

## DESIGN AND CONTROL SYSTEM OVER WWW FOR REGIONAL CWDM OPTICAL IP NETWORKS WITH RECONFIGURABLE OPTICAL ADD/DROP MULTIPLEXERS

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**ABSTRACT.** *A web-based design and control system has been investigated for regional optical IP (Internet Protocol) networks. The system can design lightpaths connecting nodes such that given traffic is groomed with minimum number of wavelengths, or give a reserve design with additional lightpaths to groom future traffic. Reconfigurable optical add/drop multiplexers (R-OADMs) were also investigated and manufactured. An experimental network with the R-OADMs was constructed, and the control function of the implemented system was examined by reconfiguring the lightpaths in the experimental network. The R-OADMs could be controlled and the lightpaths could be reconfigured successfully by the system.*

**Keywords:** Control system, Optical IP network, Lightpath reconfiguration, Wavelength assignment

**1. Introduction.** Recently, optical networks have been introduced commonly to satisfy the rapid increase of traffic demands. In addition to the high capacity characteristics of optical fibers, WDM (Wavelength-Division Multiplexing) technologies provide more bandwidth per fiber, and are used in core backbone networks, metropolitan area networks (MANs), and regional area networks. In the MANs and regional networks, wavelength routing capability in WDM networks is also investigated as well as the effective use of the high capacity. In the wide area networks (WANs) and MANs to connect buildings and offices for business use, the wavelength routing capability should be used more effectively than others.

The design procedures for the wavelength-routed networks have been investigated and published. The design issues include how many wavelengths are required to connect nodes to satisfy the traffic demands with low blocking probability [2]-[3], and to minimize the required node system scale [11]. The need for high bandwidth in today's IP-based Internet accelerated the investigation on IP-over-WDM networks. In an IP-over-WDM network, the nodes employ wavelength routing devices and layer-3 switches (L3SWs) for IP routing. The nodes are connected by fibers, and the L3SWs are connected by lightwaves with allocated wavelengths. The lightwave connection is called a lightpath [10]. In the IP-over-WDM network, IP packets are routed and transmitted by a lightpath, if the source and destination nodes are connected directly by the lightpath. If the nodes are not connected directly by a lightpath, the packets are routed electronically by the L3SWs at the intermediate nodes. Thus, the lightpaths can be designed to groom traffic by a single-hop lightpath or multihop lightpath connections in WDM networks, and it has been