BUSINESS MODEL FOR EMERGING REAL-TIME LOCATION-BASED SERVICES

A Technical Perspective

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Abstract: Recently, new and sophisticated mobile commerce applications, especially location-based services applications, have been emerging very fast, which demands a closer attention to their use, technology and business models. As a result, new business models designed specifically for the mobile arena have started to emerge. Moreover, mobile commerce is generating considerable interest and has led to the design and development of new mobile web-based services. However these services lack a suitable business model. Brokerage firms have already setup novel and profitable business models for wired web-based services. Converting these wired web-based services into mobile services introduces new challenges. In this paper, we present a business model for dynamic location-based services. We find it very useful to introduce this novel approach to define a business model for such an application. Our focus is on the value proposition for each stakeholder involved in the application. We highlight the technical perspective and analyze the different technologies used in this application.

1 INTRODUCTION

Mobile cellular is considered as the most rapidly adopted technology in history (ICT, 2009). It is the most popular and widespread personal technology with an estimated 4.6 billion subscriptions globally by the end of 2009. Mobile phones along with other wireless handheld computing devices such as personal digital assistants (PDAs) and pocket PCs provide considerable opportunities for ubiquitous computing growth. Ubiquitous computing is an emerging paradigm of personal computing, characterized by the shift from dedicated computing machinery to pervasive computing capabilities embedded in our everyday environments. A Location-based Service (LBS) is an example of ubiquitous computing. LBS take the user's location into account in order to deliver a service. It employs accurate, real-time positioning to connect users to nearby points of interest, advise them of current conditions such as traffic and weather, or provide routing and tracking information all via wireless devices. A key motivation behind LBS is to enable access to services regardless of the location of either the mobile user or the service provider. LBS offer safety, convenience and productivity to consumers and businesses (Turban, King, Lee and Viehland, 2008). Tsalgatidou, Veijalainen, Markkula, Katasonov and Hadiefthymiades (2003) classified the location-based services requirements to six categories: user requirements, usability requirements, reliability requirements, privacy requirements, location infrastructure requirements, and service interoperability requirements.

Current LBS systems present the Point of Interests (POIs) to mobile users as static icons displayed on a location map. However, in this case, the mobile users can not differentiate between open/active and closed/inactive service points. Also, the size of the transferred file is too large as it includes the location map, which is usually represented in a picture format. In a previous work, we proposed a Dynamic Location Based Service system (DLBS) that eliminates these two problems by providing real-time data of selected POIs (Sallabi, Ditsa, El-Khatib and Al Kobaisi, 2010).

New and sophisticated mobile commerce applications, especially location-based applications, are emerging very fast, which demands closer

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attention to their use, technology and business models. Looney, Jessup and Valacich (2004) stated that "Business models designed specifically for the mobile arena are reshaping the industry. But each model has unique advantages and disadvantages—potential adopters should take care in choosing among them." In the other hand, Varshney (2008) mentioned that "Mobile commerce is generating considerable interest and has led to the design and development of new services, but it lacks a suitable business model." Brokerage firms have already setup novel and profitable business models for wired web-based services. However, converting current web-based services to mobile services introduce a new wave of innovations. Brokerage firms are utilizing mobile services to differentiate themselves from others in terms of customer attraction and retention. While developing our DLBS, we realized the need to define a novel business model that suits this application. In this study, we opt to identify and address the technical issues relevant to this model, and continue to proof and enhance the business model by conducting some usability and adoptability studies.

The remainder of the paper is organized as follows. The overall architecture of the DLBS system is mentioned in section 2. Section 3 presents some review about business models essentials and requirements. The new real-time location-based services business model is explained in section 4. Finally, section 5 concludes the paper and discusses future work.

2 DYNAMIC LOCATION-BASED SYSTEM OVERVIEW

In a previous work (Sallabi et al., 2010), we presented a two-phase framework for developing and testing the acceptance of a dynamic location-based service (DLBS) prototype in the United Arab Emirates (UAE). The first phase, the development of a fully functional DLBS prototype, was successfully completed and was presented. The developed application provides users with the capability of locating nearby Point-of-Interests (POIs) such as businesses, hotels, restaurants, and others. Also, the system provides an end-to-end pervasive solution to the LBS use case. The system covers client to business (C2B) and business to business (B2B) programming model. In C2B, clients communicate with the back-end server, which might be hosted by a third party server to receive the POIs information that spans a specified distance. The B2B solution allows the POIs service providers to upload and maintain their assets/services required by end users. Figure 1 below depicts the DLBS overall system architecture. The architecture shows mainly three applications; Mobile Device Application, Gateway-Service Application and Portal Application.

