Chapter 11
Prioritization Schemes in Queuing Handoff and New Calls to Reduce Call Drops in Cellular Systems

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ABSTRACT

This paper proposes different queuing scenarios to avoid dropping of handoff and new calls in a cellular phone network, which is essential when the network has certain restrictions on the available frequencies. This limitation degrades the performance of the system and more sites are required to achieve the desired capacity and coverage. However, this leads to a higher percentage of call drops during handoff. This paper presents a queuing technique for both new and handoff calls to reduce the probability of call drop in such a system, leading to improvement in QoS. The proposed scenarios show better system performance. The blocking probability is reduced from 2% down to 0.04% for queuing handoff calls and from 2% to 1.14% when queuing new calls using the same technique. The four different presented approaches are: 1) only new calls are queued; 2) only handoff calls are queued; 3) by using all available channels; 4) by using only half. The queuing size also plays an important role for both new and handoff calls.

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1. INTRODUCTION

Over the last few years, one of the major successes in the telecommunications world has been the widespread diffusion of cellular mobile telephone which provides full mobility of users (Stallings, 2005). This implies that it is possible for a mobile set (MS) to roam from one cell to another, while information transfer over the network is in progress. In order for the communication to continue, it is necessary that the network be capable of transferring the connection from the old cell (the source BS) to the new one (the destination BS). This operation is normally referred to as call-handover or handoff (Ekiz, Salih, Kucukoner, & Fidanboylu, 2005). Hence, handovers are considered a key element for providing this mobility (Ahmed, Ibrahim, & El-Tamally, 2010). Network operators give emphasis to optimize the handover issue, since it is strongly related to drop calls rate (Markopoulos, Pissaris, Kyriazakos, & Sykas, 2004).

The transfer of a current communication channel could be in terms of a time slot, frequency band, or a code word to a new base station (BS). If a new BS has some unoccupied channels then it assigns one of them to the handed off call. However, if all of the channels are in use at the handoff time there are two possibilities: to drop the call or to delay it for a while (Stallings, 2005).

Call blocking is the phenomenon of dropping new or handoff calls, or it can be defined as suddenly dropping already established calls (for special reasons). In cellular networks, blocking occurs when a base station has no free channel to allocate to a mobile user (Raskutti, Zalesky, Wong, & Zuckerman, 2007). The two kinds of blocking are the new call blocking and handoff blocking (refers to blocking of ongoing calls) due to the mobility of the users. The phenomenon of drop calls has been analyzed to allow the network operator to optimize system performance (Boggia, Camarda, D'Alconzo, De Biasi, & Siviero 2005; Vassilakis, Kallos, Moscholios, & Logothetis, 2008).

The Quality of Service (QoS) or the Grade of Service (GoS) in cellular networks is mainly determined by the two quantities; the first determines the fraction of new calls that are blocked, while the second is closely related to the fraction of admitted calls that terminate prematurely due to dropout. Hence, the main aim of this work is to achieve a good QoS in cellular network by putting handoff and new calls in a queue until it can be processed, the Queuing theory allows the design of communication links that can provision the quality of service in time-varying channels (Negi & Goel, 2005). This will reduce the percentage of lost calls (Falowo & Chan, 2010).

This paper is organized such that section two describes the handoff initialization decision based on the received signal strength with four techniques; relative signal strength, with threshold, with hysteresis and with hysteresis and threshold. Section three explains the point at which handoff must be initiated and the action protocols MCHO, NCHO, and NCHO/MAHO. The prioritization schemes are illustrated in section four. Section five discusses the queuing schemes used with handoff or new calls. Simulation environments are illustrated in section six which talks about queuing new and handoff calls. The obtained results are analyzed in section seven.

2. HANDOFF INITIATION

The principle parameter used to make the handoff initiation decision is the received signal strength (RSS); four techniques are available to decide the necessity to initiate a handoff request, which are: Relative signal strength, Relative signal strength with threshold, Relative signal strength with hysteresis, Relative signal strength with hysteresis and threshold (Tranter, Shanmugan, Rappaport, & Kosbar, 2004; Lee, 2006; Mullett,