CAPACITY ANALISYS IN CDMA SISTEMS USING GIS PLANNING TOOLS

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INTRODUCTION

The evolution of cellular systems towards third generation has originated many controversies between manufacturers, operators and academics about the benefits of using CDMA as the third generation access standard, particularly as WCDMA. One of the aspects that worry developers and researchers planing third generation is the extended use of the Internet and the more and more bandwidth hungry applications related.

CDMA has many advantages, as the defendants of this technology says, like more capacity than TDMA based systems, co-channel interference immunity, softer (or none) frequency planning requirements, and the possibility of overlaying systems with existing second generation TDMA without interference problems.

This paper shows the performance of a CDMA system, using computer simulation with cover maps obtained from DC-CELL, a Geographic Information System (GIS) planning tool based on ARC/INFO and developed at the Technical University of Valencia. Actually it is quite common to find planning tools based on GIS that permit users to calculate cover maps, frequency plans, etc. We think that this is an interesting tool in order to analyze the impact and capacity of a technology as CDMA, without big investments, in the way towards third generation systems and the most extended use of mobile data networks and bandwidth requirements.

A SYSTEM'S BRIEF DESCRIPTION

The model used in this project is based on coverage maps calculated with DC-Cell, in a urban environment, specifically the downtown of a city. It permits to obtain irregular cover patterns, that is the normal situation in microcelullar and indoor environments and modify in a big sense the normal conditions used to estimate capacity in mobile systems. Cover maps has been calculated using omnidirectional antennas situated below buildings, as usual in microcellular systems.

Model estimates the interference generated by users over each base station, considering both the intra-cell interference and the inter-cell interference, assuming perfect power control. In this way, it is possible to analyze the evolution of the interference over base station and interference blocking of BS.

The model used for the firsts test, use as blocking condition the specified in IS-95 standard (Eb/No=7 dB) and we are actually extending the analysis to the W-CDMA and bandwidth_on_demand systems.

With results obtained from this model, it is possible to compare CDMA capacity with TDMA in similar conditions.

SOME INITIAL RESULTS

Figure 1 shows the grade of service (GOS) for a test system with nine cells during a period of 2 minutes with an offered traffic load of 1800 Erlang.

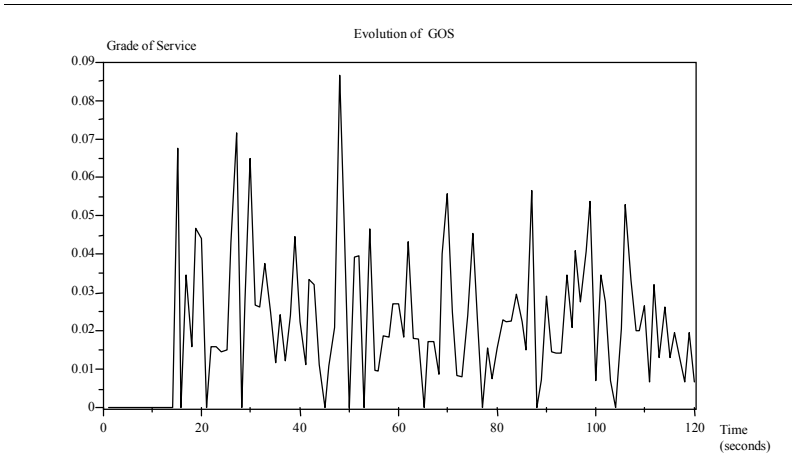

Figure 1 GOS Evolution for test system

We can observe that GOS remains below 9%, but most of the cells are blocked by interference although there are few calls in it. On the other hand, some cells have many calls and no blocking, as we can observe in figures 2 and 3. As shown in the figures, the model does not drop calls when interference from other cells exceeds the limit, as occurs in cells No.4 and No.7.

This result shows that in microcellular environments we can obtain capacities different from those obtained theoretically, because of irregularities of the cell pattern. This situation could be stronger in systems with data traffic because the bigger sensitivity to interference.

