An Adaptive Call Admission Control Approach for Multimedia 3G Network

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Abstract. The rapidly growing mobile demands have reinforced the network providers to emphasize on the basic customer needs and the resource management. The two main areas such as capacity management and data service provisions have engulfed the research field. This research paper attempts to cover both these issues in terms of Call Admission Control (CAC). Paper presents an adaptive technique built upon our previous static CAC research. The scheme provides differentiated admission to various delay sensitive (DS) and delay tolerant (DT) traffic streams for both Handover Request (HOR) and New call Request (NCR) according to current load intensity. It is based on an effective pre-emption priority in order to reduce the forced handover failure probability. Service nature and customer behaviour have been considered to lay down the different levels of priorities that were assigned at different stages of CAC Scheme in order to achieve optimal quality of service (QoS) for urban area (metropolitan) cell.

1 Introduction

The ever growing mobile market and introduction of variant services in the wireless networks has enlightened the need for optimized connection admission control (CAC) Schemes and has fuelled an extensive research work in this area. The main objective of this paper is to recognize multi-service type traffic and their prioritization depending upon service type and customer behavior. A hybrid of queuing and channel allocation priorities is presented in the proposed models.

The Quality of Service (QoS) standards are derived from the customer demands. It has been witnessed that majority of the technological advancements in late 20th century are influenced by the customer requirements. So is the case of mobile cellular industry, the introduction of modern day data services are an out come of customer demands. It is very vital to enlighten the concept of QoS because QoS provisioning is the center of all research done in CAC mainly due to the scarcity of resources in radio networks. The acceptance and rejection of a call is dependent upon QoS deterioration, as whenever the call is accepted there is some level of QoS deterioration. There are

T. Enokido, L. Barolli, and M. Takizawa (Eds.): NBiS 2007, LNCS 4658, pp. 446–455, 2007.

three levels of QoS; Bit Level parameters such as energy to noise ratio [1]; Packet Level parameter such as packet loss but majority of the research work is done in at Call Level. In Call Level QoS, the dropping and blocking probabilities are the QoS parameters [1].

Stochastic Prioritized Call Admission Control Algorithms can be divided into two major types [1,2,3]; such as Static and Adaptive CACA. In cellular systems the geographical distribution of coverage area is of great importance and can be used to organize CAC approaches. Local CAC Schemes consider only one cell and the Global CAC Schemes span over cluster or even entire network [4]. The major aims of CAC Schemes are [5] to maximize channel utilization in a fair manner to all flows, minimize the Dropping Probability of handover calls, minimize the reduction of service of connected calls and minimize the Blocking Probability of new calls.

In this paper we emphasis on a single cell CAC and Call Level QoS parameters are taken into consideration. The two QoS parameters taken into account are Blocking Probability (loss of new call) and Dropping Probability (loss of handover request) [21].

The rest of this paper is organized as follows: Section 2 includes the related work in the field of CAC Schemes and the traffic prioritizing. Section 3 presents two proposed models and a Basic priority model for comparison. Performance evaluation through simulation results are presented in Section 4. Paper is summarized in Section 5.

2 Related Work

The modern day cellular mobile networks aim to provide multimedia services including voice, data and video being the predominant ones. It creates more importance for clever designing of CAC algorithms as they ought to manage capacity distribution. In order to understand the behavior of each traffic type, the traffic is characterized on its time dependency [6]. The traditional voice call is considered as real time or delay sensitive traffic type, where as the data and video streaming are more tolerant to time; so named as non-real time or delay tolerant. It has become imperative to understand the behavior of each service type in order to derive optimized CAC Scheme.

Also the growing strength of mobile customers has forced the cell size to decrease in order to maximize the frequency reuse; this has resulted in an evident increase of number of handover calls; the calls that are carried through one cell to another. It is a universal understanding that call dropped during the talk time is more annoying than the initial rejection of connection. This has been the major driving force behind early CAC Schemes e.g., [2,7], but since we have a significant increase in number of types of traffic therefore the priority distribution has to be more specific.

Many queuing priority techniques for new call and handover traffic have been reported in the literature, e.g., [2,7-10]. These papers generally discuss various ways to assign priorities via queuing techniques. A basic categorization of queuing priority is also presented in [11] as pre-emptive and non pre-emptive. Although pre-emptive technique to prioritize a service type over another has been encouraging [6,12], yet majority of existing work handles the non pre-emptive queuing priority in CAC Schemes.