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Enhance Business Promotion for Enterprises with Mashup Technology

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Abstract: Technology improves people's life and makes business more viable than ever before, especially e-leisure and e-business. Many Small and Medium Enterprises (SMEs) which might not have enough budget for establishing their IT (Information Technology) department can today easily benefit from the use of technologies like Web technology, Web applications and their underlying supporting platforms and meta-application development methods. This paper presents an ideal about how to easily make business applications to attract customers for their patronage. Such applications are called meta-applications since they build from a simple set of basic applications to create a high-level advanced application through retooling. These meta-applications are very attractive solution in the business domain because of their low level development cost and rapid re-builds. Through our investigations and series of experiments we found that SMEs can apply mashup technology to do some basic and simple integration without having an IT department or costly external consultancy services to assist them. This paper also demonstrates a real effective example of how to create a meta-application based on Google Maps and Flickr services which shows various photos with their geographical coordinate information about restaurants, shops and hotels. Such examples not only to help SMEs saving money without increasing their budgets but also to enhance their advertising and promotion for business with ease through the Internet at competitive prices and attract customers more effectively. While it is acknowledged that this form meta-application can be developed by most novices, important issues regarding security threats and privacy violation cannot be ignored in this loose way of assembling resources. These issues are also broadly presented in this paper as well.

Key words: Business advertising and promotion · Enterprises · Mashup · Meta-application · Privacy · Security · Web and Internet technology

INTRODUCTION

For SMEs, reducing costs means increasing profits and their return on investment (ROI). To save costs, SMEs must optimize allocation of their limited budgets. SMEs always realize the importance and the benefits of online advertising, but since the investment to undertake online advertising and promotion are always costly, senior managers hesitate to invest and make profit in a long time period. A recent benchmarking report based on SMEs and their investment in advertisement expenditure from Borrell Associates Inc [1] shows that of the 2874 examined SMEs, 29% plan to increase their *online advertising investments* in 2011, which in US dollar terms mean an increase from $31.5 billion to $40.6. SMEs accounted for 19.5% of the share in the total online advertising spending in 2010. Borrell estimated that this number will increase to 23.1% in 2011. In china, online advertising revenue for 2011 was 51.29 billion yuan. This was more than 5.93 billion higher than the total advertising revenues in newspapers in the same year.

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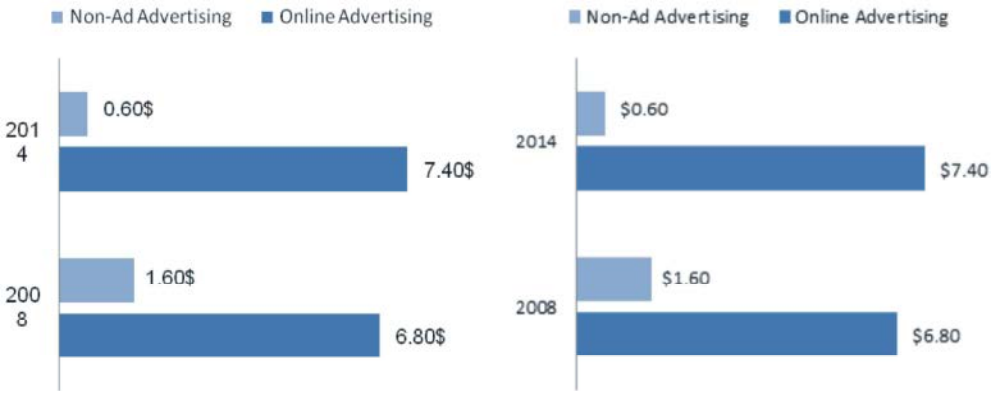

Fig. 1: Growth in Online Advertising compared to non-ad advertising [3][4]

This was still higher than all print media advertising revenue for the year, which was 55.26 billion yuan. According to iResearch, China online advertising revenue for 2013 was 24.5% higher than the overall Chinese advertising market. iResearch also estimates that the country's online advertising revenue will increase by 52.7% in 2014 to reach 1,640 billion Yuan [2]. These statistics show SMEs are considering Web technology as a new serious advertising platform and contender against traditional forms of advertising to gradually attract customers with the hope of increasing earnings. Fig. 1 shows the increase in SMEs using online Web technologies as sales channels compared.

