



## LTE-A AS A PROMISING WIRELESS COMMUNICATION

<sup>1</sup>P. BRINDA, <sup>2</sup>M. S. KRISHNAVENTI, <sup>3</sup>Dr. M. PUSHPARANI

<sup>1,2</sup>M.Phil., (computer science), <sup>3</sup>Professor and Head,

<sup>1,2,3</sup>Department of Computer Science,

<sup>1,2,3</sup>Mother Teresa Women's University,

<sup>1,2,3</sup>Kodaikanal.

### Abstract:-

In current the most widely using wireless broad band technology is LTE-A. LTE – A (Advanced Long Term Evolution) is also known as LTE Release 10 is a centralized transport network. LTE- A is a promising standard wireless communication of high-speed data for mobile phones and data terminals. It enhances LTE release 8 and it features enable one to meet or exceed IMT advance, provides high data speed between mobile phones and base antennas. LTE-A is able to realize the local meshing between eNBs. The performance race toward supporting LTE-Advanced, at the highest data throughputs and highest user densities, is now underway. This paper briefly describes LTE-A technology and its challenges.

**Keywords:** - Long Term Evolution, Ultra-Mobile Broadband, Orthogonal Frequency Division Multiplexing, Multiple Input-Multiple Output.

### 1. INTRODUCTION

The evolution of wireless communication comes under various generations based on their technologies used. In 2009 the first 4G LTE commercial networks launched in Scandinavia, and LTE-A launched in Kenya. Nairobi, Kenya- 20 January 2015. Safaricom, Kenya's leading operator, selected Nokia Networks as one of its partners to modernize and expand its 2G and 3G network infrastructure

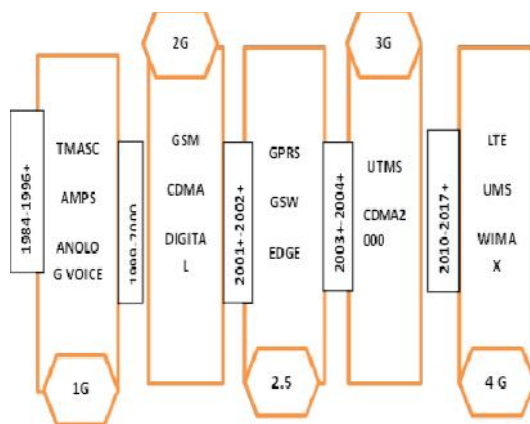
and to help launch the first LTE-Advanced (LTE-A) network in Kenya.

The United Arab Emirates' second-largest operator Du launched its LTE-A network through a partnership with Nokia Networks. The Telco used Nokia Networks' advanced radio platform Flexi Multiradio 10 Base Station, carrier aggregation software, and professional services, combining FDD-LTE bands 1800 MHz and 800 MHz's [5]

LTE ( Long Term Evolution ) is a 4G wireless communications standard developed by the 3rd generation partnership project (3GPP) [1] that's designed to provide up to 10x the speeds of 3g network for mobile devices such as Smartphone, tablets, notebooks, and wireless hotspots. The 3GPP or 3rd. generation partnership project is a consortium, or collaboration, of standardization bodies in mobile communications. In this paper, we summarize these findings in order to highlight research challenges given by LTE-A [4]. It support heterogeneous deployments where low power nodes comprising Pico cells, femto cells, relays, remote radio heads and so on are placed in a microcells layout. LTE-A includes bandwidth extension via carrier aggregation to support deployment bandwidth up to 100 MHz's. In this article we describe the deployment sceneries applicable technologies used in LTE - A and its advantages.

