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A Comparative Study of 4G and VoLTE

Atharva Khandekar[1], Aditi Bhide[2], Prof. Amit Hatekar[3]
[1]*Undergraduate Research Scholar, Department of Electronics and Telecommunication, Thadomal Shahani Engineering College, Mumbai-50, Maharashtra*
[2]*Undergraduate Research Scholar, Department of Electronics and Telecommunication, Thadomal Shahani Engineering College, Mumbai-50, Maharashtra*
[31]*Assistant Professor, Department of Electronics and Telecommunication Thadomal Shahani Engineering College, Mumbai-50, Maharashtra*

Abstract: ***This research paper provides an insight into the comparison between VoLTE and 4G. 4G Wireless Systems or Fourth generation wireless system is a packet switched wireless system with wide area coverage and high throughput. It is designed to be cost effective and to provide high spectral efficiency. VoLTE (voice over LTE) supports voice calls over 4G LTE network. With advanced VoLTE technology, the 4G network now provides high-speed data services, high-quality voice and video calls at affordable price. This paper first presents the challenges and benefits of both 4G and VoLTE and then compares them with consideration of different points.***
Keywords: GSM, LTE, VoLTE, 3G, HSPA, RAN

I. INTRODUCTION

LTE, an abbreviation for Long-Term Evolution, commonly marketed as 4G LTE, is a standard for wireless communication of high-speed data for mobile phones and data terminals. It is based on the GSM/EDGE and UMTS/HSPA network technologies, increasing the capacity and speed using a different radio interface together with core network improvements. The standard is developed by the 3GPP (3rd Generation Partnership Project). Providing much higher data speeds and greatly improved performance as well as lower operating costs, the scheme started to be deployed in its basic form around 2008.Initial deployments gave little improvement over 3G HSPA and were sometimes dubbed 3.5G or 3.99G, but soon the full capability of LTE was realised it provided a full 4G level of performance.

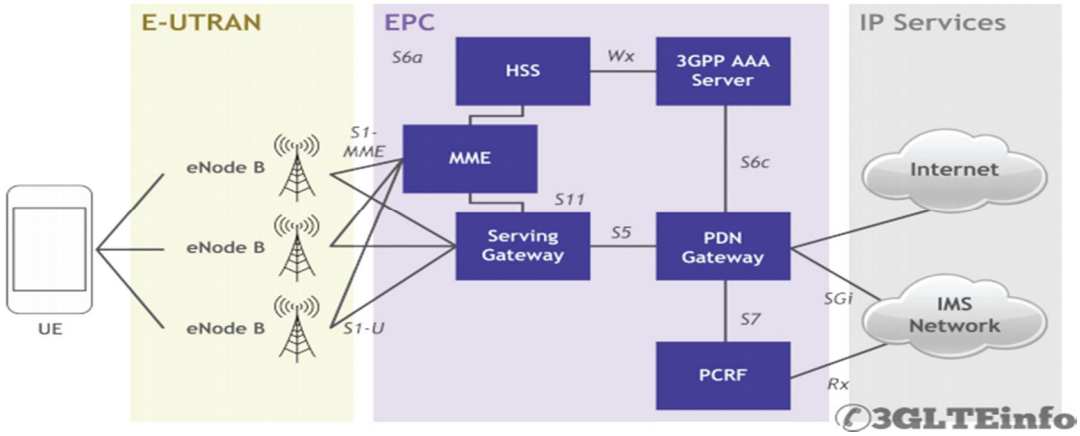


Fig 1. 4G/LTE Architecture

VoLTE stands for 'Voice over Long Term Evolution'. Utilising IMS technology, it is a digital packet voice service delivered over IP via an LTE access network. Voice calls over LTE are recognised as the industry-agreed progression of voice services across mobile networks, deploying LTE radio access technology. Since its standardization over a decade ago, VoLTE, or Voice over LTE, has been deployed by operators around the world. Compared to the traditional circuit-based 2G/3G voice solutions, VoLTE provides better voice experiences, enables rich multi-media communications features, and makes the network more efficient for operators.

