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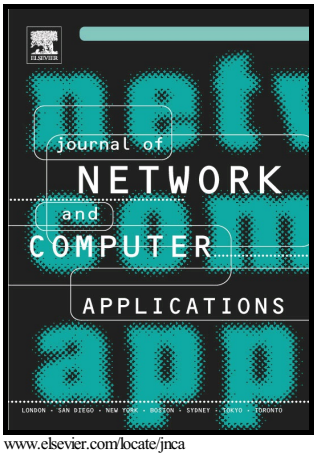

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High-performance IPv6 Address Lookup in GPU-accelerated Software Routers

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Abstract

Due to the ever-increasing physical link speed, routing table size and internet traffic, modern routers have been the major bottleneck to process packages with a high throughout. As the most time-consumption task of routers, designing efficient IP lookup schemes for IPv6 face new challenges. In this paper, we design parallel bloom filter for IPv6, and implement it on Graphics Processing Unit to develop a novel GPU-accelerated software router, GRv6. Moreover, we design two schemes to support dynamic prefix update, i.e., dynamic prefix insert scheme and dynamic prefix delete scheme. To evaluate the performance of GRv6, we implement it with NVIDIA GeForce GTX 580 and utilize 5 real-life IPv6 routing tables to demonstrate that the IP lookup engine could achieve 60Gbps for static routing tables, and 40Gbps for dynamic routing tables with 3000 updates per second.

Keywords

IPv6; IP lookup; Longest prefix matching; Graphic process unit; Bloom filter

1. Introduction

1.1. Problem Statement and Motivation

With the rapid growth of the Internet, IP address places extreme demands on the next generation internet protocol, IPv6 (Li et al., 2007). Theoretically, IPv6 provides approximately $3.4*10^{38}$ addresses with 128-bit for each address. In order to communicate with other Internet-connected devices, each device on the Internet, such as a computer or mobile telephone, can be assigned an IPv6 address. With the ever-increasing number of new devices being connected to the Internet and the growing new applications, Internet traffic is explosively increasing. Data from arbor Networks showed a peak of 0.2% of Internet traffic on IPv6 during a World IPv6 Launch on 6 June 2012 (Arbor Networks, 2012).

Although the packet header and the process of packet forwarding have been simplified in IPv6, the data plane functions stay the same as IPv4. When a packet is incoming, the IPv6 router still has to do IP address lookup to find the next hop and forwarding the packet. As one of the core functionalities and the most time-consuming task in a router, IP address lookup will match the destination IP address of every incoming packet with all prefixes stored in the forwarding table to determine the next forwarding hop according to the rule of Longest Prefix Matching (LPM).

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