

## **New Approach for Minimizing Wavelength Fragmentation in Wavelength-Routed WDM Networks**

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**Abstract :** Wavelength Division Multiplexing (WDM) is the dominant transport technology used in numerous high capacity backbone networks, based on optical infrastructures. Given the importance of costs (CapEx and OpEx) associated to these networks, resource management is becoming increasingly important, especially how the optical circuits, called "lightpaths", are routed throughout the network. This requires the use of efficient algorithms which provide routing strategies with the lowest cost. We focus on the lightpath routing and wavelength assignment problem, known as the RWA problem, while optimizing wavelength fragmentation over the network. Wavelength fragmentation poses a serious challenge for network operators since it leads to the misuse of the wavelength spectrum, and then to the refusal of new lightpath requests. In this paper, we first establish a new Integer Linear Program (ILP) for the problem based on a node-link formulation. This formulation is based on a multilayer approach where the original network is decomposed into several network layers, each corresponding to a wavelength. Furthermore, we propose an efficient heuristic for the problem based on a greedy algorithm followed by a post-treatment procedure. The obtained results show that the optimal solution is often reached. We also compare our results with those of other RWA heuristic methods.

**Keywords :** WDM, lightpath, RWA, wavelength fragmentation, optimization, linear programming, heuristic

**Conference Title :** ICNGCO 2015 : International Conference on Network Games, Control and Optimization

**Conference Location :** Copenhagen, Denmark

**Conference Dates :** June 11-12, 2015