

Chapter 19

Dynamic Quota Calculation System (DQCS): Pricing and Quota Allocation of Telecom Customers via Data Mining Approaches

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ABSTRACT

One of the most important IT sectors that requires big data management is mobile data communication systems (MDCS) of GSM companies. In the charging mechanism of current MDCS, a subscriber “surfs” on the internet that creates data traffic and a counter subtracts the amount of data used by the user from the subscriber’s quota. In other words, instant constant quota values are assigned to subscribers without concern for their previous amount of internet usage in current MDCS. Moreover, constant quota values cause constant charge calls in control traffic that are repeated for all new quota requests. Thus, performance degradation occurs because of the repetition of quota request calls and allocations. In this chapter, a dynamic quota calculation system (DQCS) is proposed for dynamic quota allocations and charging in MDCS using data mining approaches as two cascaded blocks. The first block is self-organizing map (SOM) clustering based on a sliding window (SW) methodology followed by the second block, which is the markov chain (MC); the overall system is denoted as “SOM/SW and MC.”

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INTRODUCTION

The advancement of Web and wireless technologies have allowed mobile users to demand various kinds of services through mobile devices at anytime and anyplace. Quota sizes of mobile users can highly benefit the enhancements on mobile communication system performance and quality of services. Mobile Data Communication System (MDCS) companies must satisfy a wide and varied customer base. There are two types of Internet quota sizes for mobile users, monthly and instant, where instant (750 KB) is given initially. When instant quota is depleted, a new request call is generated on MDCS to obtain a new instant quota. The charging system blocks 750 KB of data from a subscriber's monthly quota, which is resolved along with the quota system. The arrangement of instant quota size with respect to customers with low data use can cause various performance problems, such as heavy signalization in the cases of heavy users. On the other hand, the arrangement of quota size only with respect to customers with high data use clearly leads to unnecessary quota allocation.

This research aims at data mining the quota usage patterns such that suitable quota size can be predicted and assigned automatically for users. Hence, a dynamic quota allocation system is required to gain better performance using mobile user data and profile knowledge. However, to the best of our knowledge, there are few studies related to dynamic instant quota sizes in the literature. Most studies are based on Internet bandwidth and service quality employing mobile user profiles and Internet usage. Due to this reason, our study has a contribution to the literature in terms of user dependent dynamic quota calculation for telecommunication systems.

The rest of this paper is organized as follows: Section 2 gives the literature background originating our study. Section 3 describes the working mechanism for the proposed Dynamic Quota Calculation System (DQCS); then, Section 4 discusses the evaluation of simulation results and comparison of the statically-based charging and quota transfer in current MDCS with the proposed algorithm. Section 5 presents implementation of DQCS to the LTE communication systems; finally, Section 6 and Section 7 are dedicated to the future research directions and conclusions respectively.

LITERATURE BACKGROUND

Quota-based charging of mobile users was investigated in several studies. Abidogun & Omlin (2004) presented a Self-Organizing Map (SOM) model for outlier detection in call data from subscribers, over a period of time in a mobile telecommunication network so that suspicious call behavior could be isolated in order to identify abnormal call patterns from subscribers. The researchers applied the SOM model to the unsupervised classification of call data for prepaid service subscribers from a real mobile telecommunication network. They indicated that the ideas presented in their study might be used for clustering call patterns in order to label them as normal or abnormal.

Next similar study by Lehtimäki & Raivio (2005) presented an analysis process based on SOM to visualize MDCS network performance data. They applied SOM in the analysis of 3G network performance, including advanced network monitoring and cell grouping. After outlining the overall SOM based analysis process for MDCS performance data, they demonstrated the use of the analysis process in two problem scenarios in which the capacity problems in the signaling and traffic channels were analyzed.

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