Survivability
and Traffic Grooming
in WDM Optical Networks

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Survivability And Traffic Grooming In Wdm Optical Networks

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Survivability And Traffic Grooming In Wdm Optical Networks:

Survivability and Traffic Grooming in WDM Optical Networks Arun Somani,2006-01-19 The advent of fiber optic transmission systems and wavelength division multiplexing WDM have led to a dramatic increase in the usable bandwidth of single fiber systems This book provides detailed coverage of survivability dealing with the risk of losing large volumes of traffic data due to a failure of a node or a single fiber span and traffic grooming managing the increased complexity of smaller user requests over high capacity data pipes both of which are key issues in modern optical networks A framework is developed to deal with these problems in wide area networks where the topology used to service various high bandwidth but still small in relation to the capacity of the fiber systems evolves toward making use of a general mesh Effective solutions exploiting complex optimization techniques and heuristic methods are presented to keep network problems tractable Newer networking technologies and efficient design methodologies are also described *Survivability and Traffic Grooming in WDM Optical Networks* Arun K. Somani,2005 **On Traffic Grooming and Survivability in WDM Optical Networks** Long Long,2010 **Survivable Optical WDM Networks** Canhui (Sam) Ou,Biswanath Mukherjee,2010-07-19 Survivable Optical WDM Networks investigates different approaches for designing and operating an optical network with the objectives that 1 more connections can be carried by a given network leading to more revenue and 2 connections can recover faster in case of failures leading to better services Different networks wavelength routed WDM networks wavelength routed WDM networks with sub wavelength granularity grooming and data over next generation SONET SDH over WDM networks are covered Different approaches are proposed to explore every aspect of a protection scheme such as 1 Protection granularity a At wavelength granularity b At sub wavelength granularity 2 Protection entity a Path protection b Sub path protection c Segment protection 3 Routing a Single path routing b Multi path routing Tradeoffs between different objectives e g resource efficiency vs recovery time are explored and practical approaches are proposed and analyzed *Dissemination of Information in Optical Networks:* Subir Bandyopadhyay,2007-10-24 Optical networks and the related technologies network management software and services have undergone remarkable developments and such networks are now the ultra high speed backbone networks for communication Wavelength Division Multiplexing WDM the ability to support multiple communication pathways over the same fiber enables efficient use of the enormous capability for data communication of optical networks This book gives a broad overview of techniques used in the design of WDM networks for efficient dissemination of information in computer networks It starts with an overview of the hardware components then provides a thorough review of WDM wavelength routed networks algorithms for route and wavelength assignment design of broadcast and select networks logical topology design and techniques to handle faults and algorithms for efficient use of optical networks Each topic has been covered rigorously with emphasis on detailed explanations of the approaches used starting from the fundamentals up to the state of the art The optimization techniques covered in the book include graph theoretic

algorithms mixed integer linear programming and heuristics The book is intended for beginners as well as for specialists and the reader should be able to design WDM networks and follow developments in the field Each chapter contains a detailed annotated bibliography There are numerous exercises for the reader to test understanding of the subject while readers unfamiliar with mathematical programming techniques and network flow optimization are offered short easy to understand appendices at the end of the book **Design and Analysis of Survivable Optical Networks** Canhui (Sam) Ou,2004