According Borrell Associates, America's more than 14.6 million small and medium-sized businesses (SMBs) spent more than $6.7 billion on locally targeted advertising in 2008. This represents more than half the amount of money that companies spent on advertising that year. However, Borrell Associates also estimated that the figure would rise to more than $7.4 billion dollars by 2014. This shows that SME's prefer to use online advertisement platforms than other non-ad forms of advertising. For instance, the data by Borrell Associates shows that SMEs are investing 11% of their advertising dollars online, up from less than 4% three years ago. This represents a rise from $0.6 billion dollars to $1.6 billion dollars by the end of 2014 [3-5]. Not only these SMEs, but also any person or institution who has been involved in social networking or social communication have witness the explosive instant momentum and growth of activity harnessed and driven by social media. According to the statistics from Abaddi [6], by the end of March 2011, "Wikipedia has over 3.5 million pages with descriptions of entities. Flickr members have uploaded over 5 billion photos, Youtube has 35 hours of videos uploaded to the site per minute and Twitter users generate 65 million tweets a day." The big power of these social networking sites is not only empowering participants with the ability of creating contents but also the ability of direct, unedited and rapid communication. Prior to RSS (Really Simple Syndication) technology, it was not efficient to let people refresh a webpage all the time to check new updates of blogs. RSS as an emerging technology has made this possible with considerable ease and virtually no effort. Nowadays people can read and subscribe to blogs, sites and news providers very conveniently. Instead of filtering news from a largenumber of data, the latest news and images would be automatically sent to your email in boxes in terms of feeds. Search engine using crawler and harvesting technology is another way of communicating resources and enhancing the power of Web content as well [7]. Assuming you always publish reviews on "restaurant and flavor" in your blogs or show the photos of food and the facilities of hotels in Flickr for few months. Many people interested in such blogs would have searched out and linked your articles and continuously downloaded the photos and any other items and then when later you write an article recommending "The top 10 restaurants" for eating out, feed will arrive in your inbox. Such technology driven influences are considered to be equivalent to, or better than, advertising in local newspapers or even focused advertising in specific columns of print and online media [8].

This paper is about how to apply Web mashup technology to business domain in terms of resources optimization and budgets saving. The paper begins in Section II with a review of mashup development in conjunction with how SMEs could optimize the opportunities. Section III provides an example of integrating Google Map and Flickr services to show the steps involved of making an advertisement through creating a meta-application using mashup technology and

their supporting tools. While this technology is very useful, it has some concerns and drawbacks concerning security threats and privacy violation issues that can forfeit the benefit of mashup development, which are presented and discussed in Section Finally, Section V provides an overall discussions and conclusions of this paper.

Data, Service and Application Integration in Mashup: The term mashup started in the audio domain, referring to artists remixing two or more recordings into a new entity [8]. The computing fraternity latched onto the word "mashup" by combing multiple services into a single high order Web application, culminating in the buzzword "meta-application" [9]. Although many different definitions of Web mashup were defined by different groups from different points of view, mashup has its own natural attributes and common characteristics, which can be categorized as essential features [10]:

- Combines content from two or more resources into a single integrated application.
- Web technology based on World Wide Web Consortium (W3C)'s Web 2.0 and Web 3.0 as a platform which leads to information sharing, collaboration and social networking.
- Situational demands based on end-users' immediate short term needs.
- End-users as co-creators who decide which features they want and also become the owners of the data that they generate.
- Rich, interactive and user-friendly easy to use interfaces to access and easy to start of meta-applications.
- Lightweight programming model where languages and simple data format make development easy and cost effective.
- Observing the result of the meta-application instantly before showing or distributing it out online [10].

The definition of mashup appears to be coming more diversified as more end-users concentrate on them now. Mashup combines multiple services into a single attractive and useful Web meta-application which benefit users in a way that is better than the individual services which they leverage [11].

Mashup is also considered as End-User Development (EUD). It largely shortens the development cycle and substantially reduces the development costs through reuse and lightweight integration techniques [12].

