Chapter 11
Dynamic Mashup of Media-Centric Services:
Conceptual Model, Architecture, and Validation

Sang Woo Han
Agency for Defense Development, Korea

JongWon Kim
Gwangju Institute of Science and Technology, Korea

ABSTRACT

The architectural inflexibility of legacy multimedia systems makes it very difficult to reform them by reusing existing components. To create reusable multimedia applications, the service composition mechanism should be accommodated to automate the overall composition process that assembles distributed component services into an adaptive composite service. The massive and timely delivery of multimedia contents is gradually integrating itself with dynamic composition of media-centric services. By doing so, new customized media-centric services will be created with agility to meet the diverse requirements of end users. In this chapter, the authors propose a practical coordinated approach to composing adaptive media-centric services with programmable and virtualized resources to facilitate the flexible creation and consumption of dynamic mashup of media contents. More specifically, they describe a conceptual model for dynamic composition of media-centric services and propose a workflow-style coordination process for service composition and a useful software tool to support easy experimentation. The implemented software tool is validated according to targeted experimental scenarios in a realistic testbed that supports both computing and networking resources.

DOI: 10.4018/978-1-4666-6178-3.ch011

INTRODUCTION

Networks together with computing and storage servers are evolving towards service-oriented infrastructure that enables users to easily facilitate the production, conversion, delivery, and consumption of multimedia contents anytime and anywhere (Future Internet Assembly, 2009). Aligned with this foreseeable trend, we expect significant progress to be made in the way the multimedia contents are published, which will in fact impose several new challenges for the agile and economic service provisioning over underlying infrastructure. In order to build large-scale adaptive media-centric services with dynamic service composition processes, the underlying resource infrastructure should flexibly support the abstracted mapping between the resource and service layers.

The accompanying key challenges have been discussed in the research community from both high-level service composition and underlying resource infrastructure aspects. First, the challenges on high-level service composition are mainly involved in the conceptual modeling to formally describe targeted service composition in syntactic or semantic ways. According to the conceptual models, the systematic approaches are related to integrate services and handle the transactions for its composition. Next, the challenges on underlying resource infrastructure are caused by the diverse nature of supporting networks and devices in terms of availability, bandwidth, and quality. Specifically, essential operation functions (e.g., name resolution, proxy operation, etc.) should be ready for distributed nodes in the underlying infrastructure. It is quite difficult to create a transparent platform to execute the desired media-centric service composition.

We may state the above challenges more formally. In order to create a flexible distributed multimedia application, the underlying systems and networks must provide a strong support across multiple protocol/service layers for the overall service composition process. The architectural inflexibility of legacy multimedia systems makes it very difficult to reform them by reusing existing components. To create reusable multimedia applications, the service composition based on SOC (service-oriented computing) should be accommodated to automate the overall composition process that assembles distributed component services into a composite service.

For harmonious and automated service compositions, several high-level programming tools would assist service discovery, selection, execution, connection, monitoring, and customization (Nahrstedt & Balke, 2005). Resource awareness is quite challenging to economically enable appropriate QoS (Quality of Service) provisioning. To continue the smooth operation of distributed services, we need to persistently fine-tune the perceived service quality to cope with the dynamic variations of targeted environments (e.g., pre-defined demands arising from service events or time-varying resource conditions).

To address the above key challenges in a systematic manner, we suggest a coordinated approach for media-centric service composition that attempts to dynamically coordinate the service and resource components from any specific viewpoint. In response to a predefined user request, the proposed coordinated approach helps users to conduct the agile and economic composition of dispersed services.

The challenge of balancing the quality among multiple instances of composed services remains unresolved because allocated amounts of resources are highly subject to the variations of the underlying infrastructure (e.g., network bandwidth or computing availability). The composed service should adapt itself according to the monitored visibility in service status and resource utilization. To handle this, we propose a coordinated process for the media-centric service composition that consists of specific tasks such as service discovery, matchmaking, placement, stitching, monitoring, and tuning. The coordinated process automatically