

Chapter 7.14

On the Use of Web Services in Content Adaptation

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ABSTRACT

The tremendous growth of the Internet has introduced a number of interoperability problems for distributed multimedia applications. These problems are related to the heterogeneity of client devices, network connectivity, content formats, and user's preferences. The challenge is even bigger for multimedia content providers who are faced with the dilemma of finding the combination of different variants of a content to create, store, and send to their subscribers that maximize their satisfaction and hence entice them to come back. In this chapter, the authors will present a framework for trans-coding multimedia streams using an orchestration of Web-services. The framework takes into consideration

the profile of communicating devices, network connectivity, exchanged content formats, context description, users' preferences, and available adaptation services to find a chain of adaptation services that should be applied to the content to make it more satisfactory to clients. The framework was implemented as a core component for an architecture that supports personal and service mobility.

INTRODUCTION

The tremendous growth of the Internet has introduced a number of interoperability problems for distributed multimedia applications. These problems are related to the heterogeneity of client devices, network connectivity, content formats, and user's preferences. The diversity of client devices, network

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connectivity, content formats, and user's preferences posed also some challenges in aligning and customizing the exchanged data between different users with different preferences. The challenge is even bigger for multimedia content providers who are faced with the dilemma of finding the combination of different variants of a content to create, store, and send to their subscribers that maximize their satisfaction and hence entice them to come back. Most content providers have taken the costly approach of creating different versions of content for different access devices and networks.

Content adaptation is an effective and attractive solution to the problem of mismatch in content format, device capability, network access and user's preferences. Using content adaptation, a number of adaptations is applied to the original content to make it satisfy the device constraints of the receiving device and the preferences of its user. Most currently available content adaptation modules are designed to make the Web easier to use. Examples of such adaptations modules include conversion of HTML pages to Wireless Markup Language (WML, 2001) pages, enlarging text size, reducing the size of an image, changing text and background colors for better contrast, removal of redundant information, audio to text conversion, video to key frame or video to text conversion, content extraction to list a few. These adaptation modules do not have though the same requirements and challenges of real-time multimedia content adaptations. Real-time multimedia applications involve large volumes of data making trans-coding a computationally very expensive task (Chandra & Ellis, 1999, Han et al., 1998). To address this challenge, some trans-coding services have been implemented in hardware and deployed on intermediate network nodes or proxies. The disadvantage of this approach is that there are always new types of clients that cannot be supported by the deployed hardware. A more suitable approach to address the computational challenge of multimedia trans-coding is based on the observation that the general trans-coding process can be defined as

a combinatorial process (Mohan, Smith, & Li, 1999), and that multiple trans-coding services can be chained effectively together to perform a complex trans-coding task. So, instead of having all trans-coding done by one single trans-coding service, a number of trans-coding services can collaborate to achieve a composite adaptation task. For instance, trans-coding a 256-color depth *jpeg* image to a 2-color depth *gif* image can be carried out in two stages: the first stage covers converting 256-color to 2-color depth, and the second stage converts *jpeg* format to *gif* format. Using the software approach, transcoders can then be built more easily in software, and deployed and advertised more quickly to meet the needs of the users. Software-based trans-coding are also more reliable since its components can be simpler and they can also be replicated across the network. Moreover, transcoders can be modularized and re-used in different situations and contexts.

Given a composite adaptation task that can be carried out in a number of stages, and given that there could be a number of possible configurations to adapt the sender's content to make it presentable at the receiver's device, the challenge is to find the appropriate chain of available trans-coding services that best fits the capabilities of the device, and at the same time, maximizes the user's satisfaction with the final delivered content. In this chapter, we will discuss a Quality of Service (QoS) selection algorithm for providing personalized content through web-service composition. The function of the algorithm is to find the most appropriate chain of available trans-coding services between the sender and the receiver, and also to select the values for the configuration parameters for each trans-coding service. The proposed algorithm uses the user's satisfaction with the quality of the trans-coded content as the optimization metric for the path selection algorithm.

The rest of the chapter is organized as follows: In Section 2, we will introduce content adaptation and present the existing different models used in content adaptation. Section 3 lists all the required

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