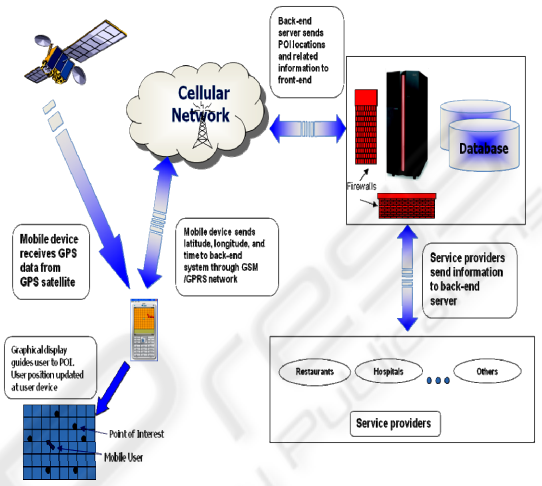

Figure 1: Dynamic LBS overall system architecture.

3 BUSINESS MODELS ESSENTIALS AND REQUIREMENTS

Traditional business models can be defined as methods of doing business by which a company can generate revenue to sustain itself (Turban et al., 2008). While m-commerce business model, refers to services, technologies, core expertise, strategies, revenue generation, and sharing of multiple players (Varshney, 2008). The major revenue models for m-commerce may include direct sales, transaction fees, service subscription fees, advertising fees, affiliate fees, and some other revenue sources. Traditional business models often incorporate the following essentials (Turban et al., 2008):

- Customers to be served and the company's relationships with these customers;
- All products and services that a business will offer;
- The business process required to make and deliver products and services;
- The resources required and the identification of which ones are available, which will be developed in house, and which will need to be acquired;

- The organization's supply chain, including suppliers and other business partners;
- The revenues expected, anticipated costs, sources of financing, and estimated profitability.

With the emergence of m-commerce applications and the rise of new market players, Varshney (2008) suggests some amendments to m-commerce business models requirements that can be summarized as follows:

- M-commerce business models must consider service-revenue generation and sharing.
- Certain requirements must be supported in designing business models that affect the design and development of m-commerce content and services.
- Wireless channels must be managed to maximize bandwidth and usability and create overall value for customers in terms of instant access, emergency use, enhanced anytime access to new services, and increased productivity.
- Wireless carriers' lack of experience in developing service content combined with the cost of building m-commerce infrastructure will require collaboration among multiple players, each using its own financial, technical, and developmental capabilities.
- With the diversity of m-commerce services, a suitable revenue model is a major requirement, with service price based on flat rate, connection time, traffic, group, transaction, or some combination.
- M-commerce services can span multiple wireless carriers with diverse access protocols and performance.
- In addition to the above listed requirements, we believe that privacy and security play significant roles in the success of the emerging m-commerce applications, and thus should be added to the list of m-commerce business models requirements, and be addressed accordingly.

Current m-commerce business models fit into two categories as seen by Wireless Service Providers (WSP); WSP-centric or WSP-managed (Varshney, 2008). In WSP-centric, WSPs control both network access and content. While in WSP-managed, WSPs control access but not content. An example of WSP-centric is Japan's DoCoMo (DOCOMO, 2010), which uses a business model that dominates the entire supply chain by creating and enforcing an exclusive set of service providers. Vodafone uses WSP-managed model. Unlike DoCoMo, Vodafone doesn't control an exclusive set of third-party providers that its wireless customers can access. Rather, content and news services are included in Vodafone's subscription charge, and the company charges news-type services as Short Message Service (SMS).

Location-based service is one of the appealing applications in Mobile Commerce (m-commerce) services. Enterprises use m-commerce mainly for location-based and tracking services, such as mobile financial services, shopping and advertisements and some other services like mobile games, payment systems, entertainment, etc. The business model for the DLBS we developed in this study involves three main stakeholders; WSP, content provider and service consumer. The DLBS business model may use WSP-centric or WSP-managed. In case of WSP-centric, WSP controls and approves content providers, and is obliged to provide location management, real-time delivery, service quality, transactions support, security, and wireless network reliability to content providers to sustain consumer retention. In case of WSP-managed, WSP collects and manages information from content providers and make them available to consumers with the same quality as in WSP-centric. WSP generate revenue from using their wireless network and they can use any payment scheme for consumers. For example, they can enforce monthly subscription fees, charge by packets or charge per transaction. There is no direct revenue for content providers, they only get revenue when consumer select and buy their product or service.

