

Project information



Enhanced Sensor and WLAN networks using UWB Communications

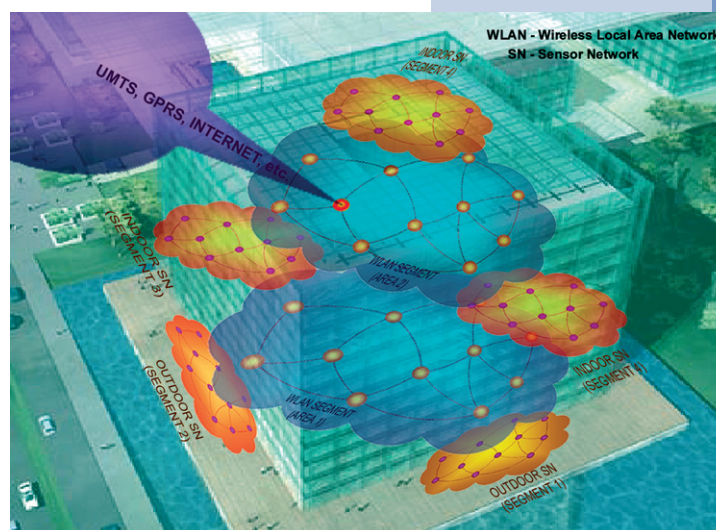
The SPEARHUW project will provide a System Concept Evaluation of service enhancements for WLAN and Sensor Networks in a Small Office / Home Office (SOHO) environment. This will be fostered by combining innovative wireless transmission and routing techniques, namely Ultra Wide Band (UWB) radio interfaces and location-assisted multi-hop transmission. The project aims to minimise the complexity and technical requirements on the physical layer and for networking protocols.

Main focus

Multimedia services are increasingly consuming resources, and there is a growing number of low cost RF devices. These trends are pushing the evolution of wireless communication. It is necessary to intensify the research of optimal spectrum usage, because spectrum availability has become one of the major hurdles for wireless communication. Other aspects of the future evolution of wireless communications will be driven by the need to reduce costs and complexity of new network deployments, leading to the abandoning of the present concept of a centralised base-station.

These facts have motivated the technical and business community in the wireless area to explore network concepts, which overcome the limitations inherent to stand-alone cellular and WLAN networks. One of these concepts is the use of UWB (Ultra-Wideband) technology, whose intrinsic characteristics promote spectrum reuse. The other main concept is multi-hop transmission techniques whose usage diminishes the required transmission power, allowing the coverage area to be easily extended.

These two concepts are synergetic, because UWB technologies allow to determine very precisely the terminal location. This, in turn, opens the way to using location-assisted algorithms for the ad-hoc planning of multi-hop transmission routes between different



terminals. Furthermore, this approach enables UWB networks to form a synergic service with existing and future radio systems, as UMTS or GPS.



Spearhuw

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Approach

Deploying wireless networks based on local area technologies requires installation of the appropriate infrastructure. While this overhead may be acceptable in some environments, it requires a level of expertise for deployment, configuration and administration, which is not suitable for the SOHO environment or sensor networks.

SPEARHUW will adapt the UWB radio technology to the requirements of SOHO environments using ad-hoc networks. These networks are characterised by their ability to operate without any fixed infrastructure, allowing self-configuring multi-hop communication over arbitrary and dynamic network topologies.

To this purpose, new routing protocols will be evaluated, specifically those relying on the distribution of topological information between nodes, either actively maintaining routes to every destination at each node, or reactively, only when a node requests a route.

UWB, based on the transmission of pulsed signals instead of the traditional sinusoidal ones, can be considered as a semi-mature

technology, with several ongoing projects in Europe and abroad, but without any available commercial products until now. Hence the research in UWB physical layer is planned to be carried out on transceiver prototypes.

Concerning MAC/RRM (Medium Access Control/Radio Resource Management) for UWB-based air interfaces, SPEARHUW will explore technologies which allow to keep complexity at a minimum while performing well under high-density conditions. The project will work on a trade-off between complexity and performance for the respective scenarios.

Main results

SPEARHUW will provide a System Concept Evaluation, with a full system approach. The project work includes:

- Examination of new technologies which allow implementing a CPN (Customer Premises Network) broadband infrastructure using UWB radio technology and location assisted multi-hop transmission.
- Early evaluation of integrated system solutions and new service concepts in a

SOHO environment, based on localisation and mobile communication.

- Identification of UWB transceivers and ad-hoc network requirements in a SOHO environment.

- Research and simulation of MAC, routing procedures and algorithms which allow the networking of UWB terminals in multi-hop ad-hoc transmission environments in two versions, Medium Data Rate (MDR) and Low Data Rate (LDR).

- Definition of the communication services for extended WLAN and for sensor networks, whose implementation will be enhanced by the combined use of UWB radio interfaces and precision location assisted multi-hop transmission.

Impact

SPEARHUW will develop a new WLAN and sensor network concept, which will overcome some of the main problems these networks face today.

This will be achieved through:

- Increase of spectrum usage efficiency, due to spectrum sharing and reuse capabilities of UWB technology.

- Decrease of terminal complexity, due to UWB transceivers lack of frequency selectivity (avoiding expensive radio frequency sections) and very low transmitted power needed in multi-hop network architecture.

- Flexible incorporation of new terminals to the network, designed on the ad-hoc topologies, where terminals are added or dropped to the network using decentralized techniques.

Additionally, SPEARHUW also addresses sensor networks, which are now starting to emerge for distributed surveillance and for the monitoring of distributed environments.

For this application, UWB technology, by its inherent wideband, allows very precise terminal location, which, in turn, enables new location-based services.

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 the only European R&D programme fully dedicated to end-to-end telecommunication solutions.

Timeframe: 5 years, from 2004 to 2008

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

Participants: small, medium and large companies from the telecommunications industry, universities, research institutes, and local authorities from 33 countries

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