Constraint-Based Planning of Mobile Communication Networks: Optimisation Models and Constraint Algorithms

Dr Wei Huang and Professor Ben Allen
University of Bedfordshire
Department of Computer Science and Technology
Wei.Huang@beds.ac.uk
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Background

Efficient network planning is crucial for the deployment of mobile communication networks. Due to the high costs of network infrastructures and the scarcity of radio resources, effective methods of computing basestation locations have become essential. In the commercial arena, network planning involves an expert to manually select and configure the base station sites in an iterative process and such a process is very time-consuming due to many tuneable parameters, so it is very unlikely to obtain an optimal solution. The automatic selection and configuration of base station sites for mobile network is vital for economic provision of mobile communication services. The selected sites form the basis of a network that must satisfy certain requirements such as high area coverage and high traffic capacity but that minimize infrastructure cost [1]. Classical coverage models adopted for second-generation cellular systems, are not suitable for planning the latest generation systems due to the increased complexity of the system and the number of parameters that have to be considered [2].

In the literature, a number of approaches have been proposed to optimise the planning process. Existing research relates to mathematical models and heuristic techniques such as Tabu Search (TS) and Simulated Annealing (SA), and usually turns the problems into NP-hard problems that are out of the reach of state-of-the-art optimisation algorithms. Therefore, in this project, a completely new way of thinking is proposed to plan mobile telecommunication networks. A novel constraint-based methodology will be developed to optimise the network planning process. By using constraint-based techniques such as constraint programming (CP), the network planning problem is treated as a constraint satisfaction problem (CSP). The constraint-based approach is effective at solving complex problems with many parameters and constraints. It is fast, practical and significantly different from existing research in mobile network planning. An in-depth investigation is needed to enable the full potential of this approach to be explored and applied in mobile telecommunication network planning. The key ideas created in this project are also expected to be useful to the 4^{th} generation wireless network design.

References

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