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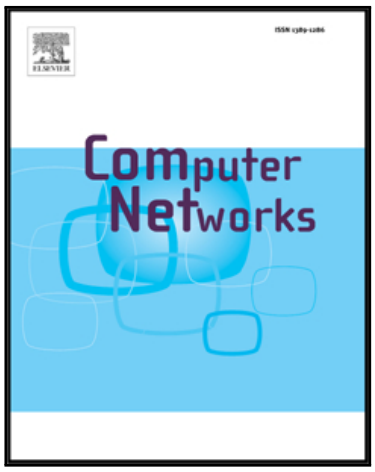

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A Low Overhead Flow-Holding Algorithm in Software-Defined Networks

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Abstract

Software-Defined Networking (SDN) allows flexible and efficient management of networks. However, the limited capacity of flow tables in SDN switches hinders the deployment of SDN. In this paper, we propose a novel routing scheme to improve the efficiency of flow tables in SDNs. To efficiently use the routing scheme, we formulate an optimization problem with the objective to maximize the number of flows in the network, constrained by the limited flow table space in SDN switches. The problem is NP-hard, and we propose the K Similar Greedy Tree (KSGT) algorithm to solve it. We evaluate the performance of KSGT against "traditional" SDN solutions with real-world topologies and traffic. The results show that, compared to the existing solutions, KSGT can reduce about 60% of flow entries when processing the same amount of flows, and improve about 25% of the successful installation and forwarding flows under the same flow table space.

Keywords: Software-Defined Networking, MPLS, Flow table reuse, Overhead.

1. Introduction

With the development of next generation Internet, Software-Defined Networking (SDN) is widely used in enterprise WANs and data center networks [1]. Surveys show some companies deploy their SDN network devices, and achieve a lot of benefits by using simple switch configuration and traffic engineering [2]. The Ternary Content Addressable Memory (TCAM) is widely used in SDN switches, which enables the fast forwarding packets in the data center network [3]. However, the capacity of TCAM in the SDN switches is limited since the TCAM is expensive [3][4]. OpenFlow in theory can establish fine-grained routing paths by installing flow entries in the OpenFlow switches via the controller [5]. But in practice, there are practical challenges such as limited flow table sizes and dynamic flow change that need to be addressed [6]. Following the basic OpenFlow principle, the OpenFlow controller installs flow entries to every switch in the forwarding path, so the flow table capacity is often not enough when there are a large number of flows in the network. The flow entries are overflowed in some core switches but underflowed in other switches, which may cause a lot of flows transmission failure because the flow entries cannot be installed successfully [7][8]. Hence,

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