## 2. WIRELESS TECHNOLOGIES MIGRATION

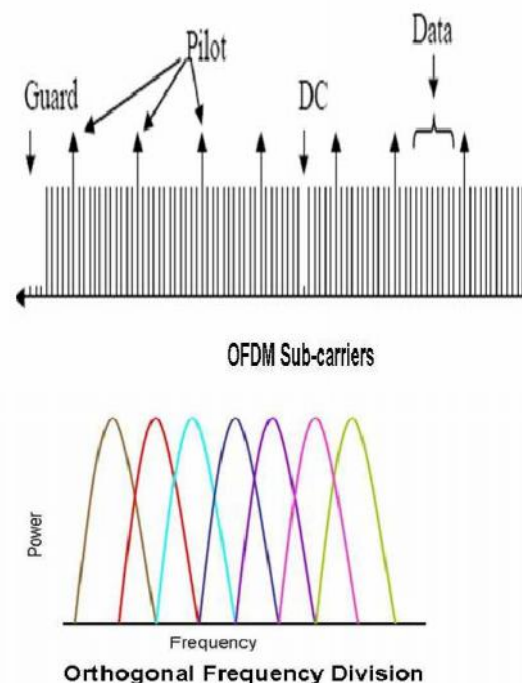
The first generation 1G was represented by analog wireless access system primarily for voice traffic. The AMPS (Advance Mobile Phone System) in United States and the TACS (total access communication system) in most parts of Europe represented in generation. The 1G technology was soon replaced by second generation or 2G technologies which represented the replacement of the analog radio network with digital radio network. There is an intermediated technology in 2G technology led to interim generation of 2.5G which implemented a packet switched domain in addition to circuit switched domain. general packet radio services(GPRS) was the 2.5 G technology adopted by GSM.The 2G technology led to evolution of third generation of mobile technology, better known as 3G.the first pre commercial and commercial 3G technologies was UTMS(universal mobile telecommunication system)is adopted 3G using W\_CDMA(Wideband code division multiple access) as the air interface. UTMS is some time called as technologies to 3GMS to emphasize the fact that it is the 3<sup>rd</sup> generation technology succeeding GSM[7].from figure:1 we can clearly understand the 4G migration in wireless technologies.



**Figure 1: migration of wireless communication**

## 3. TECHNOLOGIES ADOPTED

**3.1 OFDM: Orthogonal Frequency Division Multiplexing** is a superior air access method compared to its predecessor CDMA. Also OFDM is one of the key technologies which enable non-line of sight wireless services making it possible to extend wireless access system over wide-areas. OFDM (Figure 2) divides the frequency bandwidth in narrow orthogonal sub-parts called sub-carriers. A sub-channel is an aggregation of a number of these sub-carriers. The sub-carriers include data carriers, pilot carriers and a DC.



**Figure 2: OFDM SUB CARRIERS AND ITS FREQUENCY [7]**

**3.2 MIMO: Multiple Input Multiple Outputs (MIMO)** is one of the most popular Advanced Antenna Technologies which is supported both by LTE and UMB. The salient features of MIMO is that it offers higher throughput for a given bandwidth and higher link range for a given power value. In MIMO the transmitter and receiver have multiple antennas giving MIMO multiple flavors based on the number of antennas present on each side. However,

the key idea is that a transmitter sends multiple streams on multiple transmit antennas 9 of 15 and each transmitted stream goes through different paths to reach each receiver antenna as shown in Figure 3. The different paths taken by the same stream to reach multiple receivers allow canceling errors using superior signal processing techniques. MIMO also achieves spatial multiplexing to distinguish among different symbols on the same Frequency. MIMO thus helps in achieving higher spectral efficiency and Link reliability. It specifies downlink peak speeds of 326Mbps and uplink peak speeds of 86Mbps, both in a 20 Mhz bandwidth

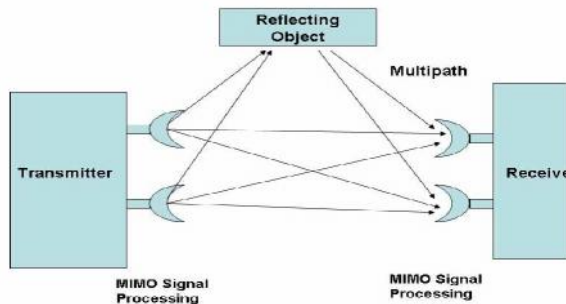


Figure 3: MIMO [7]

**3.3 WIMAX :**( Wireless Interoperability for Microwave Access) it provide peak data rate around 74mbps covering in distance of 50kms and allowing speed of 120kmph.

