

Chapter 1

Evolution of Personal Wireless Broadband Services from 3G to 4G

Sudhir K. Routray
Krupajal Engineering College, India

ABSTRACT

The chapter covers the basic conceptual model of the 4G system and the operations of its physical systems. It starts from the very basics of the wireless communication services, and then the author goes through the different standards of the systems which provide wireless broadband services, like the 3G, and other wireless broadband systems, like WiMAX etc. The author then looks through the 3GP project and its visions, then goes through the 3GPP2. The vision and the achievements of the 3GPP LTE are then discussed including the 4G and its successor systems. After that the authors turn towards the technical ideas behind the wireless broadband services like the 3G and 4G. 4G system architecture and its features are looked into, the differences between the 3G and 4G are discussed, and then the whole chapter is concluded with the impact of the 4G system on the present mobile communication scenario.

1. INTRODUCTION

The mobile communication scenario throughout the world is growing in geometric progression. After the Internet, this is perhaps the second most important invention in globalizing the world. In almost every country, from the very advanced to the deepest corner of the world, we find mobile services everywhere. It has revolutionized the way people live and think. The 'connectivity everywhere' concept has given

some extraordinary dimensions to the business community. Specifically, mobile computing related applications are like a treasure for business community and business related services.

Looking at the present demand, it is clear that the mobile communication systems needed to be evolved. In the first generation of mobile communications the services were mainly based on the analog communication techniques. However, there were many shortcomings in the analog version, so digital communication techniques were used and it was found that digital modes can handle different

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aspects properly. The second generation of the mobile systems was known as 2G. Of course the systems or technologies used in different countries were different. In Europe the GSM technology was quite popular and now it has stretched over the whole globe. GSM was nothing more than the TDMA system of the European countries with pan-European roaming facilities. It was a great revolution that a single phone could be used in different countries and thus was the main choice in many countries. In America CDMA emerged as the main competitor of the GSM. Though the CDMA technology was not as flexible as the GSM, it had some other advantages over the GSM technology, like easy dynamic channel allocation. The competition between these two technologies gave rise to many new standards and technologies. Some other versions like the Japanese PDC were also popular regionally, but later they parted with either of the two main technologies.

From the competitions between these technological systems it was expected that the evolution of the systems was going to happen sometime around the year 2000. That too happened. The GSM group or the European standards making body ETSI, was quite optimistic about that. So they proposed a project for the future of the GSM technologies. Then some other SDOs, or Standards Development Organizations, joined them from across the globe, and the project then went on to develop a new technology which we know as the UMTS or the Universal Mobile Telecommunications System. This technology that enabled GSM to leap forward and allowed high data rate services to become possible in the GSM framework. The new system that was developed through the UMTS is well known as the 3G system. Now almost all the developing countries are have 3G facilities. After 3G, people expected even more. There were some common bottlenecks in the 3G system and the rivals were trying to have a better system. They too have another project where the ITU or the International Telecommunications Union was taking the leader's role. They developed the IMT

2000. At the same time the air interface access technologies were evolving very fast. WCDMA was one of them. Similarly, CDMA2000, TD-SCDMA and their hybrid versions made it easy to provide the high broadband services. With all of these ingredients in place, business parties in the mobile communication systems started designing the next generation mobile systems. In the early years of this decade the 3G system emerged and people welcome it with enthusiasm. Although the UMTS-based 3G and the IMT2000-based 3G had some differences, they were very similar as far as the performances and the features are concerned. So it can be said the technologies are heading towards a common framework in which the better aspects of either will stay.

The ITU-supervised IMT2000, however, recommended the systems which were 3G technologies having some little differences. There are five such 3G radio interfaces.

The 3G systems were good enough in comparison to the 2G or the GPRS enabled 2.5G systems, but internet related services and anything that needed higher bandwidth were either out of reach, or the quality of service was not good enough. This led to demand for a system which could give some proper solution to these needs. 4G was first proposed by the team who were the members of the 3GPP LTE (Third Generation Partnership Project -Long Term Evolution). The front runner among the business group was the NTT DoCoMo of Japan, the first of many business partners in this project.

2. PERSONAL WIRELESS BROADBAND COMMUNICATION SYSTEMS

There are many personal communication systems evolving these days. Out of them the broadband services are the most popular ones. There are many kinds of broadband frameworks available today for public use, from traditional cable or wired

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