Chapter 25
Web Based CDN Structure for Smart Devices

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Abstract The rapid growth of telecommunication technology has led to the development of many smart devices. In particular, the smartphone market has been growing rapidly following the development of third-generation telecommunication technology. As a result, most people are expected to use a smartphone within a few years. Furthermore, the market for smart devices such as tablets and smart TVs are growing rapidly. Therefore, most people are expected to own various smart devices within a few years. However, current Contents Delivery Network (CDN) network systems are focused on a desktop PC platform, which can be problematic for smart devices. In this paper, we analyze the performance of Web browsing speed in smart mobile devices. Through this results, we propose web based CDN network structure.

Keywords CDN · Web · HTML5 · Network · Smart device · Mobile

25.1 Introduction

Recently, the number of people who own mobile devices is increasing because of the increasingly broad range of content they provide. Many people use the Internet more frequently on smart devices than on desktop PCs. For example, many people use Social Network Service (SNS) on their mobile devices. An observation of selected SNSs, such as Facebook, Twitter, and LinkedIn, revealed that each SNS

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expanded their mobile audiences by at least 50 % in the last year. Facebook was home to the largest mobile audience among the three destination with more than 57 million mobile users in August, which is higher by 50 % from the previous year. Twitter saw its mobile audience jump by 75 % to 13.4 million users, while LinkedIn's mobile audience climbed by 69 % to 5.5 million users [1].

At present, the number of mobile users is increasing rapidly, but current network systems are still largely optimized for a desktop PC platform. Hence, many Web sites are now considering building a mobile site. Therefore, we are studying ways to increase the speed for mobile Web applications.

In this paper, we conduct a performance analysis of Web-browsing speed in smart mobile devices to determine the factors that affect the speed. Next, we will propose CDN structure that suitable for a variety of smart devices. First, we show popular CDN technology. Next, we discuss previous research on Web-browsing speeds and find that existing research is almost exclusively focused on desktop PCs. Next, we show the results of our research. We checked Web-browsing speeds on various smart devices such as tablet PCs, desktop PCs, and smart phones. We then discuss our CDN structure for increasing speed in various smart devices.

25.2 CDN Technology

CDN is a large distributed system of servers deployed in multiple data centers in the Internet. The goal of a CDN is to serve content to end-users with high availability and high performance. CDNs serve a large fraction of the Internet content today, including web objects that including text, graphics, URLs and scripts, downloadable objects such as media files, software, documents, applications, live streaming media, on-demand streaming media, and social networks (Fig. 25.1).
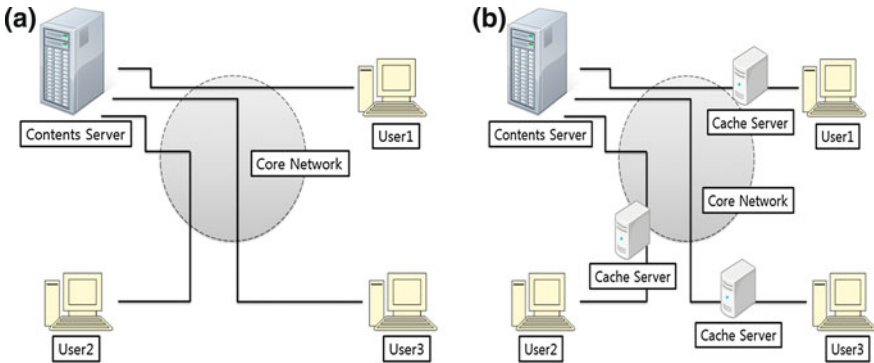

Fig. 25.1 Comparison with traditional contents delivery and CDN. **a** Traditional contents delivery and **b** contents delivery and CDN

It is separated three main methods, First is Global Server Load Balancing (GSLB). Next is synchronization technology for synchronize with contents in distributed edge server. Finally Adaptive Bitrate Streaming that is sending a contents to suit user or network environment [2].

25.2.1 Global Server Load Balancing

Load balancing is distribute workload across multiple devices or a device cluster, network links, central processing units, disk drives, or other resources, to achieve optimal resource utilization, maximize throughput, minimize response time, and avoid overload. Using multiple components with load balancing, instead of a single component, may increase reliability through redundancy. The load balancing service is usually provided by dedicated software or hardware, such as a multilayer switch or a Domain Name System server.

25.2.2 Synchronization

CDN systems save same contents in various cache servers. So it is need to contents synchronization. Especially, edge servers always have latest contents after contents uploading soon. Therefore synchronize technology is very important in CDN systems.

25.2.3 Adaptive Bitrate Streaming

Adaptive bitrate streaming is a technique used in streaming multimedia over computer networks. While in the past most video streaming technologies utilized streaming protocols such RTP with RTSP, today's adaptive streaming technologies are almost exclusively based on HTTP and designed to work efficiently over large distributed HTTP networks such as the Internet [3]. Especially it is important in current internet environment that is supporting various devices such as smart phone, tablet for seamless service.

25.3 Web Performance in Smart Devices

We analyze the browser loading time in each device. Subsequently, we compare the speeds of various smart mobile devices and determine the factors that affect the speed. Our research was conducted in three phases. First, we compared script loading times, and checked the image loading times, and lastly, we compared the desktop and mobile pages of popular portal sites (Table 25.1).

