CELTIC
Telecommunication Solutions

MOBility concepts for IMT-Advanced

MOBILIA

MOBILIA focuses on some of the most interesting challenges which will be brought about with the upcoming wireless communication technologies. In particular MOBILIA will focus on WiMAX, and will analyze relaying, cooperative schemes, scheduling, heterogeneous accesses, etc. The assessment of these aspects will be carried out by means of simulations, and over a real test bed.

Main focus

MOBILIA project targets ITU IMT-advanced requirements for future wireless systems, i.e. peak data rates of 100 Mbps for mobile applications and 1 Gbps for low mobility. The IMT-advanced vision of future network as being formed of interworking access systems will also be considered. A derived target is to obtain an increased aggregate throughput/user satisfaction vs. existing systems.
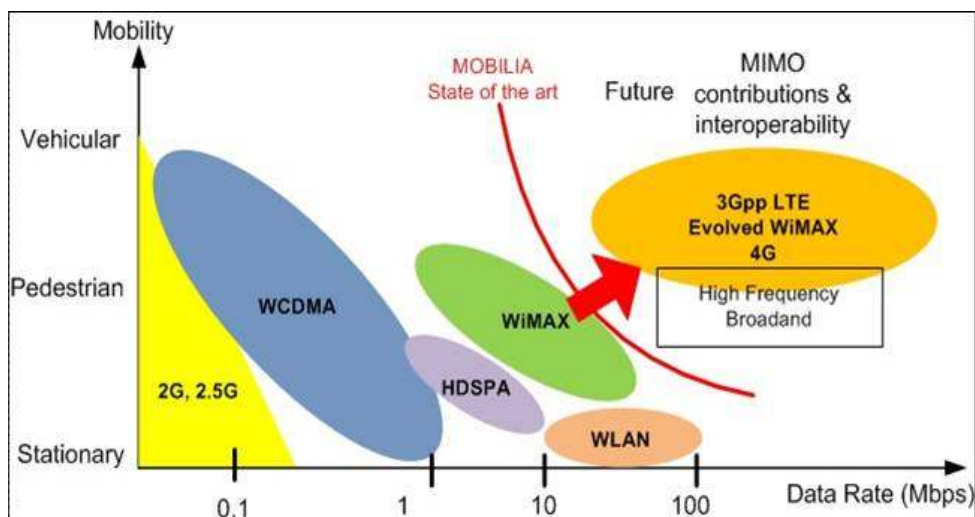
MOBILIA will address these various challenges, mainly in the context of WiMAX, covering, at least, IEEE802.16m, 802.16j and beyond. Other complementary technologies will be also analyzed, e.g. WiFi, to perform relaying in the framework of IEEE 802.16e. For that, MOBILIA will study the following enabling technologies:

♦ Multiple antennas (MIMO) schemes and algorithms.

♦ Relaying schemes: cooperative relays, which can be seen as "virtual MIMO", and may compensate spectral efficiency unbalance within a cell.

♦ Cross-layer techniques for multi user MIMO and relays, assessed by system level simulations. One of the main rationales for these techniques is energy harvesting.

♦ Network and functional architecture supporting the efficient and transparent cooperation between heterogeneous wireless access networks.

♦ Framework to adapt services to underlying resources.

♦ Reconfigurability at the user terminal.

The project will have some show-cases; real platforms will be used as a proof-of-concept.

Approach

In order to accomplish the different goals which have been identified for the project, this has been organized into five technical and two management work packages, as

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Instituto de Telecomunicações, Portugal

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Project Websites:

www.celtic-initiative.org/projects/mobilia

www.mobilia-project.org

enumerated below:

- WP1: Project Management
- WP2: Scenarios and Requirements
- WP3: Broadband air interfaces: advance algorithms and cooperative relaying
- WP4: Upper Level Solutions for BWA and 3G interworking
- WP5: Proof-of-Concept : Platform Validation and evaluation
- WP6: Dissemination and exploitation

WP3 and WP4 will develop algorithms that will be assessed, evaluated and showcased in WP5, which will use existing platforms at several partners. These platforms will be upgraded to demonstrate some of the concepts of the previous WPs. Also, specific developments will both be a proof-of-concept, and will illustrate previous WPs algorithmic performances in real life. WP2 will steer the whole project, defining the scenarios, as well for the algorithmic WPs, as for the platform developments.

Main results

- Advanced single and multi-user MIMO algorithms for OFDMA (Orthogonal Frequency-Division Multiple Access) systems, including new coding and pre-coding schemes at the transmitter, both with low complexity and low power consumption at the mobile side.

- MIMO algorithms performance evaluation, taking into account multi-antenna diagram and 3D channel model.
- Advanced power and bit allocation strategies for global throughput optimization in the SISO (single-input and single-output system), MIMO and multi-user MIMO cases. Scheduling based on cross-layer approach and Fairness issues.
- New cooperative relaying schemes.
- Packet scheduling and dynamic resource allocation with cooperative diversity for OFDMA systems.
- Architecture for a reconfigurable OFDMA terminal.
- Mechanisms over heterogeneous network technologies that preserve session continuity: addressing, routing, and handover.
- Prototype reconfigurable RF (Radio Frequency).
- Network simulator and proof-of-concept prototype for heterogeneous seamless handover with service continuity.
- Service adaptation to underlying resources.

Impact

WiMAX in particular, broadband wireless communications in general is the future market which is on the verge of an exponential growth. Since standardization on this topic is just starting, this is exactly the right moment to develop enabling technologies for such techniques. Open issues concern as well small integrated antennas for terminal and RF, reconfigurable RF and baseband, energy-saving techniques, enhanced spectral efficiency through MIMO algorithms, relay techniques, and/or multi-user scheduling, intelligent heterogeneous handover mechanisms.

The project will foster the research on this area, and will ensure a proper dissemination of the achieved results by means of publications in the appropriate conferences. In addition, the different institutions will exploit the results, so as to create new initiatives, as a way to increase their own activities, etc.

About Celtic

Celtic is a European research and development programme, designed to strengthen Europe's competitiveness in telecommunications through short and medium term collaborative R&D projects. Celtic is currently the only European R&D programme fully dedicated to end-to-end telecommunication solutions.

Timeframe: 8 years, from 2004 to 2011

Clusterbudget: in the range of 1 billion euro, shared between governments and private participants

Participants: small, medium and large companies from telecommunications industry, universities, research institutes, and local authorities from all 35 Eureka countries.

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