

SON Test-Bed

Abstract

Self Organising Networks (SON) refer to the automatic configuration, optimisation and healing of communications networks. Some basic SON aspects were standardised in 3GPP Release 8. Work is in progress to standardise more advanced SON aspects for 3GPP Release 9. Roke has developed a test-bed to support the development of SON concepts, algorithms and protocols. The test-bed uses a modular architecture which can be scaled to support complex networks consisting of many eNodeBs. Features such as the automatic establishment of X2 interfaces between eNodeBs via Automatic Neighbour Relation (ANR) functions are supported.

SON

Self Organising Networks (SON) is an umbrella term which in practice covers Self Configuration, Self Optimisation and Self Healing of communications networks. The goal is to enable the successful deployment and operation of networks with the minimum human operator intervention. This provides the operator with the benefits of reduced operating expense (OPEX) as well as increased efficiency and user satisfaction since the network is able to optimise itself as conditions change.

SON is being actively pursued for mobile networks, especially LTE because such networks exhibit high degrees of variability in terms of environment, usage patterns and growth and have potentially large numbers of basestations. SON is also important in the burgeoning femto/home basestation market where operators will rely on the end-customer to install and operate the equipment but where radio conditions and interactions with macro cells will be quite complex.

SON provides capabilities to address some of the key drivers for mobile operators: reduced OPEX (fewer skilled staff); reduced churn (increased user satisfaction) and reduced energy consumption. SON will be an important component of future mobile networks and products.

The Next Generation Mobile Networks (NGMN) Alliance places great importance on SON and has published a set of Use Cases and a Requirements Specification.

3GPP has standardised basic SON aspects for LTE in Release 8, due for completion this year and the basis for trials and early deployment of LTE. More advanced SON aspects are being progressed as a Release 9 work item.

The EU Seventh Framework Program is running SOCRATES – a 3 years research project on SON.

The following are some of the important areas where SON can provide solutions:

- Self Optimisation of femtos / home eNodeBs – neighbour list management and handover decision making for various scenarios including Closed access home, Open access home, Lamp-post and Enterprise.
- Reduced Energy Consumption – techniques for ensuring the optimal number (minimum) and most suitable cells/eNodeBs are active to support the current load and mobility patterns, and supporting seamless handover when cells/eNodeBs are turned on/off.
- Automated Tracking Area configuration and modification in order to minimize tracking area update and paging. Aspects such as seamless introduction of new cells and coping with unusual events such as sports events or festivals should be considered.
- Optimised handover decision making catering for varying load and mobility patterns.
- Load balancing between cells.
- Automated Admission Control optimisation catering for varying load and mobility patterns.
- Automated Congestion Control optimisation catering for varying load and mobility patterns.

SON Test-Bed

Roke Manor Research Ltd (Roke) has developed a Self Organising Networks (SON) test-bed which provides a platform for prototyping, evaluating and validating new SON concepts, algorithms and protocols. It allows candidate solutions and options to be quickly assessed in different scenarios for complex networks, something which can be difficult, or even impossible, using analysis alone.

In order to take advantage of real cost savings and efficiencies that SON solutions can offer, network operators have to place their trust in automatic software systems running in the network nodes, but the next generation of mobile networks are highly complex and the true performance of a new SON feature will be far from obvious.

SON test-bed features:

- Graphical user interface (see Figure 1) supporting
 - Fast and efficient scenario design and configuration
 - Real-time behavioural visualisation for rapid assessment and verification
- Nodes (e.g. eNodeBs) implemented as virtual machines to minimise hardware requirements
- Modular architecture and execution environment to ensuring accurate implementation

- Scalable architecture which allows 10s or 100s of eNodeBs to be tested cost-effectively
- Allows use of a common code base between test-bed and product
- IP network to support S1, X2 interfaces

The test-bed supports the following:

- Rapid prototyping with a short turnaround time between concept the evaluation
- Evidence based assessment of options and alternative designs
- Assessment and verification across different network scenarios and configurations
- Development of product-ready solutions



Figure 1: Automatic establishment of X2 interfaces using ANR

Customer benefits:

- Concept proving to support standardisation efforts
- Reduced time between concept and product (faster time to market)
- Verification that solutions are robust and fit-for purpose
- Fine-tuning of algorithms to optimise network efficiency
- Demonstration of the benefits of new SON solutions to operators

Summary

Roke is bringing to bear its vast experience in cellular networks, control-plane development, network management, intelligent networks, algorithms, artificial intelligence, simulation and modelling to the application of SON in LTE networks. The SON test-bed is a proprietary tool which enables Roke to develop and test new SON concepts, algorithms and protocols.

**For further information
please contact:**

Andrew Reeve

Roke Manor Research Limited

Romsey, Hampshire, SO51 0ZN, UK

T +44 (0)1794 833000

F +44 (0)1794 833433

mobile@roke.co.uk

www.roke.co.uk/lte

Part of the Chemring Group

© Roke Manor Research Limited 2009. All rights reserved. This publication is issued to provide outline information only, which (unless agreed by the company in writing) may not be used, applied or reproduced for any purpose or form part of any order or contract or be regarded as representation relating to the products or services concerned. The company reserves any right to alter without notice the specification, design, or conditions of supply of any product or service.

This is a published work the copyright in which vests in Roke Manor Research Ltd. Export of this product may be subject to UK export license approval.