Chapter 14

P2P SCCM: Service-Oriented Community Coordinated Multimedia over P2P and Experience on Multimedia Annotation Service Development

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ABSTRACT

Peer-to-Peer Service-oriented Community Coordinated Multimedia (SCCM) is envisioned as a novel paradigm in which the user consumes multiple media through requesting multimedia-intensive Web services via diversity display devices, converged networks, and heterogeneous platforms within a virtual, open and collaborative community in this chapter. A generic P2P SCCM scenario is created and examined first. A SCCM model is designed with the adoption of the service orientation approach and principles. A tunneled hierarchical P2P model is designed for improving performance of service lookup and session setup. Next, performance analysis is presented with the average number of service lookup hops in the tunneled hierarchical P2P model. Finally, a prototype service implementation is presented with the design of content annotation service and application on face detection.

DOI: 10.4018/978-1-60960-774-6.ch014
INTRODUCTION

User experiences emerge from the active participation in events or activities and lead to the accumulation of knowledge, skill and enjoyment. This is made possible by ever-growing amount of networked multimedia content (e.g., video, audio) and multimedia-intensive services (e.g., multimedia searching, annotation) together with growing number of mobile users and deep penetration of broadband Internet connections. Collaborative use of multimedia content and multimedia-intensive services empowers users to experience the real world and share it with other users. The above emerging technical phenomena is generalized with a term ‘Community Coordinated Multimedia’ (briefly, CCM) and is characterized with Web accessibility, Web service-driven, mobility, equal participativity, etc. (Zhou, Rautiainen, & Ylianttila, 2008a).

The shift towards CCM-driven user experience is manifested by several web services that have become popular in recent years, such as Wikipedia, Flickr, YouTube, and Joost. However, they are more emphasizing on community membership management and multimedia sharing, and less in the support of multimedia-intensive services such as multimedia analysis and annotation.

There are amounts of efforts on generally addressing the issues of content annotation (Hansen, 2006) and retrieval (Croft, 1993; Rautiainen, 2006). There are also tools widely developed and applied for assisting users in the task of extracting, annotating, retrieving and mining multimedia content such as GATE with unicode-based text for supporting multilingual information extraction (Damljanovic, Tablan, & Bontcheva, 2008), ANVIL with frame-accurate, hierarchical multi-layered annotation for multimodal dialogue (Kipp, 2004), and IBM VideoAnnEx annotation tool with MPEG-7 metadata (Lin, 2002). However, these tools are heavy weighted integrated multimedia processing software systems. Meanwhile they are not Web services-based.

Face detectors are studied for implementing our initial prototype, i.e., service-oriented face detection. The literature on cascade-structured detectors for faces and other objects are reviewed in (Wu, Brubaker, Mullin, & Rehg, 2008). A comprehensive review of other face detection approaches and techniques can be found in (Yang, Kriegman, & Ahuja, 2002). The cascade-structured face detectors such as Viola and Jones’ (Viola & Jones, 2004) and Wu et al.’s (Wu, Brubaker, Mullin, & Rehg, 2008) are mainly used in our experiments for test comparisons. In addition, there are many software libraries, examples of QuickTime for Java (Hoffert et al., 1992)(Chris Adamson, 2005), OpenCV (Gary Bradski, 2000), Java Media Framework (JMF) (Sullivan, Winzeler, Deagen, & Brown, 1998), open source MPlayer, that enable audio, video and other time-based media to be added to Java applications and provide various readymade functions for multimedia functionality and image processing, including face detection.

In this chapter we propose a Peer-to-Peer (P2P) SCCM solution and present an application for face detection by combining service-oriented computing and face detection techniques to tackle the emerging requirements characterized by the CCM-driven user experience, such as Web accessibility, discoverability, and community driven collaboration. On the one hand, service-orientation system design and technology exhibits strong potential in leveraging and reinforcing CCM system development in coordination, compositibility, discoverability, extensibility and agility of multimedia consumption via diversity executing environments. Existing Web services technologies, i.e., Web Service Description Language (WSDL) (W3C-WSDL, 2005), Simple Object Access Protocol (SOAP) (SOAP, 2003), and Universal Description Discovery and Integration (UDDI) (UDDI, 2004) are widely used to actualize service-oriented solutions. On the other hand,