

Chapter 2

Management of Service Level Agreement for Service-Oriented Content Adaptation Platform

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ABSTRACT

It is paramount to provide seamless and ubiquitous access to rich contents available online to interested users via a wide range of devices with varied characteristics. Recently, a service-oriented content adaptation scheme has emerged to address this content-device mismatch problem. In this scheme, content adaptation functions are provided as services by third-party providers. Clients pay for the consumed services and thus demand service quality. As such, negotiating for the QoS offers, assuring negotiated QoS levels and accuracy of adapted content version are essential. Any non-compliance should be handled and reported in real time. These issues elevate the management of service level agreement (SLA) as an important problem. This chapter presents prior work, important challenges, and a framework for managing SLA for service-oriented content adaptation platform.

INTRODUCTION

Recently, Gantz and Reinsel (2010) reported that the current amount of digital content available online is 487 billion gigabytes (GB) and is expected to increase rapidly. Most of these existing contents

however, are originally designed for display on desktop computers. With the proliferation of client devices varied in their sizes and capabilities (e.g., processing power, input and output facilities), it is becoming increasingly difficult for direct content delivery to varying devices without layout adjustment (Mohan et. al, 1999). Moreover, not every device can play all media types or formats. For

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example, a non-multimedia mobile phone cannot play continuous video clips, while only H.264, MPEG-4 and M-JPEG formats are currently supported for iPhone video playback. As such, certain widely employed video formats such as MKV and FLV will require format conversion or additional player before they can be played on iPhone. To address this problem, a service-oriented content adaptation platform that provides content adaptation functions as services to clients has recently emerged as an efficient, flexible, and scalable paradigm (Berhe et.al, 2005; Nordin et.al, 2007; Shahidi et.al, 2008; Liu et.al, 2008; Tonnie et.al, 2009). Example of content adaptation functions are format conversion, transcoding, distillation and media translation (Mohan et. al, 1999; Lum and Lau, 2003; Hsiao et.al, 2008).

The service-oriented content adaptation is distributed and totally open platform. Three major requirements for a service-oriented content adaptation system are performance, availability and security. Performance requirements imply the capability of coping with different workload intensity, adapting rich content to various adaptation requirements and assuring service quality. Availability and security requirements suggest that the system must always ready to serve clients requests, and capable to withstand attacks and failure (Park et.al, 2001). In this chapter, we focus on service quality assurance. This is achieved through service level agreement (SLA).

A client's content request is composed of multiple content objects which require a series of content adaptation tasks (Shahidi et.al, 2008). In the service-oriented content adaptation scheme, each task is performed by a particular content adaptation function that potentially be provided by multiple services located across the wide-area network. Clients pay for the consumed content adaptation services, thus demand service quality. As such, appropriate services are selected based on QoS levels tailored to specific adaptation requirements. Commitment negotiated upon by both clients and providers is officially documented through the

SLA. During service delivery, negotiated SLAs require real-time verification (Zhou et.al, 2005). This makes the monitoring and measurement of SLA an important issue. If violation occurs, appropriate action (e.g., penalty, conflict resolution) should be taken. As such, a mechanism to handle SLA compliancy is required. On the other hand, when an SLA is likely to be violated, the corresponding service provider can take proactive action that includes outsourcing the task to the similar service provider (Park et.al, 2001; Pathan and Buyya, 2009a). These issues necessitate an effective management of the SLA.

In this chapter, our main contribution is a framework of SLA management for service-oriented content adaptation. The assurance of QoS in service-oriented systems is becoming increasingly important for both clients and service providers (Park et.al, 2001). This necessitates the requirement for SLA. However, SLA is being neglected in existing service-oriented content adaptation systems (Berhe et.al, 2005; Nordin et.al, 2007; Merat et.al, 2008; Tonnie et.al, 2009). Moreover, unlike other Internet services (e.g., VoIP, content delivery network) that focus solely on monitoring network and throughput QoS levels (Menasce, 2002; Prokkola, 2007), SLA for service-oriented content adaptation should take into account content adaptation accuracy-related QoS (e.g., translation accuracy, conversion accuracy). We have incorporated these issues in constructing the framework.

The work presented in this chapter will provide readers the background knowledge of SLA management for service-oriented content adaptation systems.

BACKGROUND

In recent years, the challenge of service-oriented content adaptation is shifting from a focus on enabling content adaptation performed by a set of services (i.e., composite services), to a focus on assuring accurate adapted content version

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