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ADM Reduction in SONET-WDM Rings under stochastically varying traffic and Optimization of the P2MP multicast tree

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During this project, we have tackled two NP class optimization problems in networking and found heuristic solutions to each one. First problem deals with reduction of ADMs in SONET-WDM ring networks. The second problem is Optimization of P2MP multicast LSP trees. In the next two paragraphs we have provided abstracts to both problems. SONET-WDM rings are commonly used for wide-area network design. Reduction in the number of electronic multiplexers in SONET-WDM ring networks refers to minimization of ADMs. Minimization of ADMs under uniform and non-uniform constant traffic has been an area of active research. However, there is still no comprehensive study on minimization of ADMs under time-varying traffic. In ADM minimization, the role of stochastic traffic should be taken into account. In this regard, the study of stochastic nature of internet traffic becomes necessary. We assess the nature of internet traffic and formulate a framework for the stochastic analysis of internet traffic. We then formulate a problem of minimization of ADMs under stochastically varying non-uniform traffic for SONET-WDM ring networks under a given blocking probability constraint. We first examine the effects of breaking the problem into two parts and solving each part sequentially. Moreover, we also propose a heuristic called as the ‘‘least loaded ADM elimination’’ for the ADM reduction problem. We then evaluate its performance and study the results. Optimal P2MP multicast trees is a NP-complete problem since it can be converted into Steiner minimal tree problem. Hence, for large networks the computational complexity becomes very high. We provide a mathematical formulation of the problem. We compare the mathematical formulation of shortest path based approach and optimal P2MP multicast. We show by simulations that the use of shortest path approach is highly suboptimal in terms of bandwidth utilization. Therefore, heuristics are used to construct trees which are computationally feasible and utilize near optimal bandwidth. Virtual Space embedding is a method to generate multi-dimensional topologies which exhibit a directivity property. We use this directivity property in order to construct multicast trees with reasonable cost of bandwidth by proposing a heuristic based on VS embedding and study the results