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Evolution of Mobile Networks and Carrier Aggregation in Advanced LTE

[1]Johnu Celestine, [2]Tushar Vinayaraj, [3]Jhansi Kota, [4]Samir Hamada

[1,2,3,4] University of Bridgeport

Abstract: **Mobile communication systems have made remarkable changes in the field of communications in a short period of time making history in wireless technology. The evolution of these wireless technologies has reached the fourth generation, 4G. It has made major improvements in terms of performance and efficiency in communication environments. The early first generation 1G only had the basic voice system, and then in the second generation 2G the coverage area and storage capacity was taken into consideration. Later the third generation 3G took over both first and second generation by fulfilling faster speeds using mobile broadband. Lastly fourth generation was introduced that provided a wide variety of communication services with help of both fixed and mobile networks. They also have a wide range of data rates providing service demands at a multiuser environment. In this paper we have talked about the overview of evolution in mobile communication systems.**

Keywords: **Carrier aggregation, advanced LTE, Networks, Evolution.**

I. INTRODUCTION

There has been a phenomenal rise in the wireless industry with regards to both technology and subscribers. In late 2010, four generations of cellular technologies had been introduced. With such an increase and advancement in these technologies the need for providing network services has become more critical. In the early 1980's analog cellular technologies were used for the first generation. Later 2G came into existence which had less data speed and small messaging capacity. The 2G technology was made available in the 1990's and was later introduced to the third generation which provided 144kbps of data speed. CDMA2000 EV-DO was one of the primary technologies of 3G including the WIMAX which is considered as an official 3G technology.

For more advancement in the cellular technology the ITU has issued requirements which include operation which has 40 MHz of radio channels and also high spectral efficiency. It also needs operation having 100 MHz of radio channels and a spectral efficiency of 1.5 Gbps. WIMAX and HSPA are referred as 4G in certain areas only to improve the platform which will fulfill all the requirements. Since both have highly outperformed the 3G requirements so considering them in this generation is beyond the capability. The evolution of the LTE (long term evolution) has been compared to the 4g technology all around the world. The demand for the increase in broadband services rises, so providing the LTE technology has offered a high and very fast responsive mobile data service. By 2014 researches has proven that LTE subscribers will globally exceed by $70 billion and 300 million worldwide. The Global mobile Supplier Association (GSA) has anticipated the progress of the LTE in 41 different countries and 22 LTE networks in the commercial services. A study suggests that 132 operators in 56 different countries are now investing in LTE. For many operators LTE has made major changes in mobile systems from IP (Internet Protocol) technology and made a large impact in way the network is designed and managed.

II. EVOLUTIONS IN CELLULAR NETWORK

There has been a series of evolution in the cellular networks that has met the demands with wireless technology.

1. First generation of cellular networks

In the 1G technology analog radio transmissions were provided for voice services. This generation used FDMA (Frequency Division Multiplexing Access) which had limitations for the radio channels and also uses circuit switching technologies.

2. Second generation cellular network

In 2G technology the network is categorized digitally and due to this the user are allowed to accommodate radio spectrum by using GSM or CDMA multiplexing.

3. Third generation cellular networks

This generation provides services that are independent of the technology platform and whose design patterns are the same globally. The ITU (International Telecommunication Union) demands for 3G network with IMT 2000 standards. So an organization named 3GPP (3rd Generation Partnership Project) has worked for fulfilling the IMT 2000 standard. The IMT 2000 is the ITU T name for the 3rd Generation system.

3G networks have allowed the operators to achieve a wide range of advanced services and get improved spectral efficiency. These services include wireless voice telephony, broadband data and video calls. HSPA (High Speed Data Access) can transmit data at the speed of 14.4 Mbps on downlink and 5.8 Mbps on the uplink. In certain countries the 3G network does not use the same radio frequencies as compared to that of 2G. So this allowed the operators to build a new network entirely that provide license to the new frequencies. However in United States the carrier operator provides the 3G services in the same frequencies as other services. There are still countries like Indonesia who has still not received the license for 3G. China got its license for 3G in January 2009 but only three main companies got that license for operating the 3G network.

