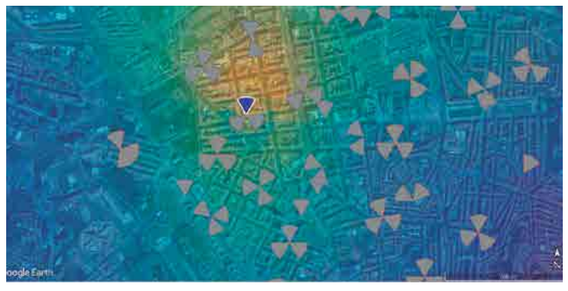
GOLD

Using Geo-Positioned Indicators for Self-optimization of LTE Data networks

The GOLD Project developed self-optimization methods in order to enhance wireless networks capacity, coverage and service quality, while contributing to significant Operational Expenditure (OPEX) reduction. Although the developed algorithms are applicable to (2G/3G) networks, the project primarily concentrated on 3rd Generation Partnership Project (3GPP)'s LTE radio interface.



Main Project Team	
António Rodrigues	**RS- Lx**
Pedro Vieira	RS-Lx
Maria Paula Queluz	MSP-Lx
José Sanguino	RS-Lx
Ivo Sousa	RS- Lx
Indicators	
Funding	35k €
Journal Papers:	1
Conference Papers	8
Concluded PhD	1
Concluded MSc:	8

Two Main Publications

A. Martins, P. Vieira, A. J. Rodrigues, On the Choice of Positioning and Cluster Size for Fixed Relay Stations in a LTE Network, Wireless Personal Communications, Vol. 1, No. 1, pp. 1 - 1, June, 2014,

I. Sousa, M.P. Queluz, A. J. Rodrigues, Efficient Visibility Modeling for Free-Space Optical Systems Design, Wireless Personal Multimedia Communications Symp. - WPMC, Hyderabad, India, Vol. -, pp. - - -, December, 2015

PROJECT WEBPAGE URL

-

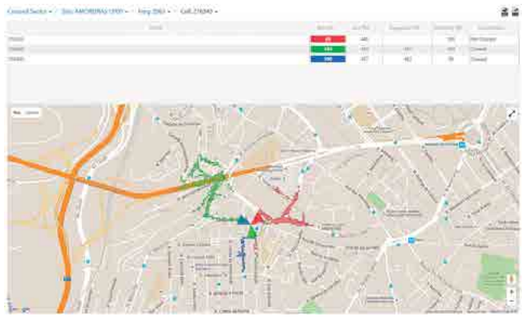


Fig. 1 Crossed sector detection for a enode b in Lisbon area.

Fig. 2 Base-station signal level footprint for central lisbon after geolocating network recordings (traces).

GENERAL MOTIVATION AND OBJECTIVES

The aim of the project was to develop self-optimization methods in order to enhance network capacity, coverage and service quality, while contributing to significant Operational Expenditure (OPEX) reduction. Although the developed algorithms are applicable to (2G/3G) networks, the project primarily concentrated on 3rd Generation Partnership Project (3GPP)'s LTE radio interface. In more detail, the main goals are the following:

1. To develop novel concepts, methods and algorithms for the efficient self-optimization of Long Term Evolution (LTE) wireless networks, optimizing the several Radio Resource Management (RRM) parameters to balance variations in the system operation, gathered traffic, mobility and also radio propagation conditions. These focused parameters manage network operation and performance and include: antenna parameters (remotely configurable antennas/tilt), neighbour lists, handover parameters, scheduling parameters and power settings.

2. To detail the required input data for the self-optimization process, its statistical accuracy and the methods of information retrieval, including the parsing interfaces. Several sources of information were be used, such as Operation and Maintenance (O&M) performance measurements (statistics), geo- located O&M traces, as well as drive tests combining air interface measurements with location information.

3. To test and validate the developed concepts and methods for self-optimization through extensive simulation experiments, using a demonstrator (simulation platform), developed from scratch for the project.

CHALLENGE

The research group for this project included experts in the mobile communications field, with different professional backgrounds, academic and also industry oriented. The project challenge was in fact a group effort between Instituto de Telecomunicações and Celfinet (Portuguese Telecom Consulting Firm), aiming to increase the competitiveness of national science and technology, while promoting the transfer of scientific and technological innovation to the productive sector.

Briefly, the planned work under the proposed project was based on a realistic simulation framework for LTE performance prediction using detailed terrain, building and street databases. The simulation platform was dynamic, hence considered UE mobility. For this reason, real mobility was used, using drive-test data and network traces after applying geo-locating techniques.

WORK DESCRIPTION AND ACHIEVEMENTS

Firstly, a LTE research platform was built, using detailed terrain, clutter and network information. Google Earth powerful Application Programming Interface (API) was set as a starting point for geo-referenced representation. Next, using real data from a Portuguese mobile operator, network inputs were added and mapped into the platform, including network configuration and statistics, drive-testing data and network trace info.

Secondly, and concerning the network traces, geo-location techniques were applied in order to position the network trace information over the simulation platform. Under this work, the following actions were scheduled:

1. Bibliographic research considering geo-locating techniques and the necessary LTE demanding parameters.

2. development of an enhanced approach for the geo-location of network trace data for a real LTE network. The algorithm was implemented using cell data, trace data and also drive-test data, the last for validation purposes.

3. Model validation using available simulations and drive-test data. Network traces associated to test UEs were used, and synchronized with the according drive-tests. Geo-location accuracy was be calculated, along with the geo-located events success rate.

the project developed a LTE geo-referenced visualization tool, where statistics, trace and drive-test data retrieved from a live network were used for self-evaluation diagnosis, allowing several pre-optimization proposals in what concerns crossed sector detection, neighbour list improvement, detection of low QoS/SNIR areas, overshooting areas, Ping-Pong handovers, etc.