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A REVIEW PAPER ON LONG TERM EVALUATION (LTE)

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Abstract

This paper provides an overview of the Universal Mobile Telecommunication System (UMTS) Long Term Evolution (LTE), which is being developed by the 3rd Generation Partnership Project (3GPP). LTE represents the latest step towards the 4th generation (4G) of radio technologies designed to improve mobile communications capability and speed. Particular attention is paid to the specifications and goals of LTE, the use of multiple antenna techniques, and the modulation scheme used in the LTE uplink of the Single Carrier Frequency Division Multiple Access (SC-FDMA). In addition, new future research areas are suggested here. For both Global System for Mobile Communication (GSM) and Code Division Multiple Access (CDMA) cellular carriers, Long Term Transition is the next-generation 4G technology. Authorized in 2008 with up to 173 Mb/sec download speeds, LTE was specified in the 3GPP Release 8 specification by the 3G Partnership Project.

Keywords: *Code Division Multiple Access (CDMA), Global System for Mobile Communications (GSM), Long Term Evolution (LTE), Universal Mobile Telecommunication System (UMTS).*

I. INTRODUCTION

In comparison to the previous 3G systems, LTE uses a different air interface and packet layout, like GSM's UMTS: Wideband CDMA (W-CDMA) and High Speed Packet Access (HSPA) and CDMA's Evolution-Data Optimized (EV-DO)[1]. It is expected, however, that both GSM and CDMA2000 carriers will eventually switch to LTE to provide a worldwide interoperable cellular infrastructure[2]. LTE is a collection of UMTS improvements that was implemented in Release 8 of 3GPP. Most of 3GPP Release 8 focuses on implementing 4G mobile communication technologies, including a flat networking architecture for all Internet Protocol (IP)[3]. The European Commission reported on August 18, 2009 that it would invest a total of EUR 18 million in research into the implementation of LTE and the LTE-Advanced certified 4G system (LTE-A). Figure 1 depicts the basic technology acceptance model[4].

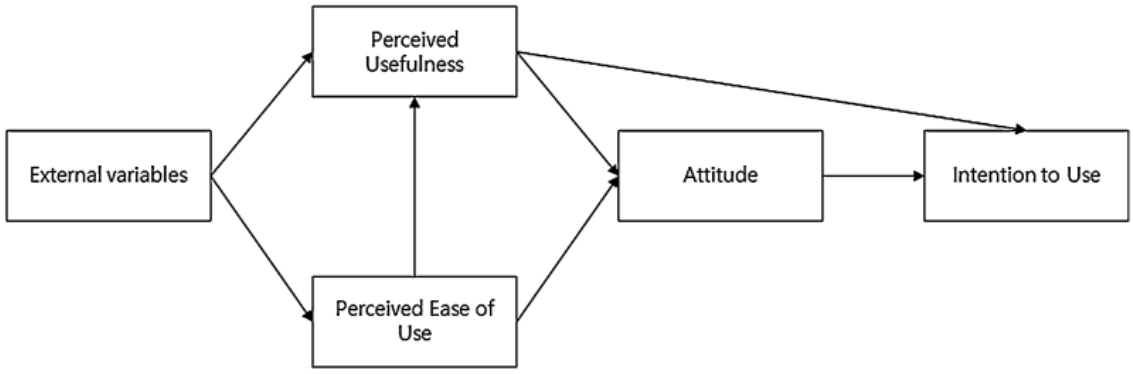

Fig.1 Illustrates the basic Technology Acceptance Model[5].

S. No.		Release-6 HSDPA	LTE	LTE target
1	Peak bit rate (Mbps)	13.3	143	99
2	Spectral efficiency (b/s/Hz)	0.74	1.83	2-3 times of HSDPA
3	Cell edge user throughput (b/s/Hz)	0.005	0.0183	1-2 times of HSDPA

Table 1 Illustrates downlink.

S. No.		Release-6 HSDPA	LTE	LTE target

1	Peak bit rate (Mbps)	4.7	56	49
2	Spectral efficiency (b/s/Hz)	0.25	0.66	3-4 times of HSUPA
3	Cell edge user throughput (b/s/Hz)	0.006	0.014	3-4 times of HSUPA

Table 2 Illustrates uplink.

The use of multiple access technologies is focused on downlink and uplink transmission in LTE: specifically, multiple access orthogonal frequency division (OFDMA) for the downlink, and multiple access single-carrier frequency division (SC-FDMA) for the uplink[6]. The downlink is first considered. OFDMA is a type of multiplexing orthogonal frequency division (OFDM), a multi-carrier optical modulation scheme commonly used in wireless networks but relatively new to cellular systems. OFDM makes use of a large number of closely spaced orthogonal subcarriers that are transmitted in parallel, rather than transmitting a high-rate data stream with a single carrier (Table 1 & 2)[7].

Holma et al. conducted a survey on LTE for UMTS Evolution to LTE-Advanced. Summary: "LTE for UMTS, Second Edition provides a complete and up-to-date overview of Long-term Evolution (LTE) in a systematic and clear way, written by experts actively involved in the 3GPP standards and product development. Building on the success of the first edition, LTE for UMTS, Second Edition has been revised to now include enhanced coverage of the details of Release 8 LTE, including fie fie." This new edition also provides an overview of Release 10, including an overview of Release 10 LTE-Advanced technology components that allow data rates above 1 GBPS to be achieved.

II. DISCUSSION AND CONCLUSION

The high OFDM-related peak-to-average ratio (PAR) led 3GPP to search for a different LTE uplink transmission scheme. SC-FDMA was chosen because it combines the low PAR techniques with the multi-path resistance and versatile frequency allocation of OFDMA in single-carrier transmission systems, such as GSM and CDMA. A short description of SC-FDMA is as follows: data symbols in the time domain are converted using a discrete Fourier transform (DFT) to the frequency domain; then they are mapped to the desired location in the

overall channel bandwidth in the frequency domain before being converted back to the time domain using an inverse FFTT (IFFT).

In this paper an overview of the LTE and LTE-A is provided. The overview focused on the LTE requirements and targets, time line for the LTE deployment, multiple access technology in LTE, MIMO, and the proposed research areas. The paper also discusses few potential new research areas covering cloud radio access network, Multihop wireless networks, and Resilience and reliability of LTE with MPLS. Recent studies have tackled the network capacity and optimization of data-transfer speed by applying protocols such as MPLS on the IP levels and on the backhaul part of networks to enhance the network performance. More studies are needed to look further into issues related to the LTE network resilient and reliability of infrastructure especially during increased demand, catastrophic network failures, or during natural disasters[8].

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