Technological Developments in Networking, Education and Automation Khaled Elleithy,Tarek Sobh,Magued Iskander,Vikram Kapila,Mohammad A. Karim,Ausif Mahmood,2010-06-18 Technological Developments in Networking Education and Automation includes a set of rigorously reviewed world class manuscripts addressing and detailing state of the art research projects in the following areas Computer Networks Access Technologies Medium Access Control Network architectures and Equipment Optical Networks and Switching Telecommunication Technology and Ultra Wideband Communications Engineering Education and Online Learning including development of courses and systems for engineering technical and liberal studies programs online laboratories intelligent testing using fuzzy logic taxonomy of e courses and evaluation of online courses Pedagogy including benchmarking group learning active learning teaching of multiple subjects together ontology and knowledge management Instruction Technology including internet textbooks virtual reality labs instructional design virtual models pedagogy oriented markup languages graphic design possibilities open source classroom management software automatic email response systems tablet pcs personalization using web mining technology intelligent digital chalkboards virtual room concepts for cooperative scientific work and network technologies management and architecture Coding and Modulation Modeling and Simulation OFDM technology Space time Coding Spread Spectrum and CDMA Systems Wireless technologies Bluetooth Cellular Wireless Networks Cordless Systems and Wireless Local Loop HIPERLAN IEEE 802 11 Mobile Network Layer Mobile Transport Layer and Spread Spectrum Network Security and applications Authentication Applications Block Ciphers Design Principles Block Ciphers Modes of Operation Electronic Mail Security Encryption Message Confidentiality Firewalls IP Security Key Cryptography Message Authentication and Web Security Robotics Control Systems and Automation Distributed Control Systems Automation Expert Systems Robotics Factory Automation Intelligent Control Systems Man Machine Interaction Manufacturing Information System Motion Control and Process Automation Vision Systems for human action sensing face recognition and image processing algorithms for smoothing of high speed motion Electronics and Power Systems Actuators Electro Mechanical Systems High Frequency Converters Industrial Electronics Motors and Drives Power Converters Power Devices and Components and Power Electronics *Advances in Evolutionary Computing for System Design* Vasile Palade,Dipti Srinivasan,2007-07-07 Evolutionary computing paradigms offer robust and powerful adaptive search mechanisms for system design This book s thirteen chapters cover a wide area of topics in evolutionary computing and applications including an introduction to

evolutionary computing in system design evolutionary neuro fuzzy systems and evolution of fuzzy controllers The book will be useful to researchers in intelligent systems with interest in evolutionary computing as well as application engineers and system designers **Optical WDM Networks** Biswanath Mukherjee,2006-06-15 Research and development on optical wavelength division multiplexing WDM networks have matured considerably While optics and electronics should be used appropriately for transmission and switching hardware note that intelligence in any network comes from software for network control management signaling traffic engineering network planning etc The role of software in creating powerful network architectures for optical WDM networks is emphasized Optical WDM Networks is a textbook for graduate level courses Its focus is on the networking aspects of optical networking but it also includes coverage of physical layers in optical networks The author introduces WDM and its enabling technologies and discusses WDM local access metro and long haul network architectures Each chapter is self contained has problems at the end of each chapter and the material is organized for self study as well as classroom use The material is the most recent and timely in capturing the state of the art in the fast moving field of optical WDM networking Parallel and Distributed Computing, Applications and Technologies Pingzhi Fan,Hong Shen,2003 Issues for 2012 to be cataloged as a serial in LC Towards Scalable Cost-Effective Service and Survivability Provisioning in Ultra High Speed Networks ,2006 Optical transport networks based on wavelength division multiplexing WDM are considered to be the most appropriate choice for future Internet backbone On the other hand future DOE networks are expected to have the ability to dynamically provision on demand survivable services to suit the needs of various high performance scientific applications and remote collaboration Since a failure in aWDMnetwork such as a cable cut may result in a tremendous amount of data loss efficient protection of data transport in WDM networks is therefore essential As the backbone network is moving towards GMPLS WDM optical networks the unique requirement to support DOE s science mission results in challenging issues that are not directly addressed by existing networking techniques and methodologies The objectives of this project were to develop cost effective protection and restoration mechanisms based on dedicated path shared path preconfigured cycle p cycle and so on to deal with single failure dual failure and shared risk link group SRLG failure under different traffic and resource requirement models to devise efficient service provisioning algorithms that deal with application specific network resource requirements for both unicast and multicast to study various aspects of traffic grooming in WDM ring and mesh networks to derive cost effective solutions while meeting application resource and QoS requirements to design various diverse routing and multi constrained routing algorithms considering different traffic models and failure models for protection and restoration as well as for service provisioning to propose and study new optical burst switched architectures and mechanisms for effectively supporting dynamic services and to integrate research with graduate and undergraduate education All objectives have been successfully met This report summarizes the major accomplishments of this project The impact of the project manifests in many aspects First the project addressed many