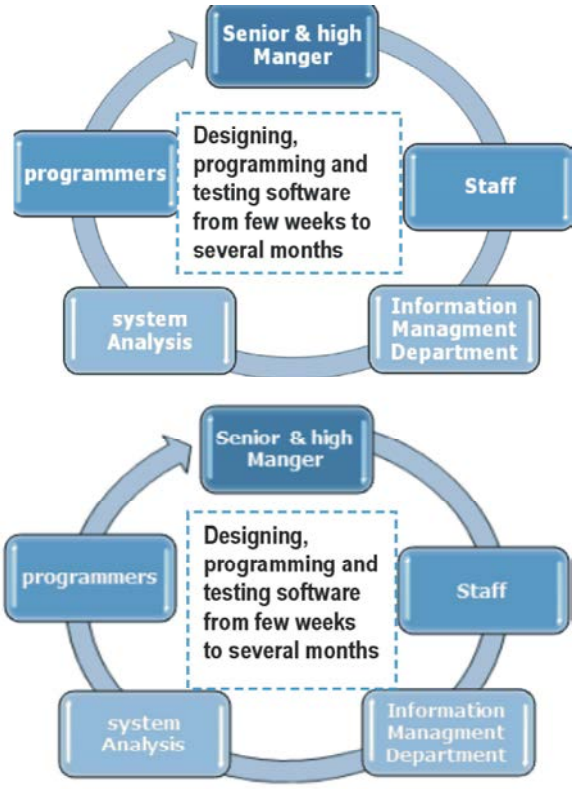

Fig. 2: Time-consuming and costly traditional component-based software development

Web application integration is a strategic approach to benefit from web service ability to exchange information and leverage processes in real time. In traditional integration, Web services are characterized by extensible application-level components with application-specific APIs; and data-driven components that have limited extensibility and are statistic would drive Data integration applications. Traditional application integration in enterprises which is mostly around data federation, service composition and portal, takes a long time to build and deploy and requires professional developers since its approach relies on having control over the applications [13].

In contrast with traditional approach, mashup facilitates application integration with lower costs, rapid development, easy deployment and greater harmony between the business and IT. The differences between mashups and traditional forms of integration originate from the basic observation that mashup mainly targets end user's personal and non-businesscritical applications with focus on opportunistic integration occurring on the Web. Fig. 2 and Fig. 3 compare traditional CBSD (Component-Based Software Development) which is a

Fig. 3: Efficient and cost saving end-user developments

traditional software development method using "developer-centric" composition technology. These figures illustrate the main feature differences between the two forms of development.

A typical mashup locates and organizes combined data from one or more sources on a customized user interface. Thus the availability of data is significant to feed the efficient data to Web services. Currently a large number of mashups are being built in countries which are rich in availability of wide range of public data such as the US and Singapore [14]. Mostly contents are in the form of web feeds or API's. All the contents are combined either on client side using client-side scripts or on server-side using some available server-side technology such as ASP, JSP, etc [15]. Mashups implement dynamic data integration by combining content from multiple sources at application runtime. If a web page mashes up more than one web application, the data from one web application may serve as iterative input into another. In fact they act as both service providers and consumers who "mash-up" services provided by others.

For SMEs, non-technical personnel can develop and deploy their own mashup at very short notice, but the technology itself is not omnipotent or invincible because there is a certain amount of know-how of the technology is required, akin to using a mobile phone for the first time. To understand and master enterprise mashup, there are three elements to be grasped:

- Mashup level: to define the types of your mashups (shown in Table 1).
- Mashup component: to define the data or components based on business requirements.
- Mashup environment: to deploy both business (consulting) staff and mashup developers' environments.

Enterprise mashups rely on the standardization of components to be fit easily with the minimum of tools required to assemble real-time situation business applications on demand. It is just like DIY (Do It Yourself) to make something from the components and tools by following simple guideline instructions. The whole developing processes are user and services-centric. In the next section, with the aid of an example based on integrating two Web services-Google Maps APIs and Flickr APIs-we will show how to create a meta-application for business advertising and promotion. In this case the meta-application is created to show the informative photos of restaurants, foods or coffee shops using related mashup principles and tools.

