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4G LTE: It's Overview

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Abstract— Thispaper gives an overview of LTE Technology. Itis based on GSM and UMTS Network Technology. LTE is Packet Switch Network. It represents latest step towards the Fourth Generation and is 10 times faster than 3G. It is able to handle download speed between 5 & 12 Mbps and upload speed between 2 & 5 Mbps with peak download speed approaching 50 Mbps. It is invented to improve the capacity and speed of Mobile Communication. The advance features of LTE Technology includes MIMO, OFDMA, SC-FDMA and Multichip wireless Network.

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I .INTRODUCTION

LTE is the next generation for 4G technology for global system, mobile communication& code division multiple access cellular carriers. LTE technology started in 2008.It was invented with 3GPP, utilizes a different air interface than 3G system, like GSM, UMTS, CDMA and HSPA .LTE allows the 20 MHz with a peak data rate of 300Mbps. It is visualize that all GSM and CDMA2000 carriers will finally migrate to LTE to provide an interoperable cellular system worldwide. LTE is a set of enhancement to the UMTS which was introduce in 3GPP Realse8. More of 3GPP Relese8 concentrates on adopting 4G mobile communication technologies, containing an all internet protocol (IP). It is also supported by public safety agencies in United States. It is considering faster than GSM, HSP, based on IP packets and voice travel over IP. The IP part of LTE is called evolved packet system (EPS). The EPS's main function is to provide the user with IP connectivity to a PDN for accessing the Internet, as well as for running service such as Voice over IP (VoIP). LTE network uses aneNodeB, a MME (Mobile management entity), a HSS (home subscriber server), a SGW (serving gateway), and a PGW (a packet data network gateway). These are considered as part of the EPC except eNodeB. Feature enhancement is possible through LTE- CDMA, OFDMA, MIMO, CARRIER AGGRIGATION and RELAYS TECHNOLOGY.

II.NEED

The appetite of advance and speeding service of mobile or internet never end and for the purpose of satisfying the user with the vast range of facilities and benefits for more out of the existing once broadband provides have to bring out LTE technology.

Table (1) and (2) show the requirements of LTE's downlink and uplink, respectively. The fulfillment of peak bit rate in both downlink and uplink is fulfilled while the spectral efficiency and cell edge user throughput is 2.5 times of High Speed Packet downlink Access (HSDPA) and High Speed Packet uplink Access (HSPA).

	Peak bit rate (mbps)	Spectral efficiency (b/s/Hz)	Cell edge user throughput (b/s/Hz)
Release-6 HSDPA	5.7	0.26	0.006
LTE	57	0.67	0.015
LTE target	50	2-3 times of HSUPA	2-3 times of HSUPA

Table (1): Uplink

	Peak bit rate (mbps)	Spectral efficiency (b/s/Hz)	Cell edge user throughput (b/s/Hz)
Release -6 HSDPA	1.44	0.75	0.006
LTE	144	1.84	0.0184
LTE target	100	3-4 times of HSDPA	3-4 times of HSDPA

Table 2: Downlink

III.WORKING OF LTE

Long Term Evolution is a standard for wireless data communications technology and an evolution of the GSM/UMTS standard. The objective of LTE is to increase the capacity and data rates of wireless data network, increase spectrum efficiency, improve coverage, decrease latency and packet-optimized system that carry multiple Radio Access. Therefore, to achieve the goals, the architecture of the network if different from the earlier wireless data transfer network, GPRS. So, the complete overview of the network architecture and basic working principle of LTE network is discussed.

Primarily, thestandard LTE supports packet switching with its all-IP network. The reason why LTE is designed only for packet switching is because it aims to provide seamless

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Internet Protocol connectivity between user equipment and the packet data network (PDN), without any disturbance to the end users' applications while mobility. Due to this characteristic, voice calls and text message natively. In LTE architecture, Evolved UTRN is an important role which is the air interface of LTE better path for mobile networks meanwhile it is conduct by an evolution of the non-radio aspects under the term System Architecture Evolution, which consist the Evolved Packet Core network. Combined LTE and SAE comprise the Evolved Packet System. Along with, LTE network uses an evolved node B, essentially an LTE base station, a Mobile management entity, a home subscriber server, a serving gateway, and a packet data network gateway. These are considered as part of the EPC except eNodeB.

