SC 5 - WDM Networks: Architecture and Technology
Instructor: Rod C. Alferness

Wavelength-Division Multiplexed (WDM) transmission systems are now being aggressively deployed by both long distance and local service providers. While initial deployment has been justified solely by increased capacity needs of point-to-point links that use embedded, standard fiber, WDM also offers the potential of high-level wavelength channel transport networking analogous to today's electrically networked time-division channels. Such networks, which are now being deployed, would provide per wavelength reconfigurable add/drop and routing through branch points to reduce electrical terminations while providing provisioning, rapid restoration, and wavelength addressed services in a network that offers overall reduced cost on a normalized bandwidth basis.

This course provides an overview of WDM networking elements and their technologies, required to build flexible WDM transport networks. After a discussion of the driving forces for evolution from today's point-to-point WDM links to reconfigurable WDM multi-point transport networks, we describe potential network architectures. Functional requirements of the WDM networking elements, primarily configurable WDM add/drop multiplexers and cross-connects, needed to implement these networks are reviewed. Proposed architectures for the configurable add/drop multiplexer, and optical cross-connect is then discussed. Some enabling technology alternatives for key components including multiwavelength sources, wavelength demultiplexers, tunable filters and optical switching fabrics to build these networking elements and representative examples of demonstrated network elements will be reviewed. As this technology has matured, new opportunities to leverage WDM for high-speed packet switching as well as for residential access appear promising. These exciting future applications are also surveyed.

Biography of Rod C. Alferness

Rod C. Alferness is currently the Bell Laboratories Research Senior Vice President. His previous position was the Bell Laboratories Optical Networking Research Senior Vice President. Rod also was the Chief Technical Officer and Advanced Technology and Architecture Vice-President of the Optical Networking Group, Lucent Technologies. Previously he was head of the Photonics Networks Research Department of Lucent Bell Laboratories, Holmdel, New Jersey.

Rod joined Bell Labs in 1976 after receiving a Ph.D. in physics from the University of Michigan where his thesis research, under the supervision of Professor Emmett Leith, concerned optical propagation in volume holograms. His early research at Bell Labs included the demonstration of novel waveguide electro-optic devices and circuits - including switch/modulators, polarization controllers, tunable filters - and their applications in high capacity lightwave transmission and switching systems. This research led to the early development of titanium diffused lithium niobate waveguide modulators that are now deployed as the high-speed signal-encoding engine in fiber optic transmission systems around the world. Dr. Alferness has also made contributions in photonic integrated circuits in InP, including widely tunable lasers, as well as in photonic switching systems and reconfigurable WDM (wavelength-division-multiplexed) optical networks. In the mid-90's, he was an originator and the Bell Labs Program Manager for the DARPA funded MONET project which demonstrated the feasibility of wavelength routed optical networks that are now being implemented

for both backbone and metro networks. Dr. Alferness has authored over 100 papers, holds 35 patents and has authored five book chapters.

Dr. Alferness is a member of the National Academy of Engineering. He is a Fellow of the Optical Society of America and the IEEE Lasers and Electro-Optics Society (LEOS). Dr. Alferness received the 2005 IEEE Photonics Award. He has served as an elected member of the LEOS AdCom and was the President of IEEE LEOS in 1997. He was General Co-Chair of the 1994 Optical Fiber Communications Conference (OFC'94). He served as Conference Chair for the IEEE Topical Meeting on Integrated and Guided-Wave Optics; OSA-sponsored Topical Meeting on Optical Networks; and the Topical Meeting on Photonics in Switching. Dr. Alferness has served as Associate Editor for Optics Letters and for Photonic Technology Letters. He has served on the OSA-sponsored Tyndall Award selection committee. He served as the Editor-in-Chief of the OSA-sponsored Journal of Lightwave Technology from 1995-2000. He served as an elected member of the Optical Society of America Board of Directors from 2001-2003. He is currently the OSA Vice President. Dr. Alferness also currently serves on the European Conference on Optical Communication (ECOC) Executive Management Committee.