A Demonstration of Practical Mashup Example: The ongoing trends show Internet is becoming increasingly localized. This opportunity is great to be grasped by SMEs which are localized in nature. For example, a restaurant in a small city does not need to be promoted globally, but owner would like to promote it for the visitors and the people who are there vicinity. The latest statistics show that adults are spending more than 15 hours per week on the Internet. Broadband access also will grow from 55% to 90% by 2012 [16]. The increasing number of Internet users can provide the chance of having more customers.

Requirements: A Web mashup can be loosely established to advertise and promote your own restaurants, cafes or cafe shops. To demonstrate the creation of the meta-application, the contents of location and photos were extracted from Flickr and pulled into Google Maps. The extracted photos and location are used to generate a search function from Flickr's *geotagged* photos which then displays the photos on Google map.

Table 1: Mashups Categorization

Category	Description
Presentation-based mashup	Information is either remixed or just placed next to each other
Data-based mashup	Similar types of media and information from multiple sources are combined into a single data source

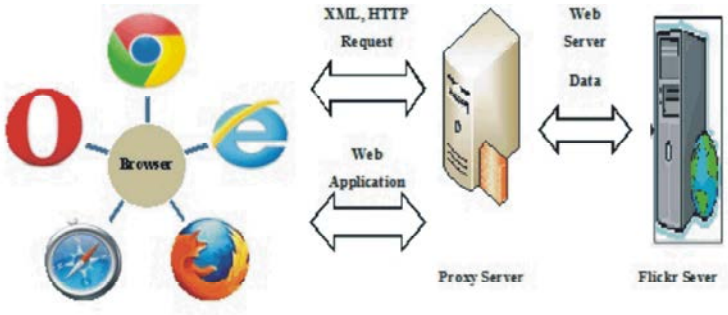

Fig. 4: Browser and Flickr server communications

To achieve this objective, two relevant technical aspects of requirements have to be understood: Flickr's *geotagged* photos and communication between browser and Web server.

Flickr's Geotag: Tags are keywords or labels on a photo which are used to make identification simpler for any users. For instance, a user can tag a photo with a phrase like "CAFÉ." Then, if other users look for pictures of "CAFÉ", they can just click that tag and get all the photos that have been tagged with the phrase of "CAFÉ" from Flickr. Geotagging is the art of adding location information to a photo. Users can geotag their photos directly from individual photo pages.

Communication Between Browser and Web Server: All the modern Web browsers impose a security restriction called SOP (Same-Origin Policy). This restriction prevents a script or application from making a connection to any Web server other than the one webpage originally came from.To communicate between client Web browser and Web server-Flickr APIs, the most commonly used solution is to install a server-side proxy. Thus, the integration is made to the server proxy and the data come back from it, hence the browser has nothing to complain about since there is no conflict of access. The communication between the client browser and the Flickr serveris shown in Fig 4, executing as follows:

- The proxy server makes the calls to the Web server proxy instead of making XMLHttp Request (XHR) calls directly to the Flickr APIs.
- The proxy then passes the call onto the Web service and in return passes the data back to the client application.

To make the communication easy between client-side and server-side, Connection Manager (CM) packages XHR as a library. Yahoo! Connection Manager (YCM) packages XHR as a library. It is a utility way that enables users to make in-page Hypertext Transfer Protocol (HTTP) requests through a simplified interface to the XHR object. It also handles cross-browser instantiation of XHR, n]egotiates the server response and uses a Callback pattern t\p/.o process the response data.

Design and Implementation: Six step implementations are required to complete this mashup application as follows:

- Upload publicity photos: Sign up for Flickr and upload your publicity photos.
- Creating a map with google: Sign up for a Google Map API key to access Google Map API and create a map view.
- Response when the scope of the map changes: Use the Google Maps Event to add a simple function of the map-usersin order toget responses when they are moving or zooming the map.
- Statically put two parts of the codes-Google Maps and Flickr- together:Integrate the content from Google Maps and Flickr together on a static HTML page.
- To Make the scope of map as the coordinates of latitude and longitude:Communication is created by putting Flickr and Google Map script code into the same HTML script. When users span or zoom the map, a new coordinate is written into the input box automatically. The coordinates consist of two pairs of latitude (lat0/lat1) and longitute point (lon0/lon1), which will be used as the new searching parameters by Flickr.
- Displaying photos on the map:To display photos on the map, a marker for all photos has to be created and displayed as an overlayer on the map. Fig. 5 illustrates the end-user interface where users are able to search out the photos by a "University California Berkeley" tag. The related photos can be shown on the map by clicking the markers.

