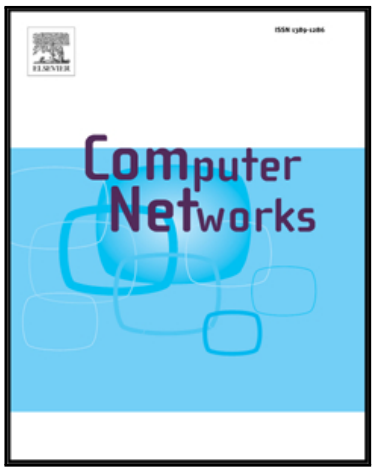

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Online Unicasting and Multicasting in Software-Defined Networks

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Abstract

Software-Defined Networking (SDN) has emerged as the paradigm of the next-generation networking through separating the control plane from the data plane. In a software-defined network, the forwarding table at each switch node usually is implemented by expensive and power-hungry Ternary Content Addressable Memory (TCAM) that only has limited numbers of entries. In addition, the bandwidth capacity at each link is limited as well. Provisioning quality services to users by admitting their requests subject to such critical network resource constraints is a fundamental problem, and very little attention has been paid. In this paper, we study online unicasting and multicasting in SDNs with an objective of maximizing the network throughput under network resource constraints, for which we first propose a novel cost model to accurately capture the usages of network resources at switch nodes and links. We then devise two online algorithms with competitive ratios $O(\log n)$ and $O(K^{\epsilon} \log n)$ for online unicasting and multicasting, respectively, where n is the network size, K is the maximum number of destinations in any multicast request, and ϵ is a constant with $0 < \epsilon \leq 1$. We finally evaluate the proposed algorithms empirically through simulations. The simulation results demonstrate that the proposed algorithms are very promising.

Keywords: Dynamic unicast and multicast request admissions, network resource allocation, online algorithms, competitive ratio analysis, Ternary Content Addressable Memory (TCAM), software-defined networks, combinatorial optimization.

1. Introduction

Software-Defined Networking (SDN) has emerged as the next-generation networking paradigm that creates an opportunity to tackle a longstanding problem in traditional networks, by moving the network control logic from the underlying routers and switches to a logically centralized controller and offering the programmability of the network [1, 7, 11, 17]. SDN now is becoming a key technology for the next-generation

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