Economic Model of an Optical Core Network Architecture

Richard A. Thompson, Maria Calle, Hammad Iqbal, Natthapong Liamcharoen,
Eugene Myakotnykh, Yuttasart Nitipaichit, James Wood
University of Pittsburgh

Abstract

Currently the transport of data in the Internet core optical network is realized by the routing of this data over lightpaths. These lightpaths are established using routing protocols necessitating the conversion of incoming optical signals to electronic signals in order to read in band routing control data. The data for transport including the routing data must then be converted back to an optical signal and forwarded to the next node in the lightpath where the process of optical to electrical to optical, O-E-O, conversion must be repeated.

Redesigning the core optical network using layer switching will result in the reduction of network equipment, significant reduction in network complexity and network switching complexity and significant power savings by eliminating unnecessary O-E-O conversions along the signal path in an optical mesh network.

This paper presents a model used to test the cost sensitivity of a number of economic parameters, in particular the network cost sensitivity to the number of nodes that comprise an optical core network. The model presents an architecture which has two tiers, access nodes and core transport nodes referred to as tandem nodes. These tandem nodes are primarily responsible for distributing traffic to the local region or forwarding traffic to other tandem nodes meant for other regions. The network consists of N tandem nodes which are transparent, link layer switches, each serving one region of the contiguous United States and M access gateways per tandem node fully connected (logically) using WDM lightpaths. The paper attempts to answer what is the optimal number of gateways and tandem nodes by comparing different arrangements of a constant product of MxN.