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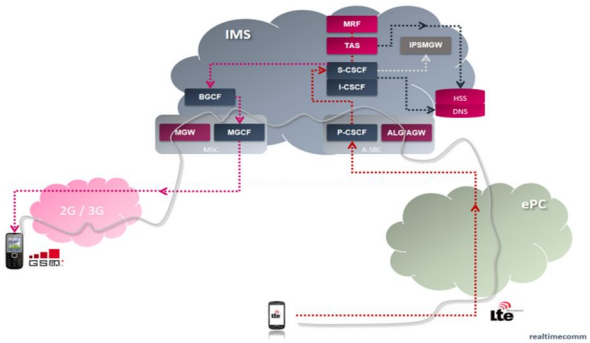


Fig 2. VoLTE Architecture

II. ADVANTAGES AND CHALLENGES FOR 4G/LTE

A. Advantages and Challenges of VoLTE

1) Advantages

a) Data as well as voice can be exchanged between participants. This is because LTE supports packet switching.

b) High amounts of data can be transferred between the sender and the receiver.

c) All data exchange occurs with very less power consumption. This leads to better life of the smartphone batteries.

d) It has high speed of the file upload and downloads.

e) It releases the network usage faster. This decreases the load on the network.

f) This decreases the traffic and moves towards lesser crashes in the service.

g) Live shows, matches and events can be easily watched using LTE.

2) Challenges

a) One of the main issues is the operating area which is a drawback to all communication networks like 2G, 3G also. As we know that many rural areas and many buildings in metropolitan cities where there with no network coverage in this technological world. This is due to our present communication standards and equipment which should be improved for this latest technology which is a promising one to deliver communication and many others advanced applications everywhere which can't be possible unless our operating area is enhanced in an effective manner.

b) In this digital world security is an important aspect in communication networks. As 4G network is not used for just communication but also it provides different functions like internet which is to be much secured. So we should estimate and solve the different security threats of 4G networks like IP spoofing, User ID theft, Denial of service, Intrusion attacks which may cause loss of information or leakage of information which is considered as great threat for the users.

c) Quality of service is more important for 4G networks as we know that telecommunication is a real time communication like Voice over IP and video streaming .In real time traffics quality of service is very important as we should estimate some factors like bit rate, jitter, delay, packet drop probability to avoid network congestion in available bandwidth effectively.

B. Advantages and Challenges of VoLTE

1) Advantages

a) Innovate and secure add-on revenues with targeted offerings using new functionality like video calling, multi-device with call transfer between your own devices, several numbers on the same phone etc. Get great reach for these services over LTE and Wi-Fi

b) VoLTE enables simultaneous LTE data surfing and voice calls (i.e. do not fall back to 2G or 3G coverage while making a voice call)

c) Faster call set-up times than in 2G/3G networks (around 1.5 sec in LTE vs. around 3.5-5 seconds in 2G/3G) and also enables quicker availability to supplementary services

d) Improved voice quality with new codec for HD voice (AMR-WB) is default on LTE/VoLTE enabled smartphones

e) Use native dialler with high-quality voice calls building on VoLTE (Quality-of service), combined with business and enterprise collaboration capabilities also for enterprise users

f) Add on unified communication offerings with enterprise collaboration capabilities on top of the VoLTE network

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2) Challenges

a) VoLTE issues within developed markets are related primarily to the EPC (Authentication failures, Gateway failures, Network failures, QoS handling failures) and IMS (SIP timeouts, Bearer control issues, diameter failures, service integration issues). Challenges can also arise between domains, where it can be difficult to pin point the root cause of issues – their location and whether it was the device, the RAN, the EPC, or the IMS.

b) In developed markets, any challenges inherent in VoLTE deployment are very different because networks have been established for longer, and there is a better overall understanding of LTE. The biggest difference is when the network is of a high quality. In this case any issues around VoLTE tend to be found in the core network, and on the user devices themselves, rather than the RAN.

c) One way calls or mute calls are also an issue for operators. This means that there are no packets flowing in one direction, and there is a loss of voice for a period of time. Detecting these types of calls requires the operator to identify when packets are not flowing from both sides of the call. This may indicate that one side of the call is muted. Operators can highlight this by correlating the UL and DL RTP streams and analysing the duration of the minimum PMOS.