Fig. 5: Displaying Google Maps and Flickr by clicking the markers

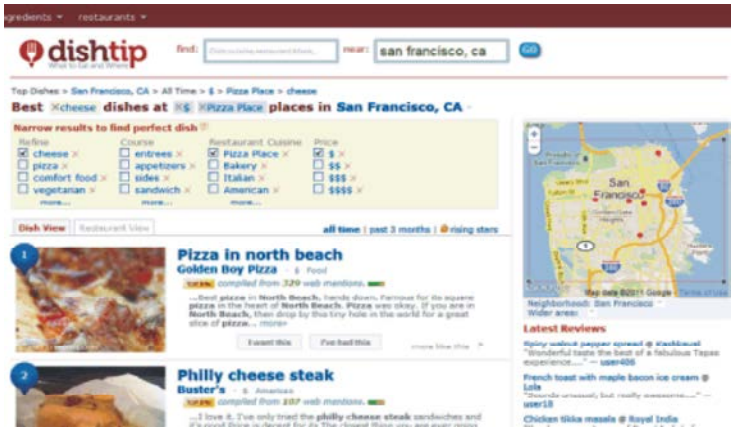

Fig. 6: Dishtip as a practical semantic mashup Web service

Semantic Mashup Application in Business Promotion: We have demonstrated the use of mashup to support business promotion by a simple practical example. However, Finding restaurant locations, photos or reviews online is definitely not a new thing. Many people have been doing this for years as a way to decide where to go eat. It can be further extended by semantic technologies to offer more innovative and sophisticated advertisement services. Semantic web technologies enable business advertisers include constraints based on the semantics of the content allowing them to more effectively target interested audiences for their products and services.

The Semantic Web is built on a decentralized and open infrastructure which facilitates data interoperability. Therefore gives great opportunity for having all sides participate in an open data Web and provides intelligent services which adapt data to the users [17]. Web sites can then benefit from this new semantically integrated to collect the relevant data from many different, heterogeneous sources to feed their specific applications. They also can display aggregated reviews and look out for trends with machine-understandable ratings and meanings. This would provide new services like *dishtip.com* with enough data to immediately produce meaningful recommendations, like food meal, turning data into a commodity rather than an asset. *Dishtip*[18] is a practical case study which can be investigated as a new kind of semantic mashup that performs a deep analysis of millions of web based-reviews, photos and content to determine the best dishes for a given location and where to eat them (see Fig 6). It uses a multifaceted classification scheme to analyze multiple data points about user sentiments, dishes, ingredients, cuisines and then offers suggestions. It allows you to conduct a search on anything related to what you want to eat. Facebook Social Plugins, Google Analytics, Google Chart, Google Geocoding and Google Maps are some of the APIs which *dishtip* is using.

Semantic Mashup is an ad-hoc mashup that on one hand connects to the preconfigured information resources and processes their data and on the other hand maps its context data to the relevant domain ontology. In other words, instead of embedding the semantic meaning to the web content, the semantic is attached to relevant content via mashups in a dynamic and loosely coupled manner. In this context, server-side components are described by an appropriate domain ontology that eases the composition of mashup widgets and creation of new mashups, as well as, facilitates the linking process and resolves ambiguity.

Most of the existing enterprise mashups provide connectors to databases and information systems like Customer Relationship Management (CRM) systems, Supply Chain Management (SCM) systems and Content Management Systems (CMS) [19]. They are aggregation tools at a business data level which cover original mashup concepts within the enterprise environment. At a high level of aggregation, business functions like ‘‘Procurement’’, ‘‘Payment’’, “Profile” and ‘‘Advertisement’’ may be distinguished by the ontologies and automatically discovered the composition of semantically annotated Web Services. As an example consider Web advertisements which have online shopping system. The payment information from the user should be provided by each shopping; while, this can be avoided by integrating the user information which reside on the user's desktop. Mashup can be used as a mediate tool between payment process and semantic repository which reads the required input data and maps the semantic of payment processes to semantic of user profile. In the near future most of business information systems will make their data available in Semantic Web Languages (RDF/OWL) format to make it accessible and linkable trough the semantic Web. In this regard some popular information systems such as Drupal (CMS), have started to add built-in ontology support in their system (see their future in Semantic Web in [20]).

