Chapter 8

Quality of Service Provisioning for Adaptive Multimedia in Mobile/Wireless Networks

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1 Introduction

During the last few years there has been a great demand for multimedia applications with Quality of Service (QoS) in wireless/mobile networks. QoS provisioning for multimedia applications has become more important than before partially due to the service users’ requirements. The key factor in QoS provisioning is Call Admission Control (CAC) [10], which can efficiently utilize the system resources and satisfy QoS parameters’ requirements. CAC has become vital for multimedia services in a wireless/mobile network’s ability to guarantee QoS requirements partially due to the network’s limited capacity.

In wireless/mobile networks, many CAC schemes in wireless/mobile networks have been proposed in the literature [1-5,7-10,13,16-17]. We can classify CAC schemes into three categories: the classical non multimedia CAC schemes [2,3], the non adaptive multimedia CAC schemes [1,8,9], and the adaptive multimedia CAC schemes [4,5,10,16,17]. In the three kinds of CAC schemes, different kinds of CAC schemes work on different situations. The classical non multimedia CAC schemes are for non multimedia traffic, e.g., traffic of cellular phone calls. The non adaptive multimedia CAC schemes are for multimedia traffic, but this multimedia
traffic is not adaptive. However, the adaptive multimedia CAC schemes are for adaptive multimedia traffic.

The classical non multimedia CAC problems typically try to find a better CAC scheme handling with handoff calls and new calls. There are three approaches for the classical non multimedia CAC schemes: the complete sharing approach, the complete partitioning approach, and the threshold approach [16,17]. The Fractional Guard Channel, a special kind of the threshold approach, is the optimal approach [2,3]. The optimization is in the sense of optimizing the revenue while satisfying the QoS requirement, which is an upper bound of handoff dropping probability. For the non adaptive multimedia CAC schemes, Choi et al. [7] present an optimal centralized CAC scheme; Kwon et al. [8] and Yoon et al. [9] propose an optimal distributed CAC scheme. Most recently, many researchers focus on adaptive multimedia services [4,5,10,16-22]. Kwon et al. [5] investigate the CAC scheme for one class of adaptive multimedia. Kwon et al. [4] seek CAC and bandwidth reallocation algorithms for multi-classes of adaptive multimedia by using a graph resource reallocation approach with a greedy algorithm, which gives a suboptimal or near optimal solution.

In order to provide QoS provisioning, a good service classification is important. In this chapter, we introduce a QoS provisioning framework for multimedia traffic in wireless/mobile networks. We classify services into three categories: Bandwidth Guaranteed (BG) service, Bandwidth Not Guaranteed (BNG) service, and Best Effort (BE) service. BG service is for non adaptive multimedia traffic or non multimedia traffic; BNG service is for adaptive multimedia traffic; whereas BE service is for computer data or multimedia traffic that can be suspended and reactivated. Both the classical non multimedia CAC schemes and the non adaptive multimedia CAC schemes are for the BG service, and the adaptive multimedia CAC schemes are for the BNG service or the BE service. Three traffic descriptors are defined here: Fixed Bandwidth (FB), Minimum Bandwidth (MB), and Upper Bandwidth Vector (UFV). For each of the three categories, traffic descriptors and QoS parameters are defined and specified. Furthermore, we abstract the three categories into a general abstract traffic model. Based on the abstract general model, we present, analytically, an optimal Call Admission Control (CAC) scheme for all service categories that guarantees the QoS parameters’ requirements and traffic descriptors, and maximizes the revenue. The proposed CAC scheme adapts well to all service categories, achieves optimal revenue, and guarantees the QoS parameters’ requirements and the traffic