

## GUEST EDITORS' INTRODUCTION

This and the subsequent issue of the *Journal of High Speed Networks* form a two-part special issue on lightwave networks employing wavelength division multiplexing (WDM). Papers published in this special issue focus on WDM-based, state-of-the-art approaches that enable end-users to tap into the enormous bandwidth of optical fibers in order to design the next generation of network architectures.

The papers in this special issue cover a variety of aspects of WDM networks, ranging from their design (architectures, protocols, algorithms) and modeling (and evaluation), to device implications (on network architectures and performance) and implementation (and related experiences).

Twelve high-quality papers are being published in this special issue, six in each part. Three papers were invited, while the remainder were submitted in response to our Call for Papers. However, all papers, including the invited papers, were reviewed by at least two reviewers. In this part (Part 1), the first three are invited papers.

In "Wavelength Conversion and Wavelength Routing for High-Efficiency All-Optical Networks: A Proposal for Research on All-Optical Networks," Li *et al.* summarize their research proposal on all-optical networks. (This proposal was one of three university consortia on all-optical networks that was funded by the National Science Foundation in Fall 1993.) This paper discusses how to develop network architectures that deal with wavelength conversion, as well as practical issues such as the nonuniform gain spectrum of erbium-doped fiber amplifiers (EDFAs); it also proposes the fabrication of an integrated wavelength converter device, and the building of an experimental WDM node.

The second paper, "Logarithmically Scalable Routing Algorithms in Large Optical Networks" by Zhang *et al.* presents work done as part of the Optical Network Technology Consortium (ONTC), which is one of the three original ARPA-funded consortia on all-optical networks. This paper provides (a) a scalable wavelength assignment scheme, (b) an approximate analysis for calculating blocking probabilities, and (c) efficient routing algorithms for optical networks.

The third paper, "Application of Optical Solitons in High-Speed and Wavelength-Division-Multiplexed Lightwave Communication Systems" by Chan *et al.* reviews the basic properties of solitons, summarizes the state of soliton transmission, and demonstrates how these properties can be exploited to realize pulse compression. The authors argue how the combination of soliton transmission and their application in WDM systems can naturally expand the capacity of optical fibers.

In "Network Interface Design for Multi-Gbit/s WDM Optical Networks," Barry *et al.* report on the design of a network interface of their distributed, packet-switched WDM network, called STARNET, which utilizes a packet-switched subnetwork (FDDI) and a reconfigurable high-speed circuit-switched subnetwork. The paper describes how the network interface was designed to handle example user applications such as electronic mail, image retrieval, and live video conferencing. With the packet subnetwork implemented using commercially-available FDDI-on-copper interface cards, performance results show that STARNET utilizing this interface can support 50 typical, high-quality (MPEG-I) video conferencing connections per node.

The next paper, "Photonic Bus and Ring Networks with Reduced Station Hardware" by Grah and Todd, studies four different WDM bus/ring networks, where each network requires a different number of tapping points, as well as different numbers of transmitters and receivers and their tunability requirements. The corresponding media access protocols are discussed, and analytic and simulation results are presented.

The final paper of Part 1, entitled "Flow Trees: A Lower Bound Computation Tool for Network Optimization," is authored by Yener and Boulton. The paper gives lower bounds on the congestion on a link in a multihop optical network based on a physical star. These bounds provide a benchmark for comparing any arbitrary topology and routing algorithm. The results in this paper contribute to the understanding of the virtual topology and routing problem in multihop networks.

In Part 2 of this Special Issue, we will be publishing the following six papers:

- "All-Optical Network Topologies Based on Expander Graphs"  
by Rajesh K. Pankaj
- "Routing of Multimedia Streams in Reconfigurable WDM Optical Networks"  
by Ciro A. Noronha, Jr. and Fouad A. Tobagi
- "Multicasting in a WDM Local Lightwave Network"  
by Mike Borella and Biswanath Mukherjee
- "Efficient Node Placement for Supporting Multipoint Connections in Multi-Hop WDM Networks"  
by Srini Tridandapani and James S. Meditch
- "Design Principles for Multi-Hop Wavelength and Time Division Multiplexed Optical Passive Star Networks"  
by Sheau-Ru Tong, David H. C. Du, and Ronald J. Vetter
- "A Contention/Collision Free WDM Ring Network for Multi Gigabit Packet Switched Communication"  
by I. Chlamtac, A. Fumagalli, L. G. Kazovsky, and P. T. Poggiolini

This Special Issue was put together with very tight deadlines (Manuscript Submission Date: June 1, 1994; Acceptance Notification: August 1, 1994; Final Manuscript Due: September 15, 1994; and Publication Date: Early 1995).

This publication would not have been possible without the diligence of the authors (for submitting their work and quickly revising their papers in response to the reviews) and the reviewers (for their fast "turn-around" time); we sincerely appreciate their time and effort.

Finally, we thank Dr Deepinder Sidhu, Editor-in-Chief, for suggesting to us this topic, and for his encouragement throughout the preparation of the Special Issue.

Krishna Bala  
*Bellcore*  
331 Newman Springs Rd., Rm NVC 3B-309  
Red Bank, NJ 07701-7040, USA  
Tel: +1 908 758-2812  
Fax: +1 908 758-4372  
E-mail: kbala@fdm.bellcore.com

Biswanath Mukherjee  
*Department of Computer Science*  
University of California  
Davis, CA 95616, USA  
Tel: +1 916 752-4826  
Fax: +1 916 752-4767  
E-mail: mukherje@cs.ucdavis.edu

**List of Referees**

Mostafa Ammar  
Krishna Bala  
Dhritiman Banerjee  
Subrata Banerjee  
Richard Barry  
Mike Borella  
Charles A. Brackett  
Patrick W. Dowd  
Georgios Ellinas  
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Zhengsheng Zhang