

Adaptive reconfigurable access and generic interfaces in radio networks

The primary aim of the ARAGORN project is to research and to develop a Cognitive Resource Manager for collaborative wireless networks. The cognitive radio approach aims to ensure that efficient use is made of both node-local and shared resources. The project consists of seven partners from four European countries.

At A Glance: ARAGORN

Adaptive reconfigurable access and generic interfaces for optimization in radio networks



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Main Objectives

Instead of just developing theoretical and simulation tools for cognitive radio design, or concentrating on software-defined radio (SDR) research, ARAGORN will rapidly move towards a commercially viable prototyping and proof-of-concept systems.

The project goes beyond dynamic spectrum usage by applying advanced optimization methods into wireless systems as whole. ARAGORN will extend the CR paradigm to the upper layers, including the scheduling issues and will use advanced methods of artificial intelligence including the use of machine learning methods.

While the project will carry out fundamental research in these domains, the key aim is to have results applicable in industrial context as well. This requirement will be reflected in the definition of prototype scenarios and platforms. In addition to “general” CR applications, specific focus will be placed on applications of cognitive techniques on the ISM bands. Due to the already high number of devices operating on these frequency bands, they provide a highly dynamic radio environment to test new methods in, with direct applications in next-generation wireless products.

The project will also place strong emphasis on modularity of the developed solutions. Reasoning, optimization and machine learning will also be developed into a modular framework into which different information sources and configurable wireless interfaces can be dynamically added. New programming interfaces will also be specified to enable at least the factor standardization of the different parts of the framework. The consortium has strong contacts at different standardisation and industrial consortia working in the field, ensuring that rapid feedback from key stakeholders can be used to further enhance the design and ensure the applicability of the results.

ARAGORN introduces a new paradigm shift in wireless communications where machine learning is used for self-configuring the radios in a resource-limited environment.

Technical Approach

The project aims to generate not only new knowledge and methods, but also provide practical impact for the future wireless devices. The application of machine-learning methods to wireless systems has a high potential to lead a paradigm shift on the efficient use of wireless networks.

Technical and strategic goals of the project will be implemented by five workpackages.

Workpackage 1 will be responsible for the overall management and coordination of the ARAGORN project. The project will design *generic interfaces* for CRM to be able to access all required state information and update the parameter configuration in a cross-layer fashion. Final interfaces will be reported and validated by Workpackage 2.

ARAGORN will *develop and implement a Cognitive Resource Manager (CRM)*, which optimally manages the spectrum resources, networking and link parameters, using information from applications, network and transport layers, and lower OSI-layers.

ARAGORN will also enable the use of historical and collaborative information sharing to achieve better overall system performance and more efficient resource usage.

Workpackage 3 is responsible for these scientific and technical tools.

Workpackage 4 will develop or enhance existing solutions for representation of spectrum occupancy and interference information. WP4 will address the tangible problem of interworking of non-cooperative systems working in the same frequency band.

ARAGORN will prototype, test and validate the system on a reconfigurable hardware with advanced software control. All verifications and specifications will be released through Workpackage 5. The project will yield a hardware prototype and a software reference implementation that are validated in WP5.

About the Consortium

The consortium consists of seven partners from four different European countries. The participants have a proven track record on research and many of its partners have been the first movers in the domain of cognitive radios. The consortium is also striking a strong balance between academic and industry excellence in the field.

The partners are well connected not only in the research community but also have relevant contacts to standardization groups such as SCC41.

Expected Impact

Apart of building core-scientific competence for European academic and industrial partners we actively seek to apply methods to consumer-oriented products. One of the key impact expectations is to apply Cognitive Resource Manager to ISM-band devices.

The overall system and cognitive resource manager will be prototyped on reconfigurable

hardware with advanced software control. The experiments will be performed mostly in the 2.4 GHz ISM-band. The planned impacts of these experiments are to show feasibility of the chosen approaches, but also prototype the first exploitation steps towards incorporating technology into commercial ISM-band devices.

Developed tools and methodologies will be published and tools will be distributed through suitably chosen

licensing rules. We expect to leverage tools and methodology development in the dissemination and exploitation of the project. Especially open dissemination of the results and tools is expected to influence cognitive radio networks community and other project.

The ARAGORN partners will actively contribute to the appropriate standardization entities.

