Vision of WHERE

The main objective of WHERE is to combine wireless communications and navigation for the benefit of future mobile radio systems. The impact will be manifold, such as real time localization knowledge in B3G/4G systems which increase the cellular capacity. GPS as well as the upcoming European Satellite Navigation System Galileo will be supplemented with techniques that improve accuracy and availability of indoor navigation and location based service coverage.

To enable ubiquitous mobile network access and to increase data rates, scientific and technological development is more and more focusing on the integration of radio access networks (RANs). This allows an efficient use even if the radio access technology behind such networks is dynamically changing. The knowledge of the position of mobile terminals is for an efficient usage of RANs valuable information in order to allocate resources or even to predict the allocation within a heterogeneous RAN infrastructure.

Fact Sheet

Project Name	WHERE - Wireless Hybrid Enhanced Mobile Radio Estimators
Research Programme	EU Seventh Framework Programme, Information and Communication Technologies
EC Instrument	STREP Project
Call	FP7-ICT-2007-1
Contract Number	217033
Project Duration	01.01.2008 – 30.06.2010
Man-Power Effort	529 Person-Months
Total Financial Volume	5.551 Million Euro
EC Funding	4.047 Million Euro

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WHERE

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Wireless Hybrid Enhanced Mobile Radio Estimators

Key Issues

The hybrid system approach addressed in the WHERE project encompasses key innovations beyond state of the art for both communications and positioning. A joint consideration of both aspects will allow exploiting synergies among them. In the field of communications, key innovations of WHERE are:

▶ Communication using multiple RANs or radio access technologies (RATs); optimisation of that heterogeneous communications infrastructure based on positioning information of base stations and possibly RAN nodes. Examples of such RAT combinations could be cellular/WiFi or cellular/P2P. Location based protocols, developed and investigated in WHERE, will enable such heterogeneous network connectivity even if the availability of different RANs/RATs is dynamic. This leads to a more efficient use of the available radio resources through advanced location based radio resource management and handover algorithms.

▶ On the physical layer (PHY) technologies and procedures, which take into account positioning information, will be researched. Such approaches optimise MIMO strategies (spatial multiplexing, spatial diversity) or provide adaptive macro diversity techniques.

The motivation for providing accurate position estimation is twofold: Positioning information is provided also in scenarios, which are critical for global navigation satellite system (GNSS) based navigation. On the other side an operation of location-based RAN technologies with independency to GNSS is achieved. Nevertheless, WHERE aims to use GNSS based positioning, e.g., the European Satellite Navigation System Galileo, for improving position estimation. This integration becomes easily possible by hybrid data fusion in WHERE.

The key innovations of WHERE in the area of navigation are:

▶ Research multipath and non-LoS mitigation algorithms for signal correlation based positioning techniques.
▶ Hybrid fingerprinting techniques using both measurement based databases and ray-tracing based databases. Ray-tracing techniques generate position dependent profile databases starting from terrain information. Investigations of the accuracy of ray tracing based predictions by measurements.
▶ Estimation of channel dispersion profiles used in fingerprinting.
▶ Hybrid operation of positioning and communications. This yields to the approach of cooperative positioning, where several mobile terminals provide and share their position information via communication links in order to achieve a more accurate position estimation.

Expected Impact

▶ The project WHERE aims to improve the efficiency of mobile communications systems by providing innovations for the integration of communications and positioning.

▶ Global Standards for a new Generation of Ubiquitous and Extremely High Capacity Network and Service Infrastructures

▶ Reinforced European Leadership in Wired and Wireless Networks

▶ New Industrial/Service Opportunities in Europe

Technical Approach

Seven work-packages coexist and lead together to the successful demonstration combining multiple heterogenous hardware platforms by post processing the achieved innovations. The key work-packages are:

WP-0: Projectmanagement
WP-1: Scenario definitions for positioning and communications
WP-2: Positioning algorithms using communications information: hybrid data fusion and cooperative positioning
WP-3: Communication algorithms using positioning information: PHY, cross-layer enhancements, cooperative communications, optimised cellular connectivity
WP-4: Channel characterisation by measurements, modelling, and estimation methods of the different channel parameters
WP-5: Design, develop, and integrate different functionalities in available PHY platforms
WP-6: Dissemination including showcases of the different platforms at multiple events