Applications Of Genetic Algorithms To Optimal Multilevel Design Of MPLS-Based Networks

El-Alfy, ESM

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King Fahd University of Petroleum & Minerals

http://www.kfupm.edu.sa

Summary

This paper proposes a design methodology based on the application of genetic algorithms (GA) to find a minimal-cost topological structure of MPLS-based networks. MPLS technology is currently deployed in designing the backbone infrastructure of service provider networks whereas other parts of the network are still operated using the traditional IP protocol. This makes the overall topological structure of MPLS-based networks naturally breaks into two prime sub-problems: access network design and backbone network design. The ultimate goal is to identify the locations of label-edge routers and label-switching routers, and to determine the interconnection links and their capacities to accommodate expected traffic demands. The locations of label edge routers depend on the demands of a given set of terminal networks which in turn affect the design of the backbone network. This problem is a highly constrained NP-hard optimization problem for which exact solution approaches do not scale well. We first present a multilevel design model that divides the optimal topology design into a set of linear programs. Then, we propose GA-based meta-heuristics for solving them. We also discuss the impact of encoding methods and genetic operators and parameters on the performance. Numerical results for the considered cases show that the proposed methodology is effective and gives optimal or close to optimal solutions as compared with the exact branch and bound method.

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