III. COMPARISON BETWEEN LTE AND VoLTE

Comparing LTE and VoLTE

Parameters	LTE	VoLTE
Primary Purpose	LTE was originally developed to assist data-only applications. LTE was designed for lower latency, which is the time taken by the data to transmit over a given network; along with higher capacity for bandwidth. This made it ideal for Internet of Things.	VoLTE was designed to assist in both, voice as well as data transmission; rendering it more multifaceted. VoLTE maintained the salient features of LTE, and it corrected the glaring challenges faced by LTE/4G.
Voice Quality	LTE may or may not support voice and data services at the same time without affecting the voice quality, thus making it less efficient than VoLTE networks.	VoLTE networks enable faster voice call set-up. Both the users will experience an uninterrupted call session, if they are on VoLTE networks, resulting in seamless calls.
Switching Type	LTE avails packet switching exclusively and cannot support circuit-switched networks	VoLTE utilises current-packet switched LTE Network to deliver high-definition voice conversations. VoLTE avails digital packet switched network with much more efficiency, compared to traditional services.
Data Connection	In LTE, the network will switch off the data connection while making voice calls. LTE is targeted for increasing data rates on the 4G bandwidth	You don't need to turn your data connection off while making a voice call in VoLTE. VoLTE is targeted towards both voice calling and internet data without affecting each other.
Internet Dependability	Internet data should be enabled at all times in order to make free calls and it cannot be turned off	In VoLTE, on the other hand, you don't have to keep the internet data on to make free calls.
Call Reliability	While 4G takes longer to get up because it has to switch to a lower network, it has fewer call dropouts and call failures as it caters to a larger coverage area.	Although VoLTE has a faster call setup time, the call drop or failure rate is greater on the VoLTE network, which is still being improved or corrected by service providers.
Signal to Noise Ratio	LTE provides superior QoS. The higher the SINR, the higher the quality of service. As LTE employs 4G for internet and 2G or 3G for voice, it fares well in SNR tests. The SINR for 4G is high because it frequently switches to different networks such as 2G or 3G in order to deliver better signals to the client. However, because of the frequent conversions, the equipment's power consumption increases.	While data is only utilised for calling with VoLTE, it is not used for anything else. They have more network challenges and their signal connection is poor, as a result, the SNR for VoLTE is poor.
External Software	External software is required for you to make video calls on LTE networks such as Skype, WhatsApp, Facebook Messenger, etc.	You do not need any external software to make video calls on VoLTE networks – you just need your phone number to video call anybody.
Free Calling	In the case of LTE, to make free calls, the user needs constant internet access. Internet Connection cannot be turned off by the user, which can prove to be tedious.	In VoLTE, even if the internet connection is turned off, the user can make free calls.
Battery Consumption	In LTE, both the data and the battery are practically completely depleted.	in VoLTE, unlike LTE, data and battery are not heavily depleted as in this high-speed wireless communication standard, the system was an improvement on the previously developed LTE/4G.

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IV. PROPOSED IDEA FOR THE FUTURE

The 4G technology can be used in wildlife conservation. Signal towers can be erected at certain distances which assist the availability of the network. For example, using network for tracking the exact location of the animal that needs to tracked for the purpose of the study. It will be very helpful for the forest rangers to study the pattern in their behaviour and thus will contribute for the conservation.

V. CONCLUSION

We have undertaken an objective, comprehensive examination of 4G and VoLTE in this paper, with an emphasis on their benefits, problems, and performance analysis in real-world network implementation. We objectively distinguished the two recently developed wireless communication standards for mobile phones and data terminals, using a variety of parameters. In terms of calling, the 4G network is currently the better-suited option, while VoLTE is most favourable for streaming videos and accessing the internet. We may deduce that equipment with 4G as the network spent more power than equipment with VoLTE, based on the fact that 4G continuously switches to other networks, such as 2G or 3G, to deliver the best signal to the consumer; whereas 4G switches to the best signal, according to the requirement of the customer base.

