Performance Analysis of Communication Networks Based on Conditional Value-at-Risk

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Abstract: In this paper, we present an analysis of optimization and risk calculation in Communication Networks (CNs). The model is proposed for offline traffic engineering optimization with bandwidth allocation and performance analysis. First, we introduce an optimization model in the CN and derive the optimal bandwidth capacity. Then, we analyze the profit shortfall risk in the CN by using a conditional value-at-risk approach for two typical arrival processes of traffic demand: Poisson arrival process and uniform distribution arrival process. Finally, we give numerical results to show the impact of risk averseness and compare how the characteristics of these two arrival processes of traffic demand affect the network performance.

Keywords: Communication networks; performance analysis; stochastic traffic engineering; conditional value-at-risk; optimization.


1 Introduction

As we have presented in [1], traffic engineering in Communication Networks (CNs) is a process of controlling traffic demand in a network so as to optimize resource utilization and network performance [2], [3]. There are two forms of traffic engineering: online planning and offline planning. Online traffic engineering focuses on instantaneous network states and individual connections. Offline traffic engineering simultaneously examines each channel’s resource constraints and studies what is needed of each Local Service Provider (LSP) in order to provide global calculations and solutions for the CNs by a centralized view. Traffic engineering has greatly improved network utilization and performance by using advanced technologies such as Multi-Protocol Label Switching (MPLS) and Optical Channel Trails (OCT) [4], [5].