



## MUSCLES

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### Partners:

Altice Labs, S.A., Portugal  
Broadcasting Center Europe, Luxembourg  
EURICO Ferreira, Portugal  
Instituto de Telecomunicações, Portugal  
Instituto Politecnico de Castelo Branco, Portugal  
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### Project Website

[www.celticplus.eu/project-muscles](http://www.celticplus.eu/project-muscles)

## Mobile Ubiquitous Small Cells for Low-cost Energy and Spectrum efficient cloud service delivery

The MUSCLES project aims to develop a new low-cost intelligent network structure for next generation mobile networks. The basic idea is to extend the concept of femto cells (with its desirable throughput and energy ratings) to outdoor scenarios, through mobile small cells. These can be deployed on demand to provide connectivity that can be dynamically managed and utilize spectral resources more efficiently.

### Main focus

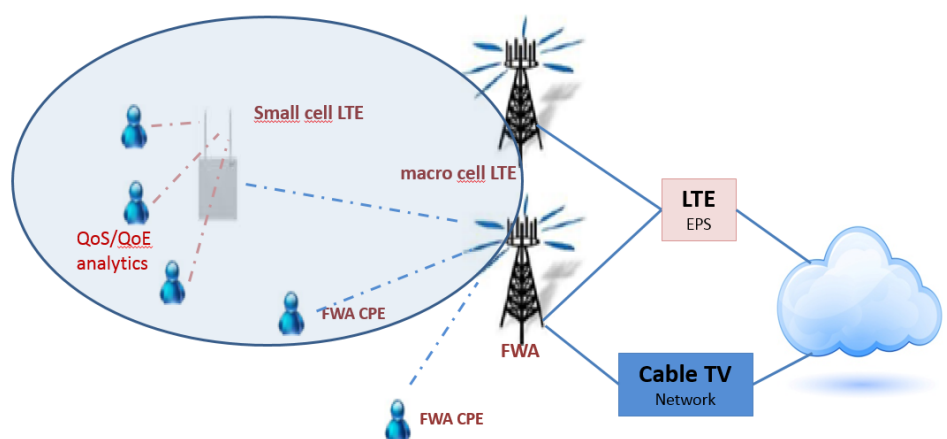
The project will not only realize implementations and showcases, but also create commercially exploitable intellectual property. By definition, MUSCLES is a research not a development project, however a number of prototypes are envisaged:

1. Self-organizing on-demand mobile small cell
2. A system level simulator (SLS), which can serve as an experimental platform to investigate new complicated scenarios
3. A software for automatic management of mobile networks, based on the latest SON algorithms

4. A SW tool for the design of dense backhaul/access networks operating at mm-Wave frequencies based on GIS (Geographic Information System) information and a variety of installation and operation constraints
5. New business models built on top of the disruptive network structure, where services provide a sophisticated, solely IP-based audio-visual content delivery system to the content provider with transparent and seamless handover to the mobile operators' network

### Approach

MUSCLES will investigate how network densification, self-organising networks and autonomous management of networks can be exploited to provide a low-cost on-demand network of small cells, which can be the solution to the increased demand of mobile traffic. Current technology only provides the highest achievable quality, at certain locations where propagation conditions are favourable, which is basically limited to locations close to base stations



(BSs) and access points (APs). The MUSCLE project will overcome such drawback of current technology by extending the notion of Femto-cell (with its desirable ratings in high-speed throughput and energy efficiency) to outdoor scenario; hence providing high-speed broadband service at low energy consumption and reduced costs, anywhere, anytime, without the need for prolonged network pre-planning or high cost infrastructure deployment. It is expected that the MUSCLES technology will contribute to the increase in achieved data rates over mobile networks, without increasing the bill for the mobile network operating costs (OPEX).

## Main results

- ◆ New version of Femto-like small cells that can be instantaneously deployed based on requirements without the need for pre-planning or infrastructure deployment
- ◆ Self-Organizing Networks (SON) capabilities to provide automatic detection and resolution of problems
- ◆ Mobile multimedia services including efficient fast content delivery in order to optimize the utility of the data and minimize the delay for delivery to users
- ◆ A set of algorithms and methodologies for network synthesis

subject to constraints relevant to the usage of mm-wave radio links. Such constraints may include distance limitations, coverage constraints, capacity variability due to whether change, static and dynamic interference mitigation, latency constraints, redundancy and availability constraints

- ◆ A solution that supports efficient handover within a heterogeneous environment, including mobile small cells
- ◆ New disruptive business opportunities for all players and stakeholders, including mobile operators, and mobile cloud service providers.

## Impact

MUSCLES project contributes to a better connectivity of mobile devices (hence addressing the topic of Celtic-Plus "Get Connected), while providing low cost and energy efficient solution.

The project addresses the topic of delivering high bandwidth mobile services, using reduced-cost, spectrum and energy efficient techniques.

The aim lies in providing a low cost solution to address the issue of the unprecedented increase in mobile traffic (which is expected to continue) and ever higher requested data rates, by creating a flexi-

ble solution that can automatically adapt to the changes in the mobile network environment and the traffic demands, without manual intervention. The MUSCLES project will contribute to the advances of mobile industry by delivering an innovative adaptable solution that provides Europe with an edge ahead of North America and Asia.

## About Celtic-Plus

Celtic-Plus is an industry-driven European research initiative to define, perform and finance through public and private funding common research projects in the area of telecommunications, new media, future Internet, and applications & services focusing on a new „Smart Connected World“ paradigm. Celtic-Plus is a EUREKA ICT cluster and belongs to the inter-governmental EUREKA network. Celtic-Plus is open to any type of company covering the Celtic-Plus research areas, large industry as well as small companies

or universities and research organisations. Even companies outside the EUREKA countries may get some possibilities to join a Celtic-Plus project under certain conditions.

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