

# Advanced Resource Management Solutions for Future All IP Heterogeneous Mobile Radio Environments

*The AROMA project aims to devise and assess a set of specific resource management strategies and algorithms for both the access and core network parts that guarantee the end-to-end QoS in the context of an all-IP heterogeneous network.*

## At A Glance: AROMA

### Project Coordinator

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**Duration:** 01/2006 – 12/2007

**Total Cost:** €3,47 m

**EC Contribution:** €2,0m

## Main Objectives:

The objective of the AROMA project is to devise and assess a set of specific resource management strategies and algorithms for both the access and core network parts that guarantee the end-to-end QoS in the context of an all-IP heterogeneous network.



In order to achieve this main objective, the following partial goals will be addressed in the project:

- To identify, propose, simulate, assess and validate **advanced Radio Resource Management (RRM) algorithms** for GERAN and UMTS as well as novel radio concepts beyond 3G (B3G).
- To develop **Advanced Common RRM (CRRM)**, covering among other: CRRM algorithms exploiting the non-homogeneous system conditions along time, Load-sharing CRRM algorithms using GERAN and UTRA MBMS, and Cross layer RRM algorithms based on IP-RAN.
- To propose simulate, assess and validate **innovative end-to-end QoS strategies** considering both radio and core network aspects under a variety of conditions, at least including: MPLS and lower-layer interaction for end-to-end support, IP-RAN traffic engineering strategies and Mobility issues.

- To develop mechanisms allowing **automated tuning of the CRRM/RRM algorithms** and corresponding parameters via network management software.
- To carry out **economic evaluation on the impacts of the novel solutions** considered by the project.

Therefore, the AROMA project aims not only to assess and maximize the potential benefits coming from the medium-term evolution of the considered radio-access technologies (e.g. HSDPA/HSUPA; MBMS) but in parallel also to promote and investigate potential benefits coming from a long-term evolution towards an all IP heterogeneous mobile and wireless network architecture. In that context, the RAN architecture should be also evolved to accommodate future IP-based networks, which allow a common transport even in different access networks, simple resource management, and easy heterogeneous inter-working.

## Technical Approach

The project will be carried out in the following main stages:

1. Determination of interest and relevant target scenarios. This includes the following considerations:
  - a. Communications environment, i.e. macrocell, microcell, indoor, etc., and user mobility.
  - b. Radio Technologies deployed (GSM, GPRS, EDGE, UMTS, 802.11, WIMAX), their corresponding capabilities and functionalities, as well as their corresponding network architectures and entities.

- c. Service mix and service load (conversational, interactive, streaming, etc.).

These activities are carried out in WP2

2.- Development of advanced resource and QoS management algorithms, with simulation evaluation. Focus will be placed on finding commonalities among the different scenarios considered, rather than trying to optimize algorithms and algorithmic parameters for a specific scenario. Thus, the goals of AROMA extend the mere analysis of different scenarios and will target the definition of generic end-to-end resource management criteria, facilitating their applicability in scenarios differing from those studied in detail within the project.

These activities are carried out in WP3.

3.- Techno-economic aspects: economical analysis and evaluations of the technical outputs of the project. These activities are carried out also in WP2.

4.- Validation and demonstration of the proposed algorithms for the defined scenarios by means of a real time testbed supporting IP-based mobile multimedia applications with end-to-end QoS capabilities.

These activities are carried out in WP4.

Two additional workpackages (WP1 and WP5) are dedicated to project management and dissemination, and standardization.

### Key Issues

The research challenges, to be tackled by AROMA project, can thus be summarized as follows:

- To define an advanced All-IP hierarchical end-to-end architecture and to investigate issues related to the inter-working of the core network and access part.

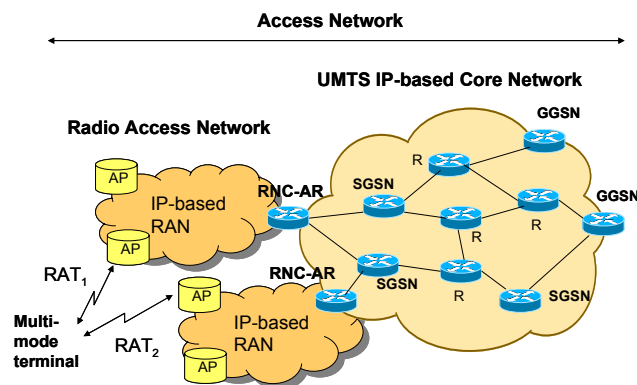


Figure.- All-IP mobile network architecture (all-IP UTRAN evolution for UMTS).

- Further, the project will pursue to define, assess and validate Common RRM (CRRM) algorithms within and between mobile and wireless systems (e.g. GERAN, UMTS, and IEEE 802 standards).
- Another objective of the project is to define, assess and validate specific solutions for the optimization of radio protocols for IP traffic, mainly with respect to latency and enhanced data throughput (i.e. header compression algorithms, RAB setting optimization, MAC scheduling algorithms, etc.).
- To establish a new and advanced methodology for 3G network automatic planning and optimization, which will enable 3G mobile operators to improve their networks' coverage, quality and capacity, thus resulting in better profitability and reliability.
- Similarly, to increase the spectrum utility over the scarce resource air-interface, cross-layer RRM (XLRRM) will also be considered, following two objectives: specific service optimization and specific scenario optimization.
- Last but not least, it is also of prime importance to carry out economic evaluations on the impacts of the novel solutions considered by the project.

### Expected Impact

The expected research results from the AROMA project can be summarised as follows:

- Further progress on the definition of advanced RRM/CRRM mechanisms leading to an optimized usage of the different Radio Access technologies.
- Providing innovative end-to-end QoS strategies for an All-IP mobile access network. Define the interactions between a BB and the radio entities, in order to provide the adapted QoS to the service and to use in an optimal way the heterogeneity of the All-IP access network.
- To develop mechanisms allowing an automated tuning of the CRRM/RRM algorithms and corresponding parameters via network management software.
- To carry out economic evaluations on the impacts of the novel solutions considered by the project.

The commercial impacts of the studies carried out within the project are expected to be viable in the years 2010-2015; from the much hoped-for commercial success of 3G networks until their full maturity.