**3.4 LTE FEMTO CELLS:**

LTE eNodeBFemtocells (compliant with 3GPP Releases 8/9 and including L2/L3 stacks)

- Performs 1ms TTI for handover,>100 Mbps, at low power
- Location determination with 0, 5 m accuracy
- Specific functionality: automatic neighbor relations, SON, mobile load balancing, closed subscriber group options, LIPA, hybrid mobility and inbound mobility, network management for small cell networks
- Example suppliers: Tata Elxsi; see Femto Forum

- Business concepts: 1) off-load 2) closed groups 3) social femto which combines location info with Twitter for check-in etc.

**3.5 Antenna ports**

This antenna ports are logical entities distinguished by their reference signal sequences. Multiple antenna signals can be transmitted on a single transmit antenna. Example: C-RS port 0 and UE-RS port 5. Single antenna port can be spread across multiple transmit antennas Example: UE-RS port 5 [2]

**3.6 Single stream beam forming**

The features of single stream beam forming technology provides expand coverage, increase cell capacity and minimize interference which improves reliability of cell edge users as well as the throughput of cell center users.[3]

**3.7 Dual stream beam forming**

It is used for sufficient signal scatters. It efficiently brings together smart antenna beam forming technologies (single – stream beam forming technology) and MIMO spatial multiplexing technology [3].

**4. LTE TRANSMISSION MODE**

According to the technologies used in LTE, it comes under different modes.

3GPP RELEASE(LTE)	3GPP RELEASE	DESCRIPTION
LTE RELEASE 8	MODE1	Single-antenna support
	MODE2	Transmit diversity
	MODE3	Open-loop spatial multiplexing
	MODE4	Closed-loop spatial multiplexing

	MODE5	Multi-use MIMO
	MODE6	Single layer close-loop spatial Multiplexing
	MODE7	Single-layer beam forming
LTE RELEASE 9	MODE8	Dual-stream beam forming
LTE RELEASE 10	MODE9	Multi-layer transmission
LTE RELEASE 11	MODE10	Multi-layer transmission

**Table: 1 modes of LTE-A**

### 5. BENEFITS OF LTE-A

LTE is a 3GPP standard that provides for an uplink speed of up to 50 (Mbps) and a downlink speed of up to 100 Mbps. We can identify the following in this technology.

1. Higher spectral Efficiency
2. Reduced cost per bit
3. Increased Service provisioning by lowering the cost and increasing efficiency and experience
4. Open Interfaces as against closed technologies of the past
5. Power consumption efficiency
6. Scalable and flexible usage of frequency bands
7. Higher bandwidth with reduced noise.
8. It has multiple antenna support.

### 6. COMPARISONS BETWEEN LTE AND LTE-A

Let us discuss about the difference between the LTE and LTE-A technologies briefly.

LTE	LTE-A
Standard is 3GPP Release 8	Standard is 3GPP Release 10

It support Bandwidth of 1.4MHz, 3.0MHz, 5MHz, 10MHz, 15MHz, 20MHz	It support Bandwidth of 70MHz Downlink(DL), 40MHz Uplink(UL)
Data rate: 300 Mbps Downlink(DL) 4x4MIMO and 20MHz, 75 Mbps Uplink(UL)	Data rate: 1Gbps Downlink(DL), 500 Mbps Uplink(UL)
Theoretical Throughput of LTE is About 100Mbps for single chain(20MHz,100RB ,64QAM), 400Mbps for 4x4 MIMO. 25% os this is used for control/signaling(OVERHEAD)	Theoretical Throughput of LTE is 2 times more than LTE

**Table: 2 LTE vs. LTE-A**

### CONCLUSION

This article presents two main protagonists for the world's 4G efforts and an overview of the technologies of LTE-Advanced. Which make us to move faster; in reality it brings the places closer. We have explored about transmission modes of LTE-Advanced and its technologies used. We hope that LTE-Advanced will provide more features than LTE, such as higher scalable efficiency, flexible usage of frequency bandwidth and fast data communication.

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