

Quantitative Assessment of Secondary Spectrum Access

The overall objective of the QUASAR project is to remove the “hype” from Cognitive Radio and Dynamic Spectrum Access discussion and replace that with clearly justified facts and quantified spectrum opportunity models that can be used to make real business and deployment decisions.

At A Glance: QUASAR

**Quantitative
Assessment of
Secondary
Spectrum Access**



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Main Objectives

The need for the radio spectrum for the rapidly growing broadband access services is evident. Abundant and fast access to spectrum has three main advantages: it fosters rapid innovation in wireless systems and services lowering entry barrier on the market; it enables affordable mobile broadband access to all; and it makes new energy efficient wireless systems possible.

Secondary use of already licensed, but inefficiently used spectrum, (Cognitive Radio) has been proposed as a solution to make more efficient use of the spectrum. Low spectrum occupancy in a number of measurement campaigns worldwide has been the basis for claims of large gains in spectrum efficiency by cognitive radio. However, little research has been done to substantiate these claims. The QUASAR project aims at bridging this gap between the claims made in conventional cognitive radio research and practical implementation by assessing and quantifying the “real-world” benefits of secondary (opportunistic) access to primary (licensed) spectrum.

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The specific objectives of QUASAR project are:

- investigating the impact of opportunistic spectrum access on primary system performance, especially as a function of primary system receiver requirements.
- moving the community from “detecting spectrum holes” to the regime of “discovering ‘real’ spectrum opportunities.”
- developing detailed methods to assess the impact of multiple secondary users.
- multi-parameter and utility based assessment of value of spectrum (opportunities).
- providing detailed roadmaps and guidelines on how to apply and analyze new opportunistic spectrum access business models.
- providing specific and reasoned proposals to go beyond the current regulatory framework and to cover the whole value-chain inspiring interaction between all stakeholders and regulators.

Technical Approach

The QUASAR project is broken down into six work packages (WPs). WP1 has two stages – the first task is to define the models, scenarios, performance measures and to make initial proposals for a number of secondary spectrum access regimes that are to be studied in the project. A key line of investigation in the project is about establishing the technical, business and regulatory feasibility of the secondary access regimes. The assessment of the business impact of the proposed schemes, and the regulatory feasibility is done in the remainder of WP1.

Work packages WP2-4 study three key issues that will determine the technical feasibility and performance of the proposed schemes. WP2 introduces the concept of spectrum opportunity discovery and will estimate the performance of secondary access with respect to various methods to determine the possibility to fit the secondary link into the spectrum, space and time constraints given by the primary users.

WP3 studies the impact of the performance of the primary system, in particular the capabilities of the primary receivers to withstand secondary

interference both inchannel as well as in adjacent channels. Both current primary systems (ignorant of potential secondary use) as well as future systems, designed to withstand various amounts of secondary interference.

Unlike most previous studies, which analyze the behaviour of a single secondary user accessing the primary's spectrum, WP4 studies schemes for and interference impact caused by secondary multi-access, i.e. when several secondary users access the spectrum in a cooperative or non-cooperative way. Besides analyzing the feasibility of the various proposed secondary access regimes, WP2-4 will have the common objective to provide models and tools for the performance evaluation.

These methodologies and tools provided by WP2-4 will be put together in WP5. They will be developed and integrated into a toolbox for

quantitative assessment of the spectrum availability and achievable performance of secondary access. This assessment will be done both with respect to traditional capacity measures as well as using user utility base performance measures. The tools are demonstrated by assessing the performance of the proposed schemes in the scenarios defined in WP1.

WP6 finally deals with the dissemination of results with focuses on two items – technical publications and input to regulatory bodies. The toolbox used for spectrum availability assessment (or parts of it) is also made publicly available on the project website.

Expected Impact

Together with other European Projects in the area QUASAR is re-positioning Europe to the forefront

of cognitive radio research. As some of the competing economies, most notably the USA through FCC decisions, have started to work on dynamic spectrum access and cognitive radio technologies, it is imperative for European industry and community to build a cohesive policy framework and business model to ensure competitiveness. It

should be noted that developing only technology advances or pure standardization alone will not necessarily ensure commercially viable exploitation and success, as has been learn from recent history. The European industry position is strengthened by moving it to the forefront of new spectrum use concepts.

QUASAR will provide a comprehensive analysis of the techno-economical environment and provide detailed roadmaps and guidelines on how to apply and analyze new opportunistic spectrum access business models. The project will finally provide specific and reasoned proposals to go beyond the current regulatory framework. A balanced project team will provide results of high scientific quality and strong impact on the regulatory process and wireless business.

