing rad tasks:

- preservation of existing voice services with all the current functionality;
- providing cover for a long time;
- continuity of voice transmission services through various wireless access systems;
- Support for roaming.

One of the most promising wireless access systems today is the technology LTE. Architecture LTE network was designed to provide support for packet traffic with the so-called "smooth" mobility, minimal delay delivery of packages and high levels of quality of service [2]. The main purpose of networks meringue LTE technology is Internet access, voice services earlier in these systems was not provided. However, because voice services are still quite lucrative for operators, it has been developed by different manufacturers making glad voice networks LTE, as well as recommendations ETSI, for example, such 3GPP TS 123.216,3GPP TS 23.272,3GPP TS 23.216.

In order to create the conditions for making calls using VoLTE, you must support this functionality not only the network, but UE (User Equipment / UE).

At the moment, there are three main solutions for the transmission of voice over LTE:

- Circuit Switched Fail-Back (CSFB);
- Voice over LTE Generic Access (VoLGA);
- Single Radio Voice Call Continuity (SRVCC).
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III. CIRCUIT-SWITCHED FALLBACK (CSFB)

One of the first decisions that has spread, is the decision of Circuit-Switched Fallback (CSFB). This solution was first developed by a consortium 3GPP and defined by, for example, in the recommendations: 3GPP TS 23.272, ETSI TS 122,011, ETSI TS 124,301.

The decision is based on CSFB convergence of wireless data networks LTE and networks GSM / UMTS. wherein data transmission services are provided through the LTE and voice services via GSM / UMTS. In this case, the convergence is carried out on a subscriber level: the terminal must be dual-mode and support work in both technologies, the interaction of LTE and GSM / UMTS switching is done at level (MSC).

The base station must support GSM network Dual Transfer Mode, to provide both voice and data, as after completion of the call back to the subscriber unit moves LTE network immediately.

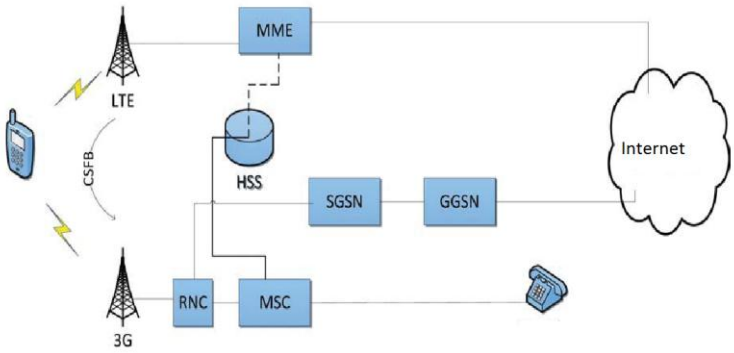

Figure 1. Architecture CSFB

The essence of the solution consists in that the subscriber unit, operating in a network LTE, at the time of the voice call is switched to a traditional GSM or UMTS. A session of the LTE data transfer at this time or be suspended with the recovery after the call, or as switches to GSM / UMTS.

This approach allows the use of existing network infrastructure as the GSM / UMTS, and LTE, and requires virtually no upgrading. Subscribers also provides a full range of traditional services available in the networks of GSM / UMTS, including basic voice calls and additional services, delivery of SMS, calls prepaid and intelligent services.

However, CSFB technology has several drawbacks:

• the cost of upgrading to support MSC to CSFB can be significant.

• The need to switch to GSM / UMTS leads to a marked increase in delay establishing voice connections as in the outbound and inbound calls.

• due to suspend the session or data rates to reduce the level of GSM / UMTS subscribers may create the impression that while a voice call session data is interrupted.

• it is imperative Coverage radio for LTE and GSM / UMTS.

A serious drawback is the fact that few networks GSM, that support Mode Dual Transfer Mode, which allows simultaneous voice and data transmission, as after completion of the call back to the subscriber unit moves LTE network immediately.

IV. (VOICE OVER LTE VIA GENERIC ACCESS) VOLGA

The solution was developed by VoLGA Forum. The initiators of the development of the decision made by the manufacturers of the equipment, but the solution is not standardized.

VoLGA also makes full use of the infrastructure networks GSM / UMTS and LTE. A key feature of the solution is the presence of VoLGA Access Gateway - VANC (VoLGA Access Network Controller.

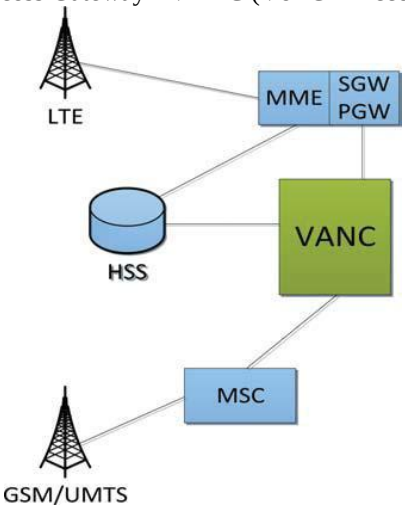

Figure 2. architecture VoLGA

In networks LTE, VANC connected to the packet gateway (P-GW) via a standard interface SGi, that carries both signal and user traffic (voice). On the part of the network LTE, VANC looks like any other external IP-node and IP packets are transmitted between subscriber units and gateway VANC.

