Chapter 29
Middleware for Community Coordinated Multimedia

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ABSTRACT
Community Coordinated Multimedia (CCM) envisions a novel paradigm that enables the user to consume multiple media through requesting multimedia-intensive Web services via diverse display devices, converged networks, and heterogeneous platforms within a virtual, open and collaborative community. These trends yield new requirements for CCM middleware. This chapter aims to systematically and extensively describe middleware challenges and opportunities to realize the CCM paradigm by reviewing the activities of middleware with respect to four viewpoints, namely mobility-aware, multimedia-driven, service-oriented, and community-coordinated.

INTRODUCTION
With the popularity of mobile devices (e.g. mobile phone, camera phone, PDA), the advances of mobile ad hoc networks (e.g. enterprise networks, home networks, sensor networks), and the rapidly increasing amount of end user-generated multimedia content (e.g. audio, video, animation, text, image), human experience is being enhanced and extended by the consumption of multimedia content and multimedia

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services over mobile devices.

This enhanced human experience paradigm is generalized with the term of Community Coordinated Multimedia, abbreviated as CCM, in this chapter. The emerging CCM communication takes on the feature of pervasively or wirelessly accessing multimedia-intensive Web services for aggregating, sharing, viewing TV broadcasting/multicasting services, or on-demand audiovisual content over mobile devices collaboratively. Thus the end user’s experience is enhanced and extended by mobile multimedia communication with the transparencies in networking, location, synchronization, group communication, coordination, collaboration, etc. (Zhou et al., 2008a).

Middleware plays a key role in offering the transparent networking, location, synchronization, group communication, coordination, collaboration, etc. In this chapter, middleware is perceived as a software layer that sits above the network operating system and below the application layer. It encapsulates the knowledge from presentation layer and session layer in OSI model that provides controls on the dialogues/connections (sessions) and the understanding of syntax and semantics between distributed applications, and abstracts the heterogeneity of the underlying environment between distributed applications.

This chapter presents a survey and initial design of P2P service-oriented community coordinated multimedia middleware. This work is a part of EUREKA ITEA2 project CAM4Home metadata-enabled content delivery and service framework. The chapter investigates technological CCM middleware challenges and opportunities from four viewpoints that describe the CCM: mobility-aware, multimedia-driven, service-oriented, and community-coordinated. These are the most highlighted characteristics for CCM applications. The following lists identified middleware categories for addressing challenges and opportunities in the CCM paradigm:

- Middleware for mobility management. The middleware for mobility management aims to provide mobile access to distributed multimedia applications and services, and addresses the limitations caused by terminal heterogeneity, network resource limitation, and node mobility.
- Middleware for multimedia computing and communication. The middleware for multimedia computing and communication aims to provide standard formats, specification and techniques for representing all multimedia types in a digital form, handling compressed digital video and audio data, and delivery streams.
- Middleware for service computing and communication. The middleware for service computing and communication aims to provide specifications and standards in the context of Web services to achieve the service-oriented multimedia computing paradigm covering service description, interaction, discovery, and composition.
- Middleware for community computing and communication. The middleware for community computing and communication aims to provide standards and principles which govern the participation of peers into the community and messaging models.

The remainder of the chapter is organized as follows: Section 2 defines concepts relevant to CCM and middleware. Section 3 illustrates a generic CCM scenario. Section 4 analyzes the requirements of middleware for CCM. Section 5 designs a middleware architecture for CCM. Section 6 surveys middleware technology for CCM with respect to mobility-aware, multimedia-driven, service-oriented, and community coordinated viewpoints. Section 7 discusses the future trends towards the evolution of CCM. Finally, Section 8 draws a conclusion for the chapter.