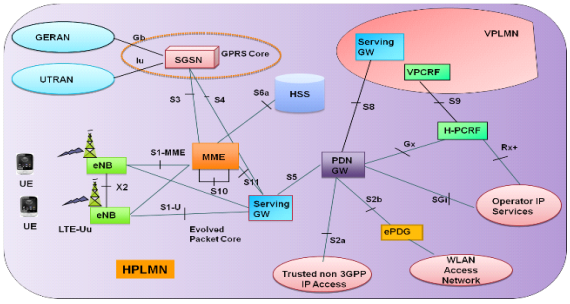

Figure (1)

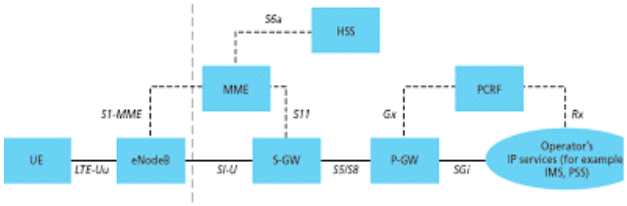

Figure 2

Evolved packet system provides the user with IP connectivity to a PDN for accessing the Internet and for running service such as Voice over IP (VoIP). The bearer of EPS is associated with a QoS. Multiple bearers can be established for a user in order to provide different QoS streams or connectivity to different PDNs. In the above Figure overall network architecture, the network elements and the standardized interfaces are shown. At a high level, the network is comprised of the CN (EPC) and the access network E-UTRAN. While the CN consists of many logical nodes, the access network is made up of essentially just one node, the evolved NodeB (eNodeB), which connects to the UEs. Each of these network elements is interconnected by means of interfaces that are standardized in order to allow multi-vendor interoperability. This gives network operators the feasibility to source different network elements of different vendors. In fact, network operators may choose in their physical implementations to split or merge these logical network elements depending on commercial considerations.

IV.COMPARISION WITH 3G -TECHNOLOGY

A.What is 3G?

"Third generation", 3G is a mobile communication standard. Service providers networks make use of 3G approve technologies. This grants us to connect to the internet through our mobile phones. Before 3G there was 2G. People required more time waiting for web pages to load back then. It was irritating. But 3G overcome that. It was first commercially invented in Japan in 2001. 3G is the third evolution of a project invented in the early 80's. That is nearly 21 years of development.

B. What is LTE?

LTE is a latest version of 3G. LTE is "long term evolution". It is derived from the journey of mobile connectivity. LTE is the greatest of many years of development. It is usually compared to 4G. But the standards for 4G are really higher than LTE's current capacity. We will receive to the speeds in a minute.

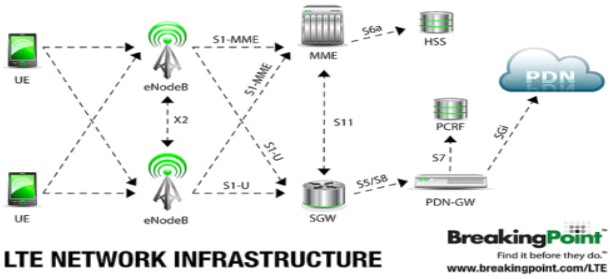

Figure (3)

C. 3G vs. LTE

As 3G and LTE, these two are family. LTE is the modern commercial technology over 3 G technologies. LTE is a faster than 3G, but in high traffic areas can be slower than 3G. When it is urgency hour in the city, it is sometimes faster to take the back roads the freeway. While 3G can be faster than LTE in rare case, the normally is that LTE is more faster. There is also 3G HSPA+, which is faster than its 3G cousin. But it is still no match, under ideal case, to LTE. Network stability can also play a important role in connection speeds. A stable 3G network can better an unstable LTE network.

3G	LTE
Speeds of up to 7.2Mbps.	Speeds of up to 1Gbps.
Old technology with stable, established servers.	New technology. Servers can be unstable in rare cases.
Good for older model phones.	Good for newer model phones.

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V.ENHANCEMENT IN LTE

A.CDMA

Code-Division Multiple Access prefers to any of various protocols used in second-generation and third-generation wireless communications. CDMA is a composition of multiplexing, which permitted many signals to occupy a only one transmission channel, access the use of available bandwidth. This technology is used in ultra-high-frequency cellular telephone systems in the 800-MHz and 1.9-GHz bands.

CDMA use up analog-to-digital conversion (ADC) in co-operation with spread spectrum technology. Audio input is first converted into digital that means binary elements. The frequency of the transmitted signal is vary according to a based band signal, so it can be appropriate only by a receiver whose frequency response is compute with the same code, so it proceed from completely along with the transmitter frequency. There are trillions of accessible frequency-sequencing codes, which increase privacy.