From the point of view of circuit switchboard network (GSM / UMTS) gateway VANC connected to the switchboard MSC. For MSC Gateway VANC - normal base station controller GSM network or a radio network controller UMTS.

In this case, subscribers are presented VoLGA switch MSC conventional subscribers GSM / UMTS.

The VoLGA allows operators to use established MSC switches without any upgrades and provide subscribers with the whole set of traditional services available from MSC.

To use the network VoLGA natural requirement is to support the procedures and protocols of VoLGA on subscriber devices.

However, despite the apparent attractiveness, this solution has not received wide acceptance in the mobile industry. Architecture VoLGA actually passed into the frozen state after the publication of the recommendations of NGNM to use CSFB. Operators seeking to prevent fragmentation of networks and avoid problems with roaming inherent in the implementation of incompatible methods of voice over LTE.

V. SINGLE RADIO VOICE CALL CONTINUITY (SRVCC)

In connection with the development of 3GPP technologies continued study voice in LTE networks and developed the solution SRVCC, which was standardized in the recommendations: 3GPP TS 23.216, 3GPP TS 23.292,3GPP TS 23.237.

This solution is based on the convergence of wireless data networks LTE and networks GSM / UMTS. A key feature is the availability of the equipment operator IMS. In that solution, the convergence is performed at the subscriber level: the terminal must be dual-mode and support the work of both technologies, the interaction of LTE networks and GSM / UMTS equipment is carried at IMS.

The solution SRVCC seamlessly automatically transmit the current session (handover), which enables operators to seamlessly transmit voice traffic from LTE networks in GSM / UMTS.

One of the key technologies to ensure continuity at the exit of the subscriber network coverage LTE.The essence SRVCC is that, that any call to signaling terms "fastened" in domain IMS for a specific application server (SCC-AS). LTE network signal to switchboard MSC about handover subscriber device in GSM / UMTS, and the switch MSC, improved support SRVCC, initiates a voice call transfer (from the SCC-AS to a subscriber unit), the coordinating process with the process of normal handover to GSM subscriber unit / UMTS. This second "half" call by SCC-AS to the recipient, remains unchanged.

Architecture SRVCC shown in Fig. 3.

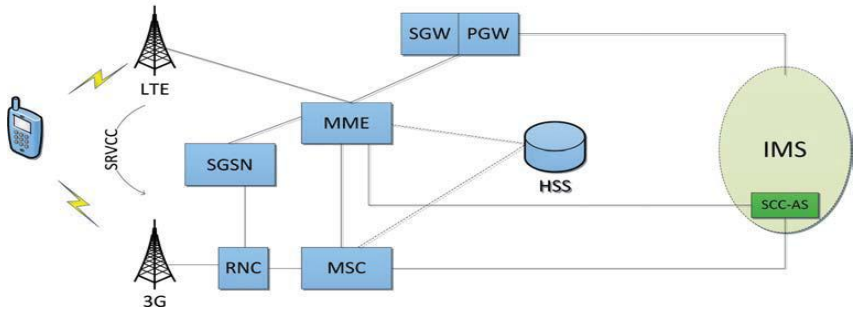

Figure. 3. Solution Architecture SRVCC

Architecture SRVCC uses an enhanced version of SIP (Session Initiation Protocol) to process voice calls and text messages. To realization this solution revealed several problems. Requires terminals supporting SRVCC; application IMS in the operator's network; modernization of the network switch MSC to GSM / UMTS. The realization of SRVCC based on IMS possible to solve several problems: - to provide support for emergency services; - To solve the problem of long delays handover- when the subscriber is roaming.

VI. CONCLUSION

Thus, despite the attractiveness of network LTE, major drawbacks is the inability to transmit voice over the network. Therefore operators have to resort to a modern solution to this problem.

Modern solutions involve voice:

• infrastructure through cellular networks;

• In the case of IMS;

• Voice over IP protocol;

• using the LTE network controllers to establish the call.

Table 1 shows the comparative of characteristics of the solutions reviewed.

solution	Advantages	Drawbacks
CSFB	He requires IMS. Allows reuse existing infrastructure networks GSM / UMTS and LTE.	Modernization of MSC. It should coverage LTE networks and GSM / UMTS. subscriber equipment required to support procedures and protocols. base station must support the mode Dual Transfer Mode. Most post-composing delay
VoLGA	It does not require rework switching centers (MSC). Allows reuse existing infrastructure networks GSM / UMTS and LTE.	Subscriber equipment required support for specialized procedures and protocols. not standardized. It requires additional Equipment (VANC).
SRVCC	Support for voice call continuity during handover LTE-GSM / UMTS. Minimum composing of post-delay. Support emergency services.	Expensive decision on implementation, as it requires the use of IMS systems modernization MSC The need to support technology VSS UE

As can be seen from Table 1, no solution is not fully provides voice to the extent necessary. Uncertain payback period, high cost, the fragmentation of networks in the implementation of various decisions and maintain a subscriber devices stop operators.

Differences in the realization of support voice calls over LTE is one of the main factors hindering their widespread use around the world. So the question of the mechanisms of voice over LTE is still open, therefore it is necessary to develop a united solution to eliminate the defects of solutions CSFB, VoLGA, SRVCC. This united solution can be completion subscriber unit, which will provide for the automatic recognition and connection to different radio access systems LTE / GSM / UMTS, which will provide a continuous handover and improve quality of voice services in mobile networks .

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