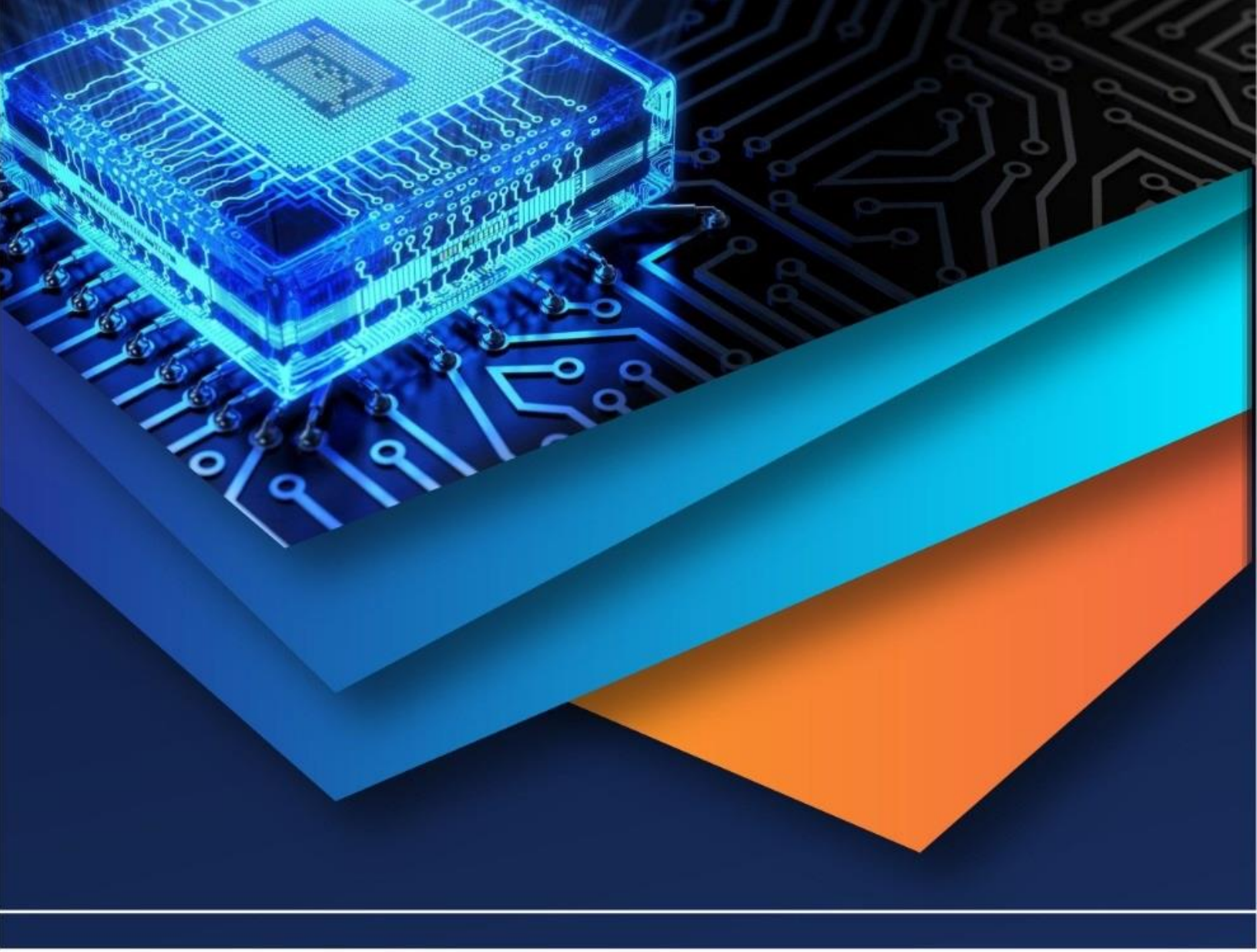
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