# Effect of Increasing Buffer Size on Prioritized Guard Channels with Queue during Call Traffic Congestion

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***Abstract*— Prioritized guard channel (PGC) assignment with queue was designed to reduce call dropping probability associated with a base station congested with handover call traffic. The Markov chain was used in the analysis of the PGC scheme and queuing discipline was FIFO for a PGC+MAHO scheme. Simulation was carried out using MATLAB. The results showed that increasing buffer size reduces call dropping probability which becomes discontinuous at some value of traffic arrival rate for each buffer size. It was found out that some queuing parameters such as queue product form becomes undefined at an arrival rate for a large buffer size. This limits the extent to which buffer size can be increased. System computational speed was also a contributory factor.**

***Keywords—buffer size; call dropping probability; handover queue; product form***

## I. Introduction

Queue result at base stations due to non-availability of assignable channels partly because all channels are busy and this presents a problem as a result of small time interval required for handover completion. The calls on queue are assigned to the next idle channel(s) (that is as soon as they are released) provided handover has not timed out or dropped due to signal deterioration [1]. In cellular networks, queuing of handover calls is possible because of the overlapping region between the adjacent cells. So, a mobile station (MS) can communicate with more than one cell. Hence, it is expected that the queuing time period of a handover request should be less should be less than or equal to the time of existence of the MS in the overlapping region of the cells. This means that the overlapping area can be used to reduce call blocking and call dropping probabilities. Invariably, a direct relation exists between queue/buffer size and the overlapping region.

It was mentioned that queuing scheme reduces call dropping probability and increases new call blocking probability thereby leading to decrease in the ratio of carried traffic to admitted traffic. In the study conducted, system capacity was enhanced by load balancing in the neighboring cells using a FIFO queuing scheme [2]. In [3], received signal strength quality factor (α) was used to determine the quality of radio frequency (RF) signal received by a mobile station (MS). This was to aid handover decision between two adjacent base stations in a dynamic guard channel and mobile assisted handover (DGC+MAHO) scheme. Meanwhile, the metric of traffic intensity to channel ratio was used to determine how congested a system. It was mentioned in [4] that when the traffic intensity to channel ratio is above 1, then the network is very congested and can be optimized with the queue of handover calls.

Queuing priority employs delay of handover calls to minimize call dropping probability. The simulation results showed that either of originating or handover calls can be queued when there is no congestion but that handover calls are better queued when the system is in congestion state. The study in [5] considered different queue times for each type of user that is high and low speed users in a two-tier architecture. Markov models for single and two-tier cellular networks were proposed to solve handover call dropping probability problem. The two-tier architecture was an overlaid micro-cells (low speed users) in macro-cell (high speed users) with FIFO queues while the single-tier was a cellular network with FIFO queue. The two-tier model had higher performance.

The investigation carried out in [6], used threshold-based guard channel admission control policy for wireless multimedia networks dealing with two traffic classes (voice and data). Effect of the thresholds on buffer size was examined with each class of traffic having its own threshold different from the other class. This reduced the handover voice call blocking probability as buffer size was increased. The main call-level service parameters are new call blocking probability and handover call blocking probability. Also, that queuing of handover calls can be a better option of assigning priority to handover calls [7][8].

An analytical framework for dynamic priority queuing of handover calls in wireless networks was proposed by [9] which employed a queuing policy of two classes of priority. The policy was a combination of received signal strength and the remaining time in the overlap region between two cells.it was said that handover requests should be queued so that the priority can change dynamically to account for dynamics of motion [9][4].

978-1-5090-5510-4/16 $31.00 © 2016 IEEE
DOI 10.1109/CSCI.2016.200