A Novel Approach to Construct Semantic Mashup using Patterns

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ABSTRACT

With the coming of Web 2.0, several technologies are developed to facilitate creating, sharing and reusing of web resources. In this context, the mashup is a novel approach that allows the user to aggregate multiples services to create a single one with a new user interface. However, a key limitation of existing mashups applications is the need to compute semantic and syntactic similarities between data in different services and create or modify workflows in applications mashups without enlisting the talents of the original developers or vendor. In fact, automatic matching tools help users to facilitate automatic integration of both data and APIs without knowing their structure and semantics. In this paper, the authors suggest a novel approach which consists in building a semantic mashup using a matching tool, domain ontology and a set of patterns to facilitate and automate services and data integration. As a study use case, they develop a semantic mashup application for a travel agency that provides a single interface to users.

KEYWORDS
Mashup Patterns, Matching, Semantic Mashup, Web 2.0

1. INTRODUCTION

With the coming of Web 2.0, the user can show his existence through the use of various technologies like collaborative environments, social networking, mashups... etc (Lytras et al., 2008). In this context, the main goal of mashup applications is to combine: data, user interfaces of the published web sources that are reused via APIs (Yu et al., 2008). Naturally, the mashups often take the form of a website or webpage that integrate heterogeneous information and services from various sources (Garriga et al., 2016). In fact, for integrating APIs and data of mashup applications, the user must understand their structures and semantics. Thus, we need to introduce a semantic layer to collect heterogeneous data into a composite application for facilitating the automatic integration of the APIs and data through the Semantic Mashups. In turn, the patterns help the designers to discover combinations of the architecture and develop the solution blocks that have been shown to present useful solutions in the past, which can provide the core for efficient future solutions (Liu et al., 2011).

Currently, several papers have dealt with the automatic integration of data and APIs in mashup applications ((Kopecký et al., 2007), (Lathem et al., 2007), (Maleshkova et al., 2009), (Ngu et al., 2010), (Meditskos & Bassiliades, 2011), (Malki & Benslimane, 2012), (Liu et al., 2011), (Lee, 2014), (Tjoa et al., 2015), (Park et al., 2015), (Lee, 2015) and (Trinh et al, 2016)). The key challenges of these approaches are the need to 1) compute semantic and syntactic similarities between data in different services and 2) create or modify workflows in mashup applications without enlisting the talents of the original developers or vendor.
In order to address these problems and to enhance the quality of data and services integration in mashup applications, this paper puts forward a novel approach which consists in building a pattern-based semantic mashups for the enterprise 2.0. Our approach relies on the use of domain ontology and a matching tool to match heterogeneous data in different services with ontological concepts. In addition, we use a set of patterns to facilitate the construction and the use of the semantic mashup. First, we use the pattern ‘Content Integration’ to integrate data after the matching process. Then, we use the pattern ‘Usability Enhancer’ to present the application in one interface instead of wasting time to switch between different applications. Finally, we use the pattern ‘Workflow’ that manages the chaining of the spots.

We evaluate our system prototype with a study use case; when we develop a mashup application for a travel agency. It provides a single interface that allows the user to specify the starting location, destination and favorite transportation (flight or train). After the submission of the data, our system retrieves the availability of the flight or train as well as the availability of hotels and car rental options using domain ontology and a matching tool.

The rest of this paper is organized as follows. We provide a background on Web 2.0, mashup, semantic mashup, the process of computing data mashups and mashup patterns in section 2. Section 3 reviews the state of the art in semantic mashup. In section 4, we give an overview of our approach. Section 5 illustrates a study use case to evaluate our system prototype. We conclude with lessons learned and we describe our future work in section 6.

2. BACKGROUND

This section serves to expand your knowledge in mashup, semantic mashup, the process of computing data mashups and mashups patterns types.

2.1. Web 2.0, Mashup, Semantic Mashup

Web 2.0 is the business revolution in the computer industry caused by the move to the Internet as platform, and an attempt to understand the rules for success on that new platform.

In Web 2.0, we move from deal based Web pages to communication-based ones. Web2.0 facilitates creating, using, searching, sharing, and reusing of web resources (O’Reilly, 2005). Based on these concepts, several technologies are developed (e.g. social networking sites, folksonomies, wikis, blogs, and mashups) (Lee et al., 2009).

As the objectives of web2.0, the mashup application appears as inevitable solution. Thus, it is a novel approach that allows the user to aggregate multiple services to create a single service with a new user interface that meets its objective (Yu et al., 2008). Typically, the architecture of a mashup application contains a set of components, namely data, RSS feeds, web services, service platforms, etc.

Mashup application aims to reduce the cost and the development time of web applications (Doan et al., 2012). Nevertheless, in spite of these advantages the mashup can be done by a developer who not only needs programming competences but also understanding the structure and semantics of APIs that he wishes integrated.

In order to solve this problem and give end users the ability to create mashup applications with less computer skills, there are a set of tools (IBM-CENTER, Dapper, Convertigo, Serena, Popfly, Yahoo cleaners, etc.) (Hoyer & Fischer, 2008) that solves the problem of APIs combination and aggregation and ignore the intervention of the developer, but this last is necessary in case the data and APIs are heterogeneous; thing that have pushed researchers an effective solution for creating a mashup so an end user can develop mashups application as a tool to guarantee him the discovery, selection, and automatic or dynamic overlay based on the semantic approach is that we call “SEMANTIC MASHUP” (Anjomshoaa & Tjoa, 2014).
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