The CDMA channel is normally 1.23 MHz wide. CDMA networks use a scheme called soft handoff, which decreases signal breaking as a handset travel from one cell to another. The combination of digital and spread-spectrum modes comfort various times as more signals per unit bandwidth as analog modes. CDMA is appropriate with other cellular technologies. The original CDMA authoritative, also known as CDMA one, donate a transmission speed of only up to 14.4 kbps in its single channel form and up to 115 Kbps in an eight-channel form. CDMA2000 and Wideband CDMA distribute data many times faster.

B.OFDMA

OFDM is a modulation arrangement that is being used for current wireless and telecommunications standards .OFDM has been approve in the Wi-Fi area where the standards like 802.11a, 802.11n, 802.11ac and more. It has also been used for the cellular telecommunications standard LTE, LTE-A, and in accession to this it has been agree by other standards such as Wi-MAX and more. OFDM is used for large number of broadcast standards from Digital Radio to the Digital Video Broadcast standards. As well as used for broadcast systems containing Digital Radio Mondi ale used for the long medium and short wave bands. While orthogonal frequency division multiplexing is more complicated than previous forms of signal format, OFDMA gives advantages in terms of data transmission, mainly where high data rates are required along with relatively wide bandwidths.

OFDM is a formation of multicarrier modulation. An OFDM signal subsists of a number of nearly spaced modulated carriers. When modulation of any form - voice, data, etc. is applied to a carrier, then sidebands spread out each of two side. It is needed for a receiver to be able to receive the complete signal to be able to satisfyingly demodulate the data. As a result when signals are forwarded close to one another they must be spaced so that the receiver can divide them using a filter and there must be a guard band between them. While the sidebands from each carrier overlap, they can still be received without the interference that might be expected because they are orthogonal to each another. This is obtained by having the carrier spacing equal to the reciprocal of the symbol period.

C.MIMO

MIMOis a radio communications technology or RF technology that is being indicated and used in more new technologies these days. Wi-Fi, LTE, and more other radio, wireless and RF technologies are using the new MIMO wireless technology to deliver improve link capacity and spectral efficiency combined with increase link reliability using what were before seen as interference paths.

There are many MIMO wireless routers on the market, and as this RF technology is becoming more widespread, more MIMO routers and other items of wireless MIMO equipment will be seen. As the technology is complex more engineers are asking what is MIMO and how does it work. A channel may be affected by fading and this will impact the signal to noise ratio. In turn this will impact the error rate, assuming digital data is being transmitted. The principle of variety is to supplied the receiver with multiple types of the same signal. If these can be made to be affected in various ways by the signal path, the probability that they will all be affected at the same time is noticeably reduced. Accordingly, diversity helps to balance a link and increase performance, decrease error rate.

D. CARRIER AGGREGATION

Carrier aggregation is used in LTE-Advanced in order to increase the bandwidth, and thereby increase the bitrate. Since it is important to keep backward similarity with R8 and R9 the aggregation is depend on R8/R9 carriers. Carrier aggregation can be used for both FDD and TDD.

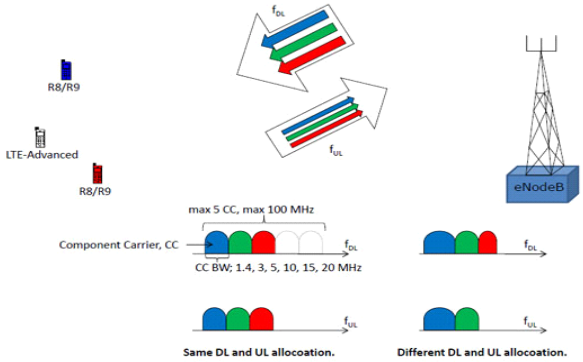

Fig: 4

Fig (4) shows FDD and TDD each aggregated carrier is referred to as a component carrier. The component carrier can have a bandwidth of 1.4, 3, 5, 10, 15 or 20 MHz and a most of five component carriers can be aggregated, therefore the maximum aggregated bandwidth is 100 MHz In FDD the number of aggregated carriers can be different in DL and UL, see figure (4). But, the number of UL component carriers is

always equal to or lower than the number of DL component carriers. The personal component carriers can also be of different bandwidths. For TDD the number of carrier components as well as the bandwidths of each one carrier component will commonly be the same for DL and UL. The simplest way to manage aggregation would be to use adjacent component carriers inside the same operating frequency band (as defined for LTE), so called intra-band contiguous. This might not regular be possible, due to operator frequency allocation scenarios. For non-contiguous allocation it could either be intra-band, i.e. the component carriers belong to the same operating frequency band, but have a gap, or it could be inter-band, in which case the component carriers belong to different operating frequency bands, see figure (5).