The third parties in our explained practical mashup example also joined to this revolution. The results of extracting and browsing of the uploaded pictures from Flicker can be stored in Semantic Web Language (OWL) through Splicker, which is an application based on Flicker APIs for querying Flicker database. Also, Flicker has a clustering algorithm that provides some semantic group functionality [21]. Google Map also benefits from the capabilities of *Semantic Maps*, which includes the ability to add, edit, aggregate and visualize coordinate data stored through the Semantic Web [22].

Security and Privacy Issues Threatening Mashups: Enterprise mashups depend on the lightweight programming model, which is a programming method stands for a high-level of accessibility for the end-users and developers. However, mashup relies on this model presents many security risks. Web has gone through four generations from Web 1.0 to Web 4.0 [23] and the pace of Web evolution is really fast, but the essential security and privacy regarding the development of mashup meta-applications is still a big challenge which needs to be addressed and investigated. The main problem is that Web browser was not originally designed for the mashup and with each new data source added to a mashup, security risks increase. The principles of the Web browser security model are far falling behind with the development pace of Web mashup applications. SOP prevents integrating data from one domain to another domain. So a third-party service is essential to support running the mashup meta-application to assemble internal data with external data. The source of external data might be malicious or malformed code.

Taking restaurant companies as an example, they might establish a mashup to compare advantages and disadvantages of their location and prices. A mashup application which combines Google Map and Yelp is able to address this problem. The mashup application will run sets of tables through third-party tools for comparison with competitors’ locations and prices in the same zip codes and then use an additional third-party tool to map all the restaurants in the specified area. Without security measures and safeguards, mashup could make the company's internal and private data vulnerable to malicious code in any of those third-party tools [24].

The Privacy violation is another issue that threatening mashup users. The different enterprise data tables store a number of private data tables. These data tables transfer meta data whenever a company integrates data to create a high-level application. In addition to this, high reliance on data brings out the issue of retrieving correct data since an attacker can easily get hold of the data that the system is transmitting and replay it later. In other words, the hacker will relay the data as if it is was new or occurring in real time and deceive the customer that the message is *fresh* by using the old key. This means that customer's private data can be violated without the customers knowing.

Consequently, particular enterprise mashups need security, which can be form of a set of safety measures to secure data. It is easy to develop mashup meta-application using the profiling facilities and/or the mashup

tools. These security measures should provide the customer with default settings depending on their demands, the security threats and privacy violations that they wish to overcome. According to Patel (2010), basic enterprise mashups' safety measures must have security, privacy, trust, auditing and digital forensic functions [25]. Additionally, their enforcement will depend on the confidentiality and sensitivity of the mashup and its data content and meta data [26]. Another important security and privacy measure is to create awareness in the general public about mashup's security and privacy. This is because some end-users do not have any understanding of this type of technology and its use, therefore are not b e in a position to make balanced judgments concerning the extent to which it may have a negative impact on their own perceived standards of privacy.

CONCLUSION

Mashup development based on the enterprises' environments and requirements is a lightweight programming mode. The established mashup applications are high-level, situated and on demands. Comparing with components-based software development, mashup development is more end-users concerned and low-cost development. For enterprises, professional IT departments are always supported by strong budgets. Therefore, mashup provides SMEs a wild technical opportunity in terms of resources optimization and budgets saving. SMEs also are able to develop Web meta-applications according to their business strategies to promote themselves and enhance their competitiveness.

The movement of Web architecture and technology makes applying mashup to business domain feasible. In semantic Web, an ideally world wide database, data, service and application are highly formatted and linked.

This paper discussed how SMEs can easily apply mashup technology to do some simple integration and create meta-applications in order to attract customer's support. Google Maps and Flickr services has been used as a real example to show design and implementation steps.

Mashup development paradigm is technically usable, but it is quite important to make sure the participants are not able to obtain the integrated data. Mashup definitely needs security-oriented model and privacy-preserved table with series of related specified standardizations to regulate mashup development by providing stronger levels of security and privacy protections.

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