

Path Protection and Blocking Probability Minimization in Optical Networks

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Abstract

We study the problem of shared path protection in optical networks from the viewpoint of blocking probability minimization. Unlike the worst-case approach common in other studies, which typically deals with one failure at a time and requires recomputation of the protection paths after every failure, our framework assumes a fixed path protection strategy for every connection that does not change in response to failures in other connections, which is more realistic for networks with high failure rates. We study backup-path strategy configurations that minimize the blocking probability and derive various properties. We show that configurations which do not have partial overlaps among connections' backup paths are optimal in a rather general sense. We discuss the min-max optimal configuration properties and present an efficient algorithm for finding it in a case of special interest, while showing it to be NP-hard in general. In addition, we discuss the properties of the game resulting if each connection chooses its backup path selfishly; we show it to belong to the class of potential games, well-studied in the game theory literature, and derive several further properties resulting from its specific structure.

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