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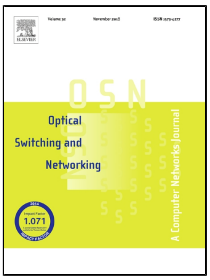

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Distributed Sub-Light-Tree based Multicast Provisioning with Shared Protection in Elastic Optical Datacenter Networks

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Abstract

In an elastic optical network, it is critical to protect a multicast request against any single link failure with minimum spectrum consumption. However, conventional single light-tree based multicast provisioning schemes are spectrum inefficient with low modulation level employed. Since a multicast service can be hosted in multiple geographically-distributed datacenters in an elastic optical datacenter network (EODN), we construct several distributed sub-light-trees (DSLTs) to serve the users of a multicast request. Further, we protect each source-destination pair of a primary DSLT by a link-disjoint backup path against any link failure. Spectrum resource can be shared among the backup paths of different multicast requests (i.e., cross-sharing) or among the primary paths and the backup paths of the same multicast request (i.e., self-sharing) if they do not fail simultaneously. To formulate such a problem, an Integer Linear Program (ILP) is developed for a static traffic scenario. We also propose an efficient heuristic approach for the dynamic traffic scenario. Numerical results show that the proposed DSLT-based multicast provisioning with shared protection scheme outperforms conventional survivable multicast provisioning schemes based on single light-tree with or without shared protection in terms of spectrum efficiency and blocking probability.

Keywords

Multicast provisioning, elastic optical datacenter network (EODN), distributed sub-light-tree, shared protection.

1. Introduction

The increasing bandwidth-intensive multicast applications such as ultra-high-definition TV, interactive distance learning, and distributed games require that multicast services are provided over the optical layer rather than IP layer in datacenter networks by taking advantage of its high spectrum and power efficiency [1]. Various studies on multicasting in conventional wavelength-division multiplexing (WDM) networks have been conducted [2-3]. Compared with WDM networks, an elastic optical datacenter network (EODN) employing multi-carrier modulation techniques (i.e., orthogonal frequency-division multiplexing (OFDM), Nyquist-WDM, etc.) can provide better flexibility in spectrum allocation and achieve high spectrum efficiency [4-5]. Consequently, EODN has become a promising candidate for next-generation optical datacenter networks.