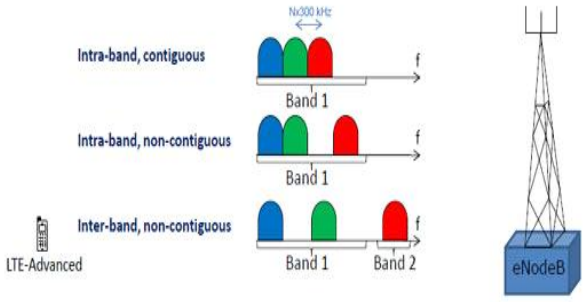

Figure (5)

D.RelayTechnology

LTE relaying is totally different to the utilization of a repeater that re-broadcasts the signal. A relay can receive, demodulates and decodes the info, detects error, etc. so re-transmit a brand new signal. During this means, the relay is employed to boost the quality of signal instead of suffering degradation from a decreases signal to noise quantitative relation once employing a repeater. For associate degree LTE relay, the UEs communicate with the relay node that successively communicates with a donor eNB. Relay nodes will freely transfer higher layer practicality, for instance rewrite user knowledge from the donor eNB and re-encode the info previous transmission to the UE. it's a set relay - infrastructure while not a wired backhaul association that relays messages between the bottom station and mobile stations through multihop communication. There square measure numerous situations wherever LTE
relay are advantageous.Improve network capability: LTE relay nodes are often settle terribly quickly in things wherever the aim is to boost network capacity by increasing the amount of eNBs to confirm smart signal levels square measure received by all users. LTE relays square measure simple to put in as they need no separate backhaul and that they square measure little enabling them to be put in in several convenient areas, e.g. on streetlamps, on walls, etc.

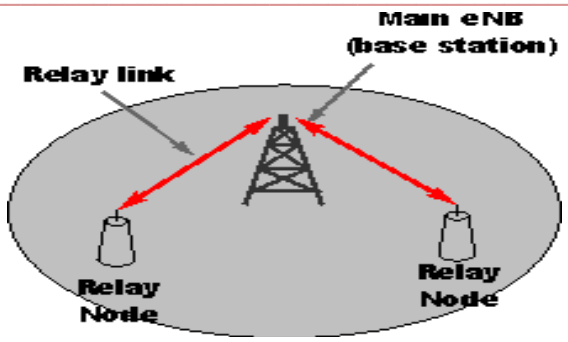

Figure (6) LTE relay used to increase network density

Network coverage addition:It is usedas a suitable method of filling small holes in coverage. There is no need to install a complete base station, the relay can be firstly installed so that it fills in the coverage black spot.

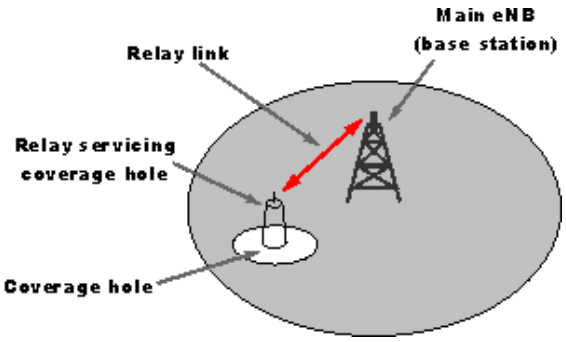

Figure (7) LTE relay coverage addition - filling in coverage hole

VI. CONCLUSION

In this paper 4G LTE: LTE overview provided .The overview concentrated on the need of LTE. In this paper we explain what is LTE, LTE is a latest version of 3G. It is nothing but the long term evaluation of the universal mobile telecommunication system. LTE is the greatest of many year of development. In this paper we use various multiple access technique, like CDMA, MIMO, OFDMA, CRRIER AGGREGATION and RELAY TECNOLOGY.CDMA is a composition of multiplexing, which permitted many signal to occupy only one transmit ion channel, access the use of available bandwidth. MIMO is radio communication or RF technology. LTE and more other radio wireless and RF technologies are using the new MIMO wireless technology to deliver to improve link capacity and spectral efficiency combined with increase link reliability. OFDMA is digital multi carrier modulation system that is widely used in wireless system to transmitting a high stream of data with single carrier. Relay node establish wireless connection with radio access network. The relay nodes are low power base station that provide large coverage in low cost .carrier aggregation technology is used in LTE to increase the bandwidth and bite rate.

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