Project Achievements

CELTIC Telecommunication Solutions

WIreless Systems providing high QUAlity Services

WISQUAS aimed at playing a key role in providing the enabling technologies for the future wireless multimedia communications, by conceiving excellent fast physical layers, and appropriate higher layers to achieve the best possible performance from the physical layers for the service provisioning at minimum power and cost.

Main focus

The WISQUAS project aimed at enabling multimedia services in future wireless networks. On the one hand, wireless bandwidth is a scarce resource. On the other hand, users want terminals to be light and consume minimum power. Within these constraints, a wide variety of multimedia services are desired. Therefore, current wireless systems need to be upgraded to offer:

- Higher data rates
- Better coverage
- More flexibility, possibility to select between several air interfaces
- Seamless heterogeneous handovers
- Quality of Service (QoS) provisions
- Low energy operation and low power consumption
- High integration
- interference robustness

To fulfil these needs, innovative research was performed and demonstrated for the following topics:

- System specification and innovative design flow to allow cross-layer optimisation
- Advanced physical-layer air interfaces, featuring flexibility, scalability, adaptivity, high capacity and bandwidth efficiency
- Advanced protocols and architectures for QoS at higher layers
- System integration and validation

Low-energy and low-power consumption were mainly investigated through functional models and across several communication layers.

A typical scenario is that of a home network, where several multimedia wireless devices communicate with a wireless router. QoS requirements for multimedia services, e.g. video streaming, are quite stringent. In addition, in-band interferences may arise from other appliances such as microwave ovens, Bluetooth equipment, etc.

Approach

WISQUAS made substantial enhancements to the state of the art in mobile technology and wireless connectivity. It produced disruptive, new algorithms and protocol solutions with a view at the entire communication stack. WISQUAS provided a thorough methodology that guides the designer from service and user definitions towards system specifications.

It enables mobile multi-media terminals,

WISQUAS

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Belgacom, Belgium

CEA-LETI, France

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IMEC - Interuniversitair Micro-Electronica Centrum, Belgium

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capable of adapting their internal radio resources, to suit the particular quality of service being requested at the time, and featuring the possibility to high data rate and mobility using techniques such as diversity and MIMO (multiple input multiple output).

The terminals achieve levels of adaptive quality/power far beyond the state of the art at the beginning of the project.

Intentionally, this project reuses existing platform architectures developed in earlier European projects to maximize the focus on novel algorithm, protocol, and methodology development.

Achieved results

Celtic WISQUAS focused on the development of new functionality and, through the reuse of existing platforms from earlier European projects, minimized the design effort to prove algorithmic and protocol concepts in realistic B3G scenarios.

The main results of the WISQUAS project are

- The validation of new air interfaces designed for realistic B3G scenarios meeting multimedia multi-mode communications user requirements. These new air interfaces adapt more easily to realistic scenarios and services than existing solutions through the development and introduction of advanced algorithms and advanced protocols.
- Cross-layer exploration improved system performance/cost at the expense of a more complicated design phase. This project came up with a sound methodology for a systematic evaluation and optimization of algorithms, protocols, and architectures. Significant results were obtained in term of energy saving at the terminal level. Cross-layer techniques also enable an increase in network capacities by advanced resource allocation management algorithms.
- Another important issue for the user satisfaction is ubiquity, i.e. available radio resources should be accessible in a transparent way. This means that advanced heterogeneous handover procedures should be devised; these handovers should be seamless, maintaining Quality of Service and Quality of Experience for the user.
- The introduction of novel algorithms and architectures require a careful validation on realistic platforms. A proof-of-concept phase using several existing platforms made sure that the new algorithmic and protocol concepts represent indeed valuable solutions for realistic B3G scenarios.

Impact

New wireless technologies touch every aspect of people's lives and impact what people use (mobile devices, cars, home devices, etc.), the networks that connect user's interfaces (GSM, GPRS, UMTS, Bluetooth, WLAN, UWB, satellite networks, etc.), the systems that provide usefulness and efficiency (application servers, e-commerce platforms, middleware technologies or more accurate location sensing capabilities). The challenge clearly resides in the seamless integration of these different technologies to offer end-users a high performing end-to-end experience. The demand of mobility in conjunction with higher data-rates and spectrum efficiency still require huge R&D investments.

Funding R&D projects around mobile multimedia such as WISQUAS enables European market leaders to play a significant role upgrading the standards to deliver the required quality of service for mobile multimedia, at minimum power consumption.

Technologies developed by WISQUAS will target the wider wireless community, as the technology will support backward compatibility to a variety of existing and emerging air interface standards. Standards that have been impacted by WISQUAS are IEEE 802.11n and IEEE 802.16h. 3GPP UMTS LTE (Long Term Evolution) has been monitored and may be impacted in the future. Results have been widely disseminated in WWRF, in 40 conferences and workshops, and 3 Journal papers. The complete list of publications, and whenever permitted by copyrights, the publication itself, may be found on WISQUAS website www.wisquas.org.

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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