Chapter 2.5
Enhanced QoS through Cooperating Schemes in Next Generation Wireless Networks

Dimitris E. Charilas
National Technical University of Athens, Greece

Athanasios D. Panagopoulos
National Technical University of Athens, Greece

Philip Constantinou
National Technical University of Athens, Greece

ABSTRACT

This chapter addresses the critical issue of Quality of Service (QoS) provisioning in next generation wireless networks. While the QoS offered to users may be enhanced through innovative protocols and new technologies, future trends should take into account the efficiency of the resource allocation strategies and the network/terminal cooperation as well. 4G networks will be characterized by an heterogeneous environment where several access networks will be available. The purpose of this chapter is to summarize techniques that enable efficient distribution of resources exploiting the existing infrastructure. Such techniques may involve either smart selection mechanisms or cooperating schemes among network entities. Since decision-making processes are examined, the use of game theory is considered as a valuable asset in the authors' work. To this end, the chapter also collects applications of both non-cooperative and cooperative game theory applications in wireless networks. The main aspects of both game types are presented and several games are modeled.

DOI: 10.4018/978-1-61350-101-6.ch205

INTRODUCTION

Future wireless networks will be heterogeneous. The heterogeneous wireless networks integrate different access networks, such as IEEE 802.15 Wireless Personal Area Networks (WPAN), IEEE 802.11 Wireless Local Area Networks (WLAN), IEEE 802.16 Wireless Metropolitan Area Networks (WMAN), General Packet Radio Service (GPRS), Enhanced Data rates for GSM Evolution (EDGE), Code Division Multiple Access (CDMA) 2000, Wideband Code Division Multiple Access (WCDMA), satellite networks, etc. The proliferation of wireless access technologies, and the evolution of the end-user terminals (smart phones, PDAs, etc...) are leading fast towards a ubiquitous, pervasive and rich connectivity offer, such that the end users won't be only always connected, but also always covered by multiple access networks / technologies.

Users are expected to access personalized services with context-awareness: location, characteristics of the available networks, user preferences, application requirements and terminal capabilities. The vision is that users will not be tied down to a long-term contract with one single operator but will instead be able to dynamically choose access provision on a per call basis. The evolving competitive marketplace is expected to provide a choice of access networks in any given location, each offering different network technologies with varying characteristics to transport the user's communications application.

Selection of the most efficient and suitable access network to meet a specific application's QoS requirements has recently become a significant topic, the actual focus of which is maximizing the QoS experienced by the user. The main concept is that users will rely on intelligent network selection decision strategies to aid them in optimal network selection. The end-users can potentially take wise decisions on which access network to connect to on the basis of several merit functions including the current load of the network and the cost-for-connectivity. **The first section** of this chapter will collect modern network selection algorithms, focusing on the merits that may be used as selection criteria.

In general, the wide area access wireless networks have larger coverage and support better mobility but have lower data rates and require higher power consumption on mobile terminals, for instance cellular networks GPRS and Universal Mobile Telecommunications System (UMTS); the local area access wireless networks have higher data rates and consume much less power on the terminals but have smaller coverage with limited mobility, for instance nomadic wireless networks WLAN and Bluetooth. The tradeoff between coverage and data rate is due to the relation between radio signal attenuation and distance.

The second section of this chapter will expose new ideas and trends on cooperative communication networks, in which wireless nodes cooperate with each other by transmitting information. Such schemes promise significant gains in overall throughput and energy efficiency. A feasible solution to implement the envisioned wireless networks and sophisticated terminals is twofold. On the one side cellular and nomadic (short-range) heterogeneous networks should cooperate with each other and on the other side the terminals forming a cluster should also collaborate. The next generation cooperative networks architecture is based on cellular reception of data which is then forwarded or shared among mobile devices within each others' proximity over the short-range link. To implement such cooperative networks, it requires that all the coexisted heterogeneous (wide access/local access) wireless networks can be designed to synergize efficiently. In addition, the multi-modality terminals can exploit the highly cooperative heterogeneous networks to cooperate with peers to realize the envisioned network.

Since decision-making processes are also examined in this chapter, we consider the employment of game theory as a promising asset. **The third section** of this chapter is devoted to explain

Related Content