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A Novel Network Planning Algorithm with Fixed Alternate Routing for MPLS Traffic Engineering

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Abstract. This paper solves the problem of path selection for connection-oriented MPLS-based mesh networks. A novel network planning algorithm, called Capacity-Balanced Alternate Routing (C-BAR), is proposed. For C-BAR, alternate paths between each ingress-egress pair are defined at the network planning stage according to the network topology and the potential traffic load and location of each ingress-egress pair, so that the routing of label switched paths (LSPs) can take the most advantage of the load-balancing characteristic of the alternate paths. Both analytical and simulation-based studies are conducted to examine the proposed approach. The results show that the C-BAR algorithm can significantly improve the performance in blocking probability by spreading potential traffic load into the whole network compared with the other reported connection-oriented routing schemes.

Keywords. wavelength division multiplexing, fixed alternate routing, blocking probability.

1 Introduction

Multi-Protocol Label Switching (MPLS) is favored due to its strong functionality and construct of an efficient platform of performing traffic engineering and class of service for dynamic network control and management. With the MPLS control plane, bandwidth guaranteed tunnels between ingress-egress pairs, which are called Label Switched Paths (LSPs), are allocated into the network according to vendor-defined cost function and dynamic link-state metrics in a fully distributed manner. For a request of a session, each IP datagram is labeled and sent along an LSP that provisions a bandwidth guaranteed tunnel according to the MPLS forwarding and label swapping policies in a connection-oriented fashion to ensure quality of service stipulated in the Forwarding Equivilent Class (FEC). After the session ends, the correponding LSP is torn down for releasing the reserved bandwidth. Since the requests for sessions (or connection requests for LSPs) arrive one after the other without any prior knowledge of future arrivals, on-line algorithms are needed to allocate network resources that connect the ingress and egress with guaranteed bandwidth. The routing process held in an ingress node (which is also called source routing) should be computation-efficient, so that the