

Abstract

Currently, wireless mobile communications are immersed in a process of evolution. 3G technologies give way to 4G, in a context of tremendous growth in traffic demand by users of mobile broadband, and the introduction of LTE technology is starting to spread.

In this process of improvement, which is a major financial outlay for mobile operators, there is a growing interest in reducing operational expenditures of planning and network optimization, for which automatic mechanisms that perform these functions emerge as the ideal solution.

This PhD Thesis proposes various automatic mechanisms for planning and optimization of LTE networks and provides a detailed study of its performance. The content is structured in three sections, preceded by a description of the followed methodology, which is based on simulations, and the different assumptions made.

The first part focuses on the treatment of available information and describes a set of tools designed to assist in the proposed processes. Of great relevance to the rest of the thesis is the designed location algorithm, which is a fundamental tool in all automatic planning and optimisation mechanisms due to the ability of geo-referencing the information used. The great advantage of the algorithm is that it is possible to use it without introducing any new elements in the network which enable it, as it is based on measurements made during normal operation of the network, acquired through call tracing tools. It is also worth mentioning the use of expert systems based on neural networks for obtaining feedback for specific recommendations given by the designed optimization tool.

Secondly, the planning and optimization of LTE radio access network using heuristic search methods of the optimal solution are treated. The use of realistic traffic maps, enabled by the location algorithm, and the estimation of the load in each cell allows accurate assessment of the performance of the different candidate solutions in an acceptable time, thanks to the linearization of the models used among other methods proposed for efficient execution of the process. It also assesses the impact of the localization algorithm error on the planning and optimization solutions obtained.

Finally, because of radio spectrum resources are limited and need to be managed properly, the best options are analysed when it comes to the reuse of available resources and the migration of base stations of legacy technologies. Furthermore, in order to mitigate the shortage of available resources in frequency, the usage of opportunistic spectrum access mechanisms are proposed to make use of underutilized resources in other wireless systems. This opportunistic access applies to macrocellular environments, where again the location algorithm is an essential tool, and femtocellular environments. Additionally, implementation details of the necessary coordination mechanisms and performance evaluation results are provided.