

Optimization Method of Object Packaging in Planning of Mobile Communication Systems Femtocells

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Abstract. The problem of placing access points of femtocells in the service area of the mobile base station is considered. A method of optimizing the spatial deployment of femtocells using packaging methods is proposed. Based on the method of joining the single femtocell access points, an algorithm for finding and removing potential nested containers has been built. The proposed method of optimizing the spatial placing of femtocells allows to reduce the time of finding the point of installation in order.

Keywords: femtocell, object packaging, planning, access point, container.

I. INTRODUCTION

When placing access points for femtocells, different situations arise due to the need to improve the quality of service for subscribers. There are different methods for spatial placement of access points of femtocells for cases of facilitating access of subscribers at the borders of the service areas belonging to a base station (BS) of the mobile network (Fig. 1).

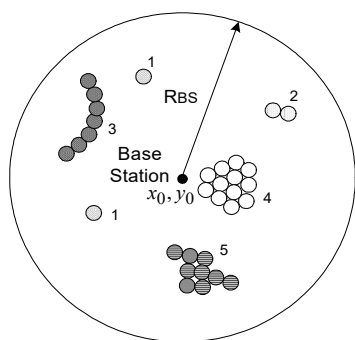


Figure 1. An example of placing femtocells in the BS service area with the coordinates $\{x_0, y_0\}$ and radius R_{BS}

Fig. 1 shows: 1 – single placing; 2 – a group of two femtocells; 3 – linear placing of femtocells; 4 – a compact group; 5 – a complex structure.

As part of the solution to the problem of constructing a network planning technique using femtocells, currently there is no common model for predicting signal propagation, especially when implementing femtocells in buildings. Thus, there is a problem of placing BS access points of femtocells in the

service area, both single objects and objects located in a line on the plane or in the structure of the BS functioning area (Fig. 1).

II. PROBLEM SOLUTION AND RESULTS

When planning service areas on the plane, their structure is represented as circles or hexagonal cells. In 3-dimensional space, the area is represented by a circle or a sphere. If we imagine this volume or plane as a container, then there arises a task regarding packaging of objects (femtocells) – axially symmetrical figures of this container [1]. There are a large number of approximate methods of packaging containers with objects of various configurations: genetic algorithms for optimizing packaging of rectangular objects; sequential, i.e. single placing of circles of different radii; methods of packaging cylinders based on Stoyan ϕ -functions; geometric combinatorics, algebraic methods, etc.

Therefore, the choice of a method is determined by the context of the problem being solved. Among the solutions to such problems, the most appropriate method is a single connection based on the logical choice, which allows to increase the capabilities of the network and is relatively simple.

Based on the selected method of single attachment of objects using logical selection and analysis of the remaining free space of the i th container, an algorithm for searching and deleting of nested containers has been constructed. The proposed method of optimizing the spatial placing of femtocells allows to reduce the search time of the installation point by an order of magnitude.

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