Preface

Wavelength-division multiplexing (WDM)-based optical network is a promising solution to fulfill the sustained growth of data traffic volume. To promote an efficient and scalable implementation of optical technology in the telecommunications infrastructure, many challenging issues related to routing and wavelength assignment (RWA), resource utilization, fault management, and quality of service provisioning must be addressed with utmost importance. The most important concern regarding RWA problem is due to its nondeterministic polynomial time (NP)-hardness nature. Therefore, efficient heuristic algorithms are the possible way to tackle these difficult problems. In this direction, a large number of heuristics have been attempted by researchers to solve RWA problem. Unfortunately, these heuristics could not improve the performance of the network beyond a certain limit. The majorities of the approaches do not differentiate the connection requests and treat them the same way for RWA. In this book, we explore the possibility of prioritizing connection requests for RWA to improve network performance. Accordingly, we differentiate connection requests into different priority groups based on some criteria for improving the performance. This book makes important contributions to the development of WDM-based optical networks, concerning RWA problem, traffic grooming, network survivability, and quality-of-service provisioning.

In the near future, WDM-based optical transmission technology may be unable to fulfill the growing traffic demands as it suffers from the electrical bandwidth bottleneck limitation, and the physical impairments become more serious as the transmission speed increases. Moreover, the traffic behavior is changing rapidly, and the increasing mobility of traffic sources makes grooming more complex. In that situation, to manage the growing traffic demands is a challenging issue, which is the utmost importance for the optical researchers. This book introduces the limitations of convention WDM-based optical networks and then presents elastic optical networks for future high-speed communications.

This book starts with a brief introduction to optical networks and then moves into an overview of the existing works on lightpath establishment, routing, wavelength assignment, traffic grooming, quality of service, and fault resilience design

in WDM-based wavelength-routed optical networks. The performance analysis of major conventional routing and wavelength assignment approaches in optical networks are presented to understand the behavior of routing and wavelength assignment approaches. Thereafter, a priority-based routing and wavelength assignment scheme with the incorporation of a traffic grooming have been presented in order to reduce the call blocking in the network. We discuss a priority-based dispersion-reduced wavelength assignment scheme with incorporation of traffic grooming to achieve the reduction of the total dispersion in the network, and hence, the overall signal quality is improved without substantial increase in network setup cost. Furthermore, a reliable fault resilience scheme is presented to improve the reliability in the network; the reliable fault resilience scheme provides a new class of service, which trade offs between network reliability and blocking probability. Finally, we present the limitations of convention WDM optical networks and provide how elastic optical networks overcome these limitations.

Many electrical engineering, computer engineering, and computer science programs around the world have been offering a graduate course on optical networking. This book primarily targets both graduate and doctoral students who are interested to consider their research in routing and wavelength assignment topic. Using this book, students will understand both fundamental and advanced technologies on routing and wavelength assignment for optical networks. This book is also intended for optical networking professionals, R&D engineers, and network designer, who are currently active or anticipate future development of optical networks. This book allows them to design a cost-effective optical network while improving the network performances, such as call blocking, quality of service, and reliability.

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