# Chapter 1.1
# 4G Wireless Networks: Architectures, QoS Support and Dynamic Resource Management

**Dimitrios G. Stratogiannis**
*National Technical University of Athens, Greece*

**Georgios I. Tsiropoulos**
*National Technical University of Athens, Greece*

**John D. Kanellopoulos**
*National Technical University of Athens, Greece*

**Panayotis G. Cottis**
*National Technical University of Athens, Greece*

## ABSTRACT

*Fourth generation (4G) wireless networks aim at supporting various multiservice applications over IP architectures which satisfy enhanced users demands through innovative services of increased Quality of Service (QoS). QoS can be assured through independent optimal design of network components or by optimizing interoperability. The supported services impose also their classification into IP network service models and their specifications description. The integration of different wireless access technologies into the 4G network architecture leads to a heterogeneous network environment that raises several issues. An overview of various approaches employed to provide QoS in 4G networks concerning their architectures, different access technologies interoperability and resource management techniques are investigated in this chapter. Dynamic resource allocation, admission control, QoS provision using mobile management and pricing policies are presented. Concluding, in the demanding 4G environment under variable network conditions, appropriate schemes and architectures may provide a robust network management tool for QoS provision and efficient resource utilization.*

DOI: 10.4018/978-1-61350-101-6.ch101

## INTRODUCTION

The new social and economic trends having evolved worldwide such as the increasing demand for productivity and effectiveness, business travelling all over the world along with the pressure to respond immediately to customer needs have created an increased need for access to information any where in the world at anytime. The convergence of information communications technology and computing is creating demand and opportunities for ubiquitous computing via wireless and mobile equipment without technological restrictions. Next Generation Networks (NGNs) such as forth generation (4G) networks, also known as beyond third generation (Beyond 3G), aim at providing 'optimal connection anywhere, any time'. 4G networks support large scale global roaming across multiple wireless and mobile networks providing diverse applications over packet-switched networks.

One issue of utmost importance in 4G networks is the expected integration of all heterogeneous wired and wireless access technologies (e.g. cellular 3G /UMTS, IEEE 802.11 WLAN, Bluetooth, IEEE 802.16 WIMAX, BWA) into a common scalable network infrastructure. The terminals of 4G technology will incorporate almost all existing wireless options implemented in a unified environment assuring end – to – end Quality of Service (QoS). The rise of service-enabling technologies and platforms will help. These services include voice, data, message, video and world-wide web with high data rates and QoS, security measures, location awareness and energy efficiency ensuring better adaptation to users requirements and traffic conditions compared to existing 3G technologies (Varshney & Jain, 2001). 4G networks will be based on a common, flexible and seamless all-IP protocol (Wisely et al, 2003), where mobile terminals will need to be highly integrated multimode, multiband, and able to utilize a wide range of applications, incorporating better scheduling and Call Admission Control (CAC) techniques constituting a robust communication model and architecture. The use of the IP protocol will assure interoperability with existing widely accepted communication structures. These features offered by 4G networks will encourage new demand and create new technological and business opportunities not only for manufacturers and operators but, also, for service and content providers and above all for the end users.

In this book chapter a comprehensive survey on 4G networks regarding their characteristics, network architectures and dynamic resource management for QoS support is performed. The chapter is intended to provide a review into the most critical issues emerging in 4G networks. The chapter is composed of two main sections, organised as follows. In the first section, entitled "QoS provision in 4G networks" the key aspects of QoS provision techniques are presented, taking into account 4G networks specifications. In this section challenges related to the heterogeneity of 4G networks such as the need for seamless handoff among different access networks or between two access points of the same network and the best connectivity problem are described. Another important issue presented in the first section is the different access technologies interoperability, where the two most prevailing architectures are presented, focusing on the integration of Wireless Local Area Networks (WLANs) and cellular networks towards a unified heterogeneous network. The first section is concluded with a subsection concerning the Service Classes (SCs) supported by the network, which are mapped into the corresponding IP network service models. In the second section entitled "Dynamic resource allocation and call admission control", resource management issues related to 4G are surveyed. The diverse QoS requirements of the SCs supported and the dynamic nature of the wireless channel impose the use of efficient resource allocation techniques such as bandwidth reservation, bandwidth degradation and resource allocation with QoS renegotiation, which are presented in this section. Moreover, the integration