

Modeling Of Request Routing Management On Router For Content Delivery Network

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Abstract: A large amount of Internet traffic is organized through content delivery networks (CDNs). CDNs improve Internet access in terms of the response time and system throughput by mapping end-users to the nearest servers based on their locality, which known as request routing (RR). Most CDN systems use domain name servers (DNS) to redirect clients by issuing the IP address of the nearest server. Owing to the fact that DNS records have an expiration time (TTL), clients frequently have to contact name servers to update their IP addresses, which increases the connection delay. On the other hand, clients are demanding faster Internet connections. Because routers will be able to provide services in future networks, router-based RR has been proposed. In this paper, we study an analytical model of router-based RR. We present its architecture design and implementation, and show how router-based RR can be used to effectively redirect a clients' request. Numerical analysis results demonstrate the effectiveness of router-based RR, which shows a 64.4% reduction of the response time for a client redirection.

Index Terms: Network, Modeling, CDN, Request-Routing, Router, DNS, Queuing-Model

1 INTRODUCTION

A content Delivery Network (CDN) is designed to improve Web access [1]. To this end, CDNs place content servers geographically near the clients, and then redirect the clients to the best (nearest and least loaded) content server based on its locality and performance [2]. For example, Akamai operates more than 100,000 servers in more than 1,800 geographically distributed locations across nearly 1,000 networks [3]. The literature indicates that there are two different client request routing methods used in commercial CDNs can be classified as client-side and server-side [4]. In client-side RR, the clients are issued using the best servers IP address at the domain name server (DNS) resolution time. This method is often called DNS-based request routing (DNS-based RR) [5]. A server-side RR method uses URL forwarding to redirect clients to the best server. However, server-side RR still uses a DNS to resolve the IP address of the server. Thus, the simplicity and transparent nature of a DNS are exploited to redirect clients to the best server without any modifications to the server, clients, or Web applications. Therefore, commercial CDNs (e.g., Akamai & Netflix) use DNS-based RR in their CDN architectures. Differing from the two aforementioned request-routing methods, assume that routers in a future network are able to be utilized to provide content-based services. In this case, we propose a router-based client request routing method (router-based RR) as described in [6]. In this method, we proposed redirecting clients based on the packet content using a router. To this end, routers still do not possess the capability to provide content-based services, and therefore SoR is proposed [7-8]. In this paper, we describe an analytical model of a router-based RR. We present an architecture design and implement an analytical model.

We then show how router-based RR can be used to effectively redirect a clients' request. The contributions of this study can be summarized as follows: Router-based RR is introduced as a request routing method managed in a router. This method has some advantages over DNS-based RR. A detailed explanation of both methods of request routing is given in Section 2. A prototype of the router-based RR model was designed and is analyzed herein. Its model and architecture design are described in Section 3. Through numerical analysis and experiments that provided in section 4, we show that router-based RR is able to reduce the response time of the client requests compared to DNS-based RR. The results are presented in Section 5. Finally we conclude our study with conclusion and prospective future works.

2 BACKGROUND STUDY

2.1 Service-oriented Router

Service-oriented Router (SoR) was proposed as a novel router architecture that provides content-based networking services from a router [34-43]. Upon implementation, an SoR uses a deep packet inspection (DPI) to analyze the packet details including the header and its payload, and stores the necessary information in database (SoR-DB) [9]. Lately, major router manufacturers (Cisco, Juniper, etc.) have exposed programming interfaces that allow packet manipulation by third party applications and add new services to the routers [10-12]. Projecting this, some studies use cached content for foreseeable CDN studies [16, 17]. Therefore, it is possible for SoR to exploit the attached in-network storage modules for content caching and provide content-based services.

2.2 Implementation of router-based RR using SoR

SoRs are still under research and development. They have been developed as a complete router including software and hardware components [15, 16, 17]. Consequently, an SoR has been proposed as a request redirector for a CDN, inspecting the packet payload on an SoR, and redirecting the packet stream to

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