Overview of Long Term Evolution

Ved Prakash
Research Scholar
Department of Computer Science and Engineering
KUK

Satish Kumar
Research Scholar
Department of Computer Science and Engineering
MMU Mullana

Abstract

This paper provides a view on the technologies being considered for Long Term Evolution-Advanced (LTE-Advanced). The evolution from third generation (3G) to fourth generation (4G) is described in terms of performance requirements and main characteristics. The main technologies for LTE-Advanced are explained, together with possible improvements, their associated challenges, and some approaches that have been considered to tackle those challenges. By the design and optimization of upcoming radio access techniques and a further evolution of the existing system, the Third Generation Partnership Project (3GPP) had laid down the foundations of the future Long Term Evolution (LTE) advanced standards the 3GPP candidate for 4G. The various technology components like wideband transmission and spectrum sharing, multi antenna solutions, coordinated multiple transmission/reception (CoMP) and relaying, introduced to meet the requirements for LTE Advanced systems, have been discussed.

Keywords: LTE, LTE Advanced, Carrier Aggregation, Coordinated Transmission/Reception, Relaying

General Terms: LTE, -Advanced, Long Term Evolution, spectrum utilization, cell edge throughput

I. INTRODUCTION

Starting with first generation (in 1980’s), based on analogue standards fulfills basic mobile voice (voice calls), moving towards second generation (2G) based on initial digital standards introduced the capacity and coverage, in 1990’s. On the way to 3G there are many more designing scenarios that have deployed in between 2G and 3G like 2.5G. 2.5G includes all advances upgrade to build 2G a stronger network [2]. 2.5G act as bridge between 2G and 3G. 3G provides data at higher speeds to open the gate for truly “mobile broadband”.3G provides 144kbps of throughput at mobile speeds, 384 kbps at pedestrian speeds and 2 mbps in indoor Environment [1]. These requirements are specified by ITU. Now a days LTE (Long Term Evolution) becoming the network technology for choice of 4G deployment around the world, it has the ability to provide very fast, highly responsive data services at low cost. LTE is the initial step taken for the coming generation i.e. fourth generation (4G) Long Term Evolution (LTE)Although 3G technologies deliver significantly higher bit rate than 2G, there is still more opportunities for wireless operators to fulfill the ever changing demand of wireless broadband such as low latency and multi-megabit throughput. The solution for this is Long Term Evolution (LTE), a Third Generation Partnership Project (3GPP) standards that provides much greater spectral efficiency that the most advanced 3G network .LTE is designed to provide multi- Megabit bandwidth, more efficient use of radio network, latency reduction and improved quality. Changes in mobile communication have always been evolutionary and the deployment of LTE will be the same. LTE is the transition from 3G to 4G, as we are still in the stage of transition from 2Gto 3G. As a result mobile operators must look for strategies and solution that enhance their existing 2G and 3G network towards 4G without requiring a complete equipment upgradation. LTE is a solution for this upgradation which is based on new radio access network called OFDM (Orthogonal Frequency Division Multiplexing) technology. Release 8 of 3GPP specified the air interface for LTE which combines OFDMA base modulation and multiple access schemes for the downlink with SC-FDMA (Single Carrier FDMA) for the uplink. OFDM scheme split available spectrum into thousands of extremely narrowband carriers each carrying a part of the signal and further enhanced with higher order modulation and sophisticated FEC (Forward Error correction) scheme. The result of these radio interface feature is significantly improved radio interface features is significantly improved radio performance yielding up to 5times the average throughput of HSPA [9] Uplink Downlink rates compared for HSPA and LTE shown in fig 2 [9]The multimedia are network of LTE will pay a central role in enhancing mobility, efficient use of network resources, service control and a smooth migration from 3G to 4. This is the multimedia core network which meets the requirements of System Architecture Evolution (SAE), the 4G core architecture of the LTE standards. SAE calls for a transition to a flat, all IP core network called Evolved Packet Core (EPC), which features a simplified architecture and open interfaces as defined by the 3GPP standard body. EPC enables operators to launch services and application with internet speed while also reducing the overall cost per packet. EPC also able to address divergent mobility management problem. It supports all access technologies, including 2G, 3G, and 4G from all standards-defining organization. EPC specification call out the Mobility management Entity (MME), Servicing Gateway (SGW) and Packet Data Network Gateway (PGW) as specific network function, these three functions can logically be integrated into one node [7]. Key consideration of LTE is:

