# Trading Power Savings for Blocking Probability in Dynamically Provisioned WDM Networks

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**EXTENDED ABSTRACT**

In those networking scenarios (e.g., the stationary/mobile wireless paradigm) where limited energy storage capabilities is a limiting factor, power efficiency has been studied extensively for a long time. In the last few years, the steadily growing power consumption figures of ICT [1][2] along with a recent public awareness of the possible environmental effects, broadened the focus of the research efforts towards more power conscious solutions also for wired networks. One promising solution going in this direction is represented by transparent wavelength division multiplexing (WDM) networks, where all-optical circuits (or lightpaths) carry the network traffic from the source to the destination node in the optical domain, i.e. without any optical-to-electrical (O-E-O) conversion. To further improve network power efficiency, several approaches have been proposed in the literature attempting to reduce the power consumption in transparent WDM networks [3][4]. Among them, power aware (PA) routing and wavelength assignment (RWA) algorithms are receiving a lot of attention. One possible solution for the PA-RWA problem is to limit the number of devices in the network that need to be powered-on to support the lightpath requests [5]. These methods, however, have an adverse impact on the length of the provisioned lightpaths. In order to efficiently use as much powered-on network resources as possible, the path length is, on average, longer than the one found with traditional (and less power efficient) shortest path solutions. This is in contradiction with the goal of classical RWA algorithms that tend to minimize the resource usage (i.e., wavelengths and fibers) within the network, in order to minimize the blocking probability. When availability of network resources becomes something that cannot be overlooked, a trade off needs to be assessed between power savings and blocking probability.

In this talk, a non-conventional solution to the PA-RWA problem is presented. It is based on the intuition that, in some cases, relaxing the power minimization constraint can have beneficial effects on the overall network performance, i.e., it can contribute to the reduction of resource fragmentation in the network and, in this way, lower the blocking probability. The proposed algorithm leverages on a cost function that considers both the power status of network elements (in this particular case the in-line optical amplifiers on fiber links only) and the information about wavelength usage. The algorithm has been tested using a Pan-European core network (i.e., COST 239). Performance results confirm the presence of a trade-off between energy saving and blocking probability. They also suggest that a "binary" approach using only the powered-on/powered-off information might not always be the best choice.

**Keywords**: Green networks, power-aware routing, routing and wavelength assignment (RWA), power efficiency, dynamic lightpath provisioning, blocking probability.

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