



Self-Management for Unified Heterogeneous Radio Access Networks

At A Glance: SEMAFOUR

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SEMAFOUR

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SEMAFOUR aims at taking the operation and management of mobile wireless networks to the next level, by the design and development of a self-management system which enables the mobile network operators to manage and operate their heterogeneous radio access networks in a unified manner.

Main Objectives

The first steps towards a self-management system have already been taken with the standardised self-organising networks (SON) solutions in 3GPP. These solutions mostly target individual radio access technologies (RATs) and layers, and are missing a system-level perspective.

The overall objective of the SEMAFOUR project is to design and develop a **unified self-management system** for heterogeneous radio access networks, comprising **multiple RATs and multiple layers** of cellular hierarchy. This unified self-management system should represent the complete environment as one single network towards the operator through a unified view.

A first key objective of the project is the development of **multi-RAT / multi-layer SON functions** that provide a closed loop for the configuration, optimisation and failure recovery of the network across different RATs and cell layers. Such coordinated adaptation of radio (resource management) parameters is imperative for the global optimisation of the network performance.

The second key objective is the design and development of an **integrated SON management system**, which interfaces between operator-defined performance objectives and the set of multi-RAT / multi-layer SON functions. This new management system will provide a unified view on the performance of the heterogeneous network environment and allow its efficient control and operation. It will enable operators to move their operational focus towards a higher, more global level, which is more transparent to the specifics of the underlying network technologies and cellular layout.

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In order to assess the achievable improvements in terms of network performance and manageability, the developed solutions will be evaluated through extensive simulation experiments and visualised by a **demonstration system**.

Further SEMAFOUR aims at **influencing future standardisation** content and directions, by having a bi-directional communication with 3GPP, especially with the RAN3 group.

Technical Approach

The SEMAFOUR technical activities are organised into three work packages (WPs):

WP 2: Requirements, use cases and methodologies. In work package 2, the use cases for which technical solutions will be developed are defined, together with their requirements.

WP 4: SON for future networks. In this work package, SON functions for multi-layer LTE networks, for multi-RAT networks and for integrated multi-RAT, multi-layer networks are developed.

WP 5: Integrated SON management. In work package 5, concepts, methods and algorithms for an integrated SON management consisting of policy transformation and supervision, operational SON coordination, and monitoring, are developed.

The results of WP 4 and WP 5 will be evaluated by means of **simulation**. The reference scenarios, the modelling assumptions and the methodologies for performing simulations are defined in WP 2. The main results of WP4 and WP5 will form the basis for a **demonstrator** that will be developed in WP3. All these WPs will provide input to the **dissemination and exploitation** activities in WP6. WP1 takes care of the overall management of the project.

Key Issues

The figure shows the key elements of the SEMAFOUR technical approach.

A major step forward in the management of mobile networks would be that network operators do not have to analyse, control and optimise a multitude of RATs and layers individually and in isolation from each other, but are able to interact

with this complex heterogeneous environment through a **unified self-management system** that represents the complete environment through a unified view. Once general network-oriented objectives and desired network-wide performance and behaviour have been specified, in line with the operator's operational strategy, the SON paradigm enables the autonomous operation, configuration and optimisation of the networks such that the general network-oriented objectives are met. The SON paradigm thereby requires a multitude of **multi-RAT and multi-layer SON functions** to be operational in the network. Furthermore an **integrated SON management** is required that integrates and coordinates this multitude of SON functions and provides a common means of control and feedback on the specified general network-oriented objectives towards the operator.

Expected Impact

The targeted unified self-management system addresses an extremely important need for the operator with high-added value, as it will considerably improve the manageability of the network, provide performance and capacity gains, and reduce the network management costs.

The involvement of two major mobile operators and two major infrastructure vendors within the project, together with an advisory board to enable input and feedback from major European operators outside the project, ensures that SEMAFOUR is **industrially driven** and will consider and solve the real issues European operators are facing today and in the future.

The SEMAFOUR project addresses in this way the expected impact of the EU FP 7 ICT work programme 2011 and will contribute (i) to the development of technology for the future generations of European mobile networks; (ii) to an

increased economic efficiency of radio access infrastructure; (iii) to a strengthened position of European industry in the fields of mobile and wireless broadband systems and network management technologies; (iv) to the industry adoption of spectral-efficient broadband wireless systems; and (v) to standards and IPRs, with a predominant role for Europe in standardisation bodies and fora.

