Chapter 13
On Demand Bandwidth Reservation for Real-Time Traffic in Cellular IP Network using Particle Swarm Optimization

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ABSTRACT
Cellular IP network deals with micro mobility of the mobile devices. An important challenge in wireless communication, especially in cellular IP based network, is to provide good Quality of Service (QoS) to the users in general and to the real-time users (users involved in the exchange of real-time packets) in particular. Reserving bandwidth for real time traffic to minimize the connection drop (an important parameter) is an activity often used in Cellular IP network. Particle Swarm Optimization (PSO) algorithm simulates the social behavior of a swarm or flock to optimize some characteristic parameter. PSO is effectively used to solve many hard optimization problems. The work, in this paper, proposes an on demand bandwidth reservation scheme to improve Connection Dropping Probability (CDP) in cellular IP network by employing PSO. The swarm, in the model, consists of the available bandwidth in the seven cells of the cellular IP network. The anytime bandwidth demand for real-time users is satisfied by the available bandwidth of the swarm. The algorithm, used in the model, searches for the availability of the bandwidth and reserves it in the central cell of the swarm. Eventually, it will allocate it on demand to the cell that requires it. Simulation experiments reveal the efficacy of the model.

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INTRODUCTION

Advancement in technology opens many challenges in wireless communication especially in cellular wireless communications. Many of these challenges are due to optimism to extract more from the technological growth. To maintain better Quality of Service (QoS), to the users in a cellular system, is quite challenging task. Cellular IP network, in wireless cellular systems, uses packet switching techniques in transferring data from one user to another and is based on one of the Internet Protocols IPV4 or IPV6. The problems are to be studied well as the flow of multimedia traffic, in cellular IP network, is growing enormously. Non-real time traffic e.g. e-mail, text data etc., though important in cellular IP network, is given less importance in comparison to the real-time traffic. Often, bandwidth reservation has been advocated to provide better QoS in cellular systems. The work, proposed here, uses bandwidth reservation method for better QoS giving priority to real-time traffic. Thus the packets have been given more importance for the flow in Cellular IP network. The proposed scheme uses bandwidth reservation algorithms similar to the Adaptive Resource Reservation schemes studying bandwidth reservation using Support Vector Machine and Particle Swarm Optimization (Chenn-Jung Huang, Yi-Ta Chuang, Wei Kuang Lai, Yu-Hang Sun, & Chih-Tai Guan., 2007). Also a Probabilistic Resource Estimation and Semi-reservation scheme have been considered which uses the resource semi-reservation approach rather than the conventional full reservation method. The semi-reservation approach consumes less time of the network (Geng-Sheng Kuo, Po-Chang Ko, & Min-Lian Kuo, 2000).

Another scheme that uses Bandwidth Reservation is Dynamic Grouping Bandwidth Reservation scheme for multimedia wireless networks which is based on probabilistic resource estimation. According to this scheme, when the Mobile Host (MH) requests a new connection flow or it handoffs to a new cell, it provides some important information e.g. the estimated switching time and the estimated staying time etc (Jau-Yang Chang, & Hsing-Lung Chen, 2003).

The proposed model is an attempt to provide better QoS in Cellular IP network for on demand bandwidth reservation using Particle Swarm Optimization (PSO) algorithm. On-demand refers to a service which addresses the user’s need for instant and immediate use. It means that when a Mobile Host (MH) requests a new connection from a cell in a Cellular IP network, the base station will perform a processing based on swarm optimization algorithm to reserve the available free bandwidth in all the cells of the swarm. If it fails in doing so, the cell may demand the reservation of the bandwidth which is assigned to the non real time users. Experimental studies have been carried out and the results have been compared with the Probabilistic Resource Estimation and Semi-reservation scheme.

The rest of the paper is organized as follows. In the next section, we briefly describe cellular IP network and elaborate bandwidth reservation for real time packets in cellular IP network. Section 3, discusses Particle Swarm Optimization (PSO) algorithm. In section 4, the proposed model is elaborated. Section 5 contains the simulation experiments, the results obtained and the comparison of the results with the Probabilistic Resource Estimation and Semi-reservation scheme. In final section 6, some conclusions and observations, with the results obtained, have been made.

BANDWIDTH RESERVATION IN CELLULAR IP NETWORKS

It is imperative to brief cellular IP network before going through the bandwidth reservation in cellular IP network.
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