- Integration of intelligence at the access edge: this intelligence includes quality of services (QOS) and policy enforcement.
- Simplified network topology: in order to
- Deliver the enhanced performance of LTE effectively, the network needs to be simplified and patterned, by reducing the elements involved in data processing and transport.
- Converged mobility and policy: maintain the subscriber session is an important consideration during 4G to 2G or 4G to 3G mobility events. The Benefits of LTE Provides a global ecosystem with inherent mobility
- Offers easier access and use with greater security and privacy
- Dramatically improves speed and latency
- Delivers enhanced real-time video and multimedia for a better overall experience
- Enables high-performance mobile computing
- Supports real-time applications due to its low latency
- Creates a platform upon which to build and deploy the products and services of today and those of tomorrow
- Reduces cost per bit through improved spectral efficiency
- Within the Verizon Wireless network, LTE will operate in the 700 MHz spectrum, giving it vast potential for greater broadband speeds and access. LTE Performance Estimates and Technical Attributes Once fully deployed, LTE technology offers a number of distinct advantages over other wireless technologies. These advantages include increased performance attributes, such as high peak data rates and low latency, and greater efficiencies in using the wireless spectrum. Improved performance and increased spectral efficiency will allow wireless carriers using LTE as their 4G technology to offer higher quality services and products for their customers.

A. Benefits Expected From LTE Technology:

1) High Peak Speeds:
- 100 Mbps downlink (20 MHz, 2x2 MIMO)
  - both indoors and outdoors
  - 50 Mbps uplink (20 MHz, 1x2)
  - At least 200 active voice users in every 5 MHz (i.e., can support up to 200 active phone calls)

2) Low latency:
- < 5 ms user plane latency for small IP packets (user equipment to radio access network [RAN] edge) < 100 ms camped to active < 50 ms dormant to active. Scalable bandwidth.
- The 4G channel offers four times more bandwidth than current 3G systems and is scalable. So, while 20 MHz channels may not be available everywhere, 4G systems will offer channel sizes down to 5 MHz, in increments of 1.5 MHz. Improved spectrum efficiency:
- Spectrum efficiency refers to how limited bandwidth is used by the access layer of a wireless network. Improved spectrum efficiency allows more information to be transmitted in a given bandwidth, while increasing the number of users and services the network can support. Two to four times more information can be transmitted versus the previous benchmark, HSPA Release 6.

B. Improved Cell Edge Data Rates:
- Not only does spectral efficiency improve near cell towers, it also improves at the coverage area or cell edge. Data rates improve two to three times at the cell edge over the previous benchmark, HSPA Release 6. Packet domain only
- Enhanced support for end-to-end quality of service
- Reducing handover latency and packet loss is key to delivering a quality service. This reduction is considerably more challenging with mobile broadband than with fixed-line broadband. The time variability and unpredictability of the channel become more acute. Additional complications arise from the need to hand over sessions from one cell to another as users cross coverage boundaries. These handover sessions require seamless coordination of radio resources across multiple cells. The Advantages of LTE Despite their similarities, Verizon Wireless has chosen to deploy LTE because it offers a number of distinct advantages over WiMAX. Higher data rates and lower latency make LTE connections more responsive, enabling real-time multicast applications, such as online gaming and video conferencing. Choosing the 700 MHz frequency as the basis of the Verizon Wireless network results in a longer range from the base station, compared with systems operating at 2.5 GHz or 3.5 GHz. In addition, using the 700 MHz frequency allows for better in-building penetration and coverage by wireless signals, helping to improve network conditions. LTE also offers mobile users better coverage as they travel by providing seamless handover and roaming for true mobility. LTE is better suited for global adoption than WiMAX. Although 2.5 GHz, 3.5 GHz, and 5.8 GHz bands are allotted in many regions of the world, many growth markets require new allocations to service their populations. Given the diverse requirements and regulations of various governments, it will be a challenge for WiMAX to achieve global harmonization.

LTE has strong and widespread support from the mobile industry, including support from a majority of the industry’s key players. Many vendors will enable operator transition to LTE in a progressive, scalable, and cost-effective way—protecting investments in existing technologies made by today’s GSM and CDMA carriers. GSM is the most popular mobile communications standard currently in use. Carriers on the GSM standard predominate around the globe and will use LTE as their
wireless network upgrade pathway. According to an April 2008 report from Gartner Inc., the GSM family will account for 89% of the global market in 2011. In addition, LTE figures to enjoy widespread device support as most major device vendors have publicly announced the development of products to take advantage of LTE.

II. CONCLUSION

LTE is the future of the Verizon Wireless wireless broadband network. This technology will allow Verizon Wireless to offer users more of what they want, which is untethered mobility. Plus, LTE will support more of the products and services in use today, because of its backward compatibility to 3GPP networks. Verizon Wireless is fully committed to LTE mobile technology and improving its wireless network. To that end, the company actively participates in the development of technology standards to ensure that future standards will greatly benefit its customers. Verizon Wireless believes in the viability of the LTE standard and its future potential, having spent countless hours researching and testing 4G technologies to determine the best fit for its network. For these reasons, Verizon Wireless chose LTE as the technology to deliver the next generation of mobile services and applications to its customers.

REFERENCES

[7] Article “LTE services and implication”.