4. Fourth generation cellular networks

The increasing growth and existence of new technologies has demanded the industries to come up with a fourth generation (4G) communication network. It has accomplished newer user experiences and multi servicing capabilities. GSM (Global System for Mobile), GPRS (General Packet Radio Service), IMT 2000 (International Mobile Communication), WiFi (Wireless Fidelity Bluetooth) are some of the examples of 4G. The fourth generation makes sure that the user has freedom to select the service at an affordable price and anywhere. This communication was started in 2010 and it became a huge success in 2014.

III. CARRIER AGGREGATION IN ADVANCED LTE

In the pursuit of increasing bandwidth and speed, the latest innovation is carrier aggregation. This intuitive technology was adopted as a part of the growth from 3.9G, which is in use now, to the *real 4G*, which supports peak data rates up to 1 Gb/sec. Like any modern technology, the primary requirement of carrier aggregation should be the backward compatibility.

The basic technique underlying in carrier aggregation is the aggregation of different carriers, to obtain a bigger channel with enhanced capacity. Each of the carriers which are used in aggregation is called component carriers. The specifications of the carriers are follows:

1) Maximum of 5 carriers can be aggregated
2) Component carriers can have one of the following bandwidths: 1.4, 3, 5, 10, 15 or 20 MHz
3) In FDD, the number of components for upload should be always less than the number of components for download.
4) In TDD, the number of components for upload and download are always equal

From the above specifications, it can be inferred that the maximum possible bandwidth would be 100MHz. On a broad aspect, carrier aggregation can be divided into three types:

1) Intra band, contiguous – The component carriers are continuous and same operating frequency
2) Intra band, non-contiguous – The component carriers are not continuous, but still operate in the same frequency
3) Inter band, non-contiguous - Here, the component carriers are not continuous, and the they operate in different frequencies

As acquiring bandwidth license becomes an impractical option because of the insane price tags, the only option for increasing the bandwidth would be carrier aggregation. By carrier aggregation, the operators can come into an agreement were they share the unused bandwidth, to make a load balance and thereby get consistent, maximum bitrates.

Moving on to the implementation side, carrier aggregation was first implemented by Qualcomm Technologies, using the Qualcomm® Snapdragon™ 800 processor, integrated to the third-generation Qualcomm® Gobi™ modem. In this implementation, two carriers, of bandwidth 10MHz each were aggregated. The results were promising with peak data rates up to 150Mbps. Later by the end of 2013, two 20MHz carriers were aggregated to obtain another successful result, with peak data rates reaching 300Mbps. The target case would be an aggregation of 5 carriers, each with a capacity of 20MHz each and a resulting aggregated data pipe with a capacity of 1Gbps.

IV. CONCLUSION

An analysis of the growth of mobile networks from 1G to 4G was made and a study on the important features of the carrier aggregation in advanced LTE was made. The implementation of 5G is expected to take another five years, which makes carrier aggregation an important topic of research, and it is expected to bring into life, the real 4G, from the 3.9G which is referred to as 4G in the market. Also, cross carrier scheduling is something that can be studied along with carrier aggregation, because both these together can make significant changes to the current scenario of mobile networking.

REFERENCES

[1] Carrier Aggregation in LTE-Advanced ; Vehicular Technology Conference (VTC Fall), 2011 IEEE ; 5-8 Sept. 2011

[2] Carrier aggregation for LTE-advanced mobile communication systems ; Communications Magazine, IEEE (Volume:48 , Issue: 2) ; 29 January 2010

[3] Carrier aggregation for LTE-advanced: functionality and performance aspects ; Communications Magazine, IEEE (Volume:49 , Issue: 6) ; 06 June 2011

[4] Evolution of Mobile Wireless Communication Networks-1G to 5G as well as Future Prospective of Next Generation Communication Network ; Pankaj Sharma ;