



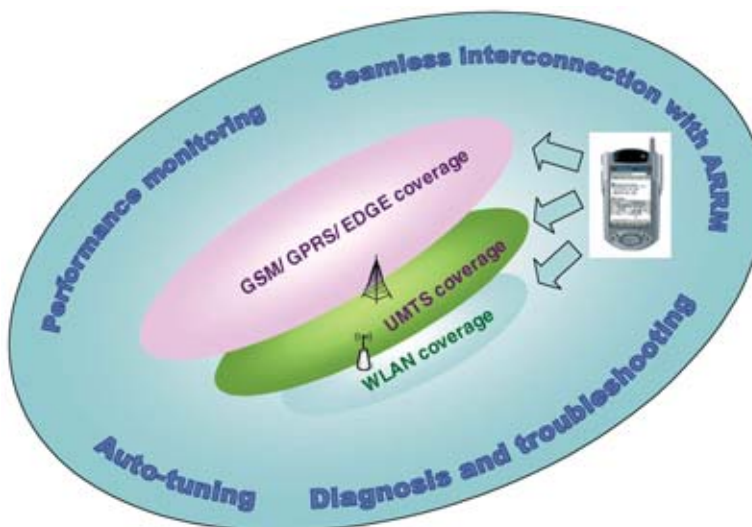
Monitoring and self-tuning of RRM parameters in a multi-system network

The main focus of Gandalf is automating common management tasks in heterogeneous mobile networks (GSM, GPRS, UMTS and WLAN) including monitoring, self diagnosis and fault management, advanced radio resource management and auto-tuning techniques. This automation will optimise the use of scarce radio resources, improving network performance and perceived quality of service and reducing operational expenditure associated with network maintenance.

Efficient ARRM that automatically and dynamically adapts to varying network conditions will be developed to improve cooperation between radio access networks. This automation of management tasks will improve heterogeneous network performance and quality of service perceived by the user. It will also lead to full resource utilization of the deployed networks and cost reduction of maintenance tasks.

Main focus

The main challenge for Gandalf is to develop and demonstrate Advanced Radio Resource Management (ARRM), auto-tuning techniques as well as diagnosis and troubleshooting in heterogeneous mobile network. Auto-tuning builds upon data collection and processing to assess network performance, it identifies problems and suggests repair actions in either dynamic or static modes of operation.



Gandalf

Project ID: CP2-014

Start Date: 11 April 2005

Completion date: 10 April 2007

Partners

Ericsson Ireland, Ireland
France Télécom R&D, France
Moltsen Intelligent Software, Denmark
Telefónica I+D, Spain
University of Limerick, Ireland
University of Malaga, Spain

Co-ordinator

Zwi Altman
France Télécom, France
E-mail: zwi.altman@francetelecom.com

Project web site

www.celtic-initiative.org/projects/gandalf

Approach

The project will develop techniques to collect and process network data on a large scale in order to produce key performance indicators to identify malfunctions, perform efficient troubleshooting and to dynamically propose and perform repair actions.

An automated diagnosis and troubleshooting approach will be developed using Bayesian networks which is an artificial intelligence based approach. Bayesian networks are probabilistic representations for uncertain relations, which have been successfully applied to real-world problems, such as diagnosis of medical diseases.

To optimize the user-perceived quality –of service (QoS) and overall multi-system performance, new radio resource management algorithms and methods for self-tuning will be developed. Algorithms based on fuzzy logic and fuzzy inference systems (FIS) will be implemented. In addition, a reinforcement learning approach called fuzzy Q-learning will be developed as well as other optimization techniques. This is meant to optimize the advanced radio

adapt the auto-tuning process to new network conditions and to traffic variation, The concepts developed in the project will be validated through simulations and emulations. The diagnosis and troubleshooting will be demonstrated through a Bayesian expert system. The ARRM and auto-tuning concepts will be validated using a multi-system simulator (GSM/GPRS/UMTS/WLAN) and a multi-system testbed.

Main results

The results of the project will include algorithms, techniques and methods to automate management tasks in a multi-system context, including large-scale data collection and processing, KPI-based assessment of radio-network quality in a heterogeneous environment, ARRM algorithms for seamless mobility and admission control, auto-tuning techniques, monitoring and troubleshooting. Engineering rules, parameterization and configuration management techniques will be developed to improve heterogeneous mobile network performance.

Software, industrial tools and a multi-system testbed will be developed to test and validate new concepts: diagnosis and troubleshooting expert system, a multi-system network simulator, and a UMTS-WLAN testbed.

Impact

The techniques developed for automation of management tasks will reduce operational expenditure of operators for maintenance, monitoring, diagnosis and troubleshooting. Moreover, automation of management will lead to full utilization of the radio resources of the deployed networks.

The improved network cooperation via novel ARRM algorithms and auto-tuning techniques will bring a better return on investment of deployed radio access networks and the full benefit from the complementarity of these networks and the overall capacity offered by them. Furthermore, better quality of service will be achieved in terms of accessibility, the extent of the service offered, and seamless mobility. The results related to network cooperation will benefit vendors in terms of orientation of roadmaps of future releases, enabling cheaper, improved and more efficient heterogeneous mobile networks.

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

CELTIC Office

c/o Eurescom,
Schloss-Wolfsbrunnenweg 35,
69118 Heidelberg, Germany
Phone: +49 6221 989 372,
e-mail: office@celtic-initiative.org
www.celtic-initiative.org