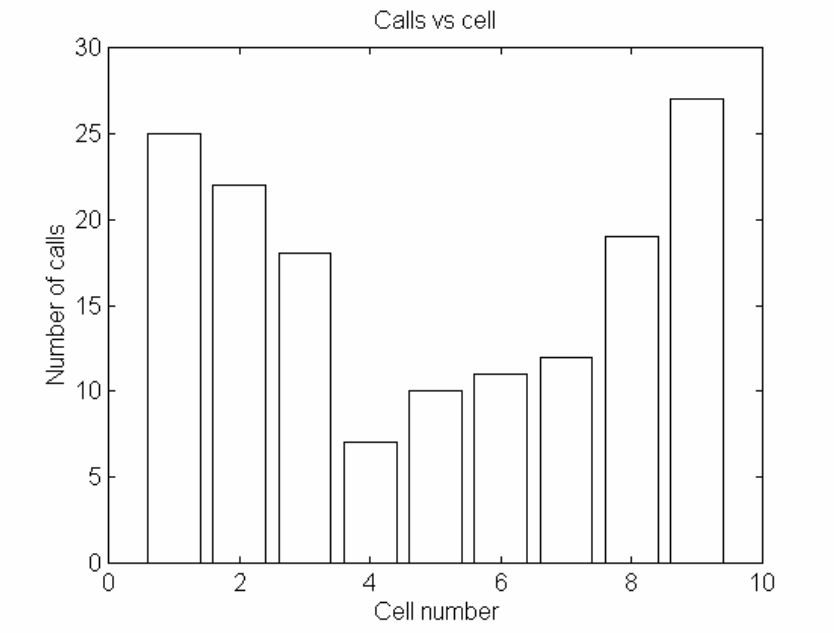

Figure 2 Number of calls vs cell

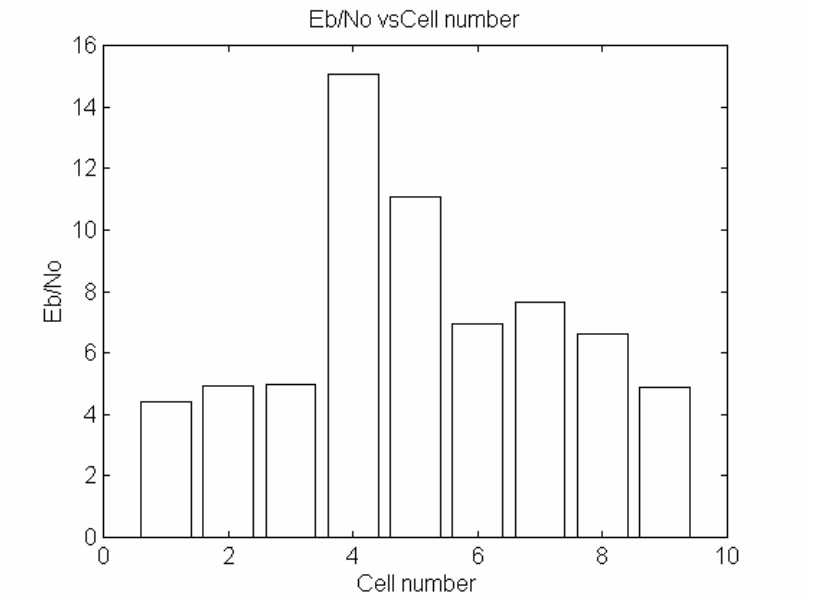

Figure 3 Eb/No vs cell number

PAPER'S NOVELTY AND RELEVANCE TO THE TOPIC

We did not find in literature any similar work using cover maps generated by planning tools to analyze capacity in microcellular environments. We think that this approach permits to obtain a better approximation to the capacity problem, thinking in current mobile data services over third generation systems.

Although many works has been done about the capacity of CDMA and TDMA and access technologies, the conditions of microcellular systems and data traffic includes more variables to the problem that are difficult to solve analytically, and the use of GIS simulation could be a good approach.

The extended paper will show new results obtained with another systems, and will show how the system capacity is modified when we consider the drop of calls by interference generated by other cells, or blocking of new calls in other cells that do not have interference problem. We will include some results from wideband data traffic versus voice traffic and how affects capacity in the system.

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