

POWEA: A System for Automated Network Protocol Parameter Optimisation Using Evolutionary Algorithms

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The continuously increasing interconnectedness and integration of large computer systems as well as the hereby accompanied raise in communication effort permanently leads to new communication systems and protocols. Simultaneously, researchers and engineers try to guarantee the sustainability of such systems by optimising and enhancing existing algorithms. This leads to a growing complexity of the particular methods and a rapidly increasing number of possibilities to configure the resulting systems.

Usually, a developer of a new network protocol starts with a theoretical model and a simulation-based validation of the process. The proof of the protocol's operation is followed by the implementation and experiments in simulation environments and real target systems. A configuration of parameters has to be found, which is adapted as well as possible to the particularly given situation. Previous approaches were usually based on manual exploration of parameter sets and trial-and-error methods combined with human estimation and logic. Manual fine-tuning of protocol parameters requires a deep understanding of the protocol itself and the solution of a full custom optimisation can not be transferred to other protocols. A standard software system, which can be used to optimise the configuration of the protocol automatically, as desired and needed by protocol developers and researchers does not exist yet.

With POWEA this paper presents an automated system for the optimisation of network protocol parameters based upon a constraint-model. We introduce EAs as basic approach followed by related work for automatic network protocol parameter optimisation. Furthermore, the approach and basic concepts of POWEA are described, following the concrete example of optimising a protocol developed by the authors of this paper. The generic character of POWEA is demonstrated by applying the system for two further protocols taken from the field of mobile ad-hoc networks. The performance is measured by comparing the results of our system with those initially applied and published by the authors of the particular protocols. Finally, we summarise the approach and name further improvements of the system and next steps of the research.