Table 25.1 Tested devices

Type	Device	Browser
Desktop	Quad core PC	Chrome
Tablet	iPad 2	Mobile safari
Smart Phone	iPhone 4	Mobile safari
	Galaxy S	Mobile chrome

Table 25.2 Comparison loading time

Method	Device	Increasing rate of loading time (%)
Script	Desktop	0
	Tablet	467
	iPhone 4	1906
	Galaxy S	2160
Image	Desktop	0
	Tablet	20
	iPhone 4	26
	Galaxy S	25

For simulation, we used three types of devices: desktop, tablet, and smartphone. Each of these devices was tested in a web wait site [4]. This site features support for checking the loading time. We ran each test 10 times in the same network environment.

We studied the difference in scripting and image loading speeds among desktops. For this research, we used only the first loading time because it shows the same result in the subsequent image loading.

As shown in Table 25.2 and Fig. 25.2, the script processing time of mobile devices is very slow compared to desktops, but the differences in image loading times is less than the difference in scripting times. From this result, we determine that it is important to reduce script source for mobile Web services. Image loading time is not as important as scripting time. Almost all mobile devices are connecting at lower network speeds than desktop PCs, using 3G, LTE, etc., so mobile Web pages should provide smaller images such as thumbnail images.

25.4 Proposing CDN Structure

Through results of Sect. 25.3, we know that contents provider must provide simple script pages and small images. Therefore it is having various type contents for provide mobile devices so we propose new CDN structure.

Our suggestion is extension of user desktop. Desktop will be parent node. It having mobile version contents and provide these contents to child nodes (Fig. 25.3).
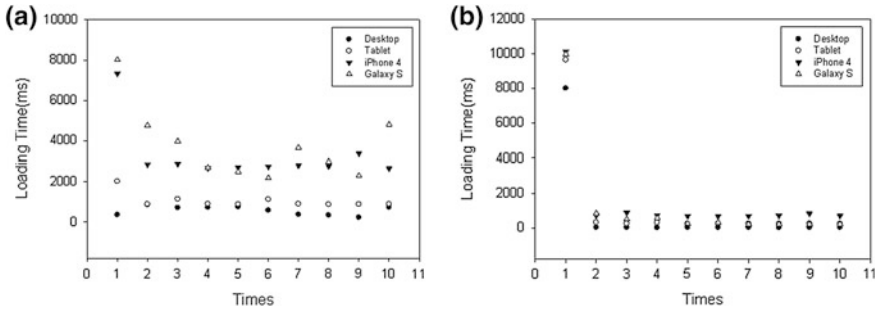
Fig. 25.2 Script loading time and image loading time. **a** Script loading time and **b** image loading time
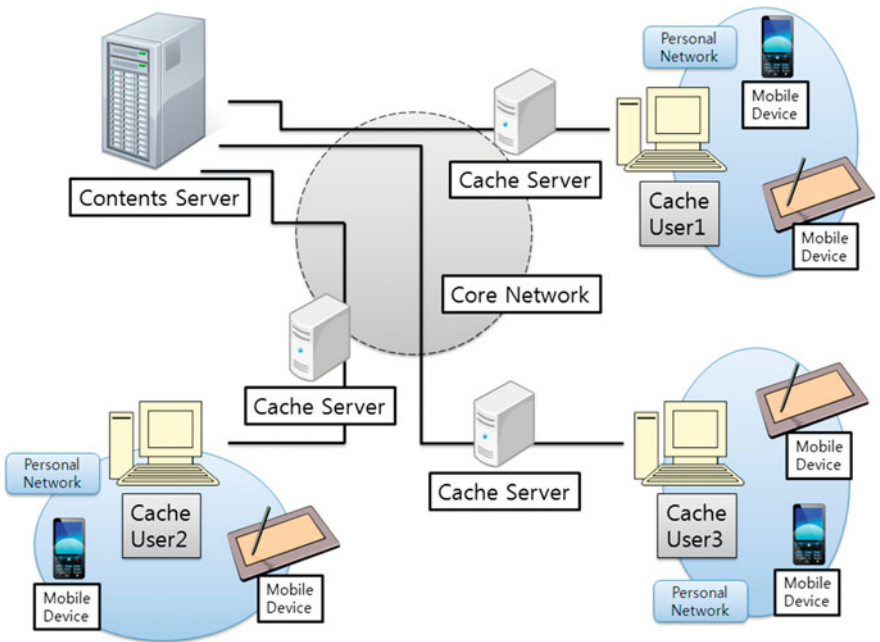

Fig. 25.3 Proposed Structure

25.4.1 Cache User

In proposed structure, user desktop of traditional CDN will acts the cache server. It is received mobile version contents from cache server and delivery contents to child mobile devices. Through that, cache server will be decrease load and mobile device receive contents quickly because cache user is close to the mobile devices.

25.4.2 Personal Network

Personal network means small network produced by desktop PC. Mobile devices receive contents from near PC always because it is had optimized contents that is received from cache server. And it is decrease load of cache server because mobile devices are provided contents by cache user.

25.5 Conclusion

Current network environment is very complex and had a lot of load because many people have various smart devices. Therefore it is need new network system. But current CDN systems focused only desktop platform. So we propose new CDN structure for supporting various mobile devices.

In this study, we conducted a performance analysis of Web-browsing speed in smart mobile devices and desktop PCs and compared the results. We consequently determined a method for reducing processing time in smart mobile devices. Using the results, we had known methods to raise the speeds of smart mobile devices. And propose cache user based CDN system. This system will decrease load in cache servers and provide fast contents delivery to mobile devices. In the future work, we will try peer to peer based CDN system that using cache user.

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