essential problems that arisen in current and future WDM optical networks and provided a host of innovative solutions though there was no invention or patent filing This project resulted in more than 2 dozens publications in major journals and conferences including papers in IEEE Transactions and journals as well as a book chapter Our publications have been cited by many peer researchers In particular one of our conference papers was nominated for the best paper award of IEEE Create Net Broadnets International Conference on Broadband Communications Networks and Systems 2006 Second the results and solutions of this project were well received by DOE Labs where presentations were given by the PI We hope to continue the collaboration with DOE Labs in the future Third the project was the first to propose and extensively study multicast traffic grooming new traffic models such as sliding scheduled traffic model and scheduled traffic model Our research has sparkled a flurry of recent studies and publications by the research community in these areas Fourth the project has benefited a diverse population of students by motivating engaging enhancing their learning and skills The project has been conducted in a manner conducive to the training of students both at graduate and undergraduate levels As a result one Ph D Dr Abdur Billah was graduated Another Ph D student Tianjian Li will graduate in January 2007 In addition four MS students were graduated One undergraduate student Jeffrey Alan Shininger completed his university honors project Fifth thanks to the support of this ECPI project the PI has obtained additional funding from the National Science Foundation the Air Force Research Lab and other sources A few other proposals are pending Finally this project has also significantly impacted the curricula and resulted in the enhancement of courses at the graduate and undergraduate levels therefore strengthening the bond between research and education **Computer Network Security** Vladimir Gorodetsky,Igor Kotenko,Victor A. Skormin,2007-08-24 This book constitutes the refereed proceedings of the Fourth International Conference on Mathematical Methods Models and Architectures for Computer Network Security MMM ACNS 2007 held in St Petersburg Russia in September 2007 Its objective was to bring together leading researchers from academia and governmental organizations as well as practitioners in the area of computer networks and information security *Survivable Design and Analysis of WDM Mesh Networks* Wei Huo,2005 **Selected Readings on Telecommunications and Networking** Gutierrez, Jairo,2008-08-31 This book presents quality articles focused on key issues concerning the planning design maintenance and management of telecommunications and networking technologies Provided by publisher **Design and Analysis of Survivable Telecom Mesh Networks** Lei Song,2007 **OptiComm ...** ,2001 *Design and Analysis of Survivability for Emerging Network Applications* Qingya She,2008 We investigate survivable traffic grooming for anycast over Wavelength Division Multiplexing WDM networks An auxiliary graph model and three differentiated survivable schemes based on the graph model are proposed At last we focus on reliable multi resource manycast over Optical Burst Switching OBS networks Reliable transmission mechanisms are proposed to minimize the resource blocking probability which results from burst contention in the OBS network and from resource unavailability at the destinations An analytical model for various schemes is developed

Traffic Grooming and Wavelength Conversion in Optical Networks Sashisekaran Thiagarajan,2001 Wavelength Division Multiplexing WDM using wavelength routing has emerged as the dominant technology for use in wide area and metropolitan area networks Traffic demands in networks today are characterized by dynamic heterogeneous flows While each wavelength has transmission capacity at gigabit per second rates users require connections at rates that are lower than the full wavelength capacity In this thesis we explore network design and operation methodologies to improve the network utilization and blocking performance of wavelength routing networks which employ a layered architecture with electronic and optical switching First we provide an introduction to first generation SONET SDH networks and wavelength routing networks which employ optical crossconnects We explain the need and role of wavelength conversion in optical networks and present an algorithm to optimally place wavelength conversion devices at the network nodes so as to optimize blocking performance Our algorithm offers significant savings in computation time when compared to the exhaustive method To make the network viable and cost effective it must be able to offer sub wavelength services and be able to pack these services efficiently onto wavelengths The act of multiplexing demultiplexing and switching of sub wavelength services onto wavelengths is defined as traffic grooming Constrained grooming networks perform grooming only at the network edge Sparse grooming networks perform grooming at the network edge and the core We study and compare the effect of traffic grooming on blocking performance in such networks through simulations and analyses We also study the issue of capacity fairness in such networks and develop a connection admission control CAC algorithm to improve the fairness among connections with different capacities We finally address the issues involved in dynamic routing and wavelength assignment in survivable WDM grooming networks We develop two schemes for grooming primary and backup traffic steams onto wavelengths Mixed Primary Backup Grooming Policy MGP and Segregated Primary Backup Grooming Policy SGP MGP is useful in topologies such as ring characterized by low connectivity and high load correlation and SGP is useful in topologies such as mesh torus with good connectivity and a significant amount of traffic switching and mixing at the nodes *WDM Optical Networks* C. Siva Ram Murthy,Mohan Gurusamy,2002 This helpful guide provides practicing engineers students and researchers with a systematic up to date introduction to the fundamental concepts challenges and state of the art developments in WDM optical networks The authors rely extensively on real world examples and draw on the latest research to cover optical network design and provisioning in far greater depth than any other book **Architectures and Algorithms for Fault Management in Optical WDM Networks** Jing Zhang,2005

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