4 REAL-TIME LOCATION-BASED SERVICE BUSINESS MODEL

In this section, we describe our real-time location-based service (RTLBS) business model, shown in figure 2. Our focus in this paper will be on the value proposition, which refers to the value stakeholders get from the business. The main value proposition on which the whole system was built is the provision of real-time (dynamic) information to mobile phone users. This has the ripple effect of value proposition to all stakeholders in our business model. Our proposed RTLBS business model involves the interactions between different stakeholders to perform an end-to-end transaction. Application developers and handset vendors are involved in the initial setup process and any subsequent application updates, while other parts are involved in every user initiated transaction.

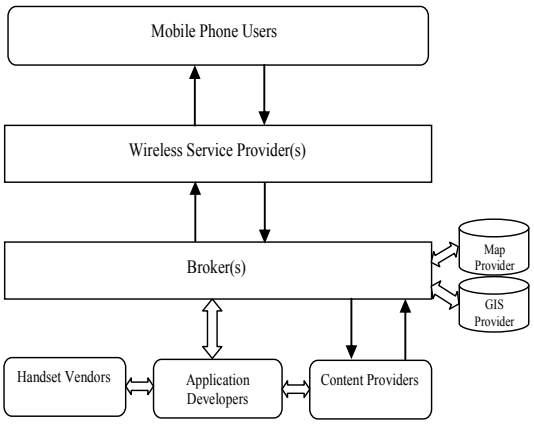

Figure 2: Real-time location based business model.

The end-to-end connection from the mobile phone user to the broker involves two types of connections; wireless and wired. Mobile phone users are connected to the system through the wireless link provided by the wireless service provider (WSP). Brokers are usually connected to the wired Internet part of the system and receive requests from mobile users through WSP. Therefore, WSP relays all requests from mobile phone users to brokers. Figure 3, depicts, with numbers, the flow of messages time sequence diagram for the end-to-end connection, which proceeds as following:

- Before the user sends any POI request to the broker, he/she needs to connect to GPS receiver and WSP. The connection to the GPS usually doesn't take too much time if the user is in line-of-sight with the GPS receiver and exists in a clear outdoor environment (no high rise buildings and undergrounds). Mobile phone interaction with the GPS is indicated with flat lines 1 and 2, which means time is not significant.
- The second step in the connection setup is to connect to the WSP and get an IP connection. This type of connection is different from user to user (depends on the requested Internet service) and it is different for different WSPs, depending on the wireless network infrastructure. Some WSPs provide always-on connections in which users get an IP connection as long as they are connected to the wireless network, other WSPs provide IP connections on demand, which means users get IP connections when they want to connect to the Internet. This situation is most likely to change in the near future by introducing all IP wireless networks. Connections to WSP are indicated by messages 3 and 4 in the diagram. There is usually some delay incurred by this connection. In general, connections to wireless networks incur more than 50 ms depending on the situation of the wireless network, but it takes less than 50 ms for wired networks.
- Once the initial setup is finished and the user is connected to both the GPS receiver and the WSP, he/she starts to send the POI request to the broker. Usually, the first POI request is to inquire about locations and addresses of certain businesses (hotels, gas stations, hospitals, car parks, etc.) This request goes to WSP through wireless link then is relayed to the broker through wired link. The broker analyzes the mobile user request and sends back the result on the reverse link. There are two options at this step; either to send plain text to users or incorporate the POI points into a map retrieved from the Map Provider. In the former case, the amount of information sent back to user is minimal and will not cost the user too much money. In the latter case, the map will add extra overhead to the message and increase considerably the amount of traffic sent to user. These steps are reflected in the diagram by messages 5, 6, 7, 8, 9 and 10.
- After the user gets the POIs, with or without map, from the broker, he/she may proceed or just use the received information. If the user decides to proceed with one of the POIs in the list, he/she will send another request to the broker to finish the transaction. This process may involve several message exchanges with the broker. This step is reflected in the diagram by messages 11, 12, 13 and 14.
- Finally, the user should confirm the transaction with the broker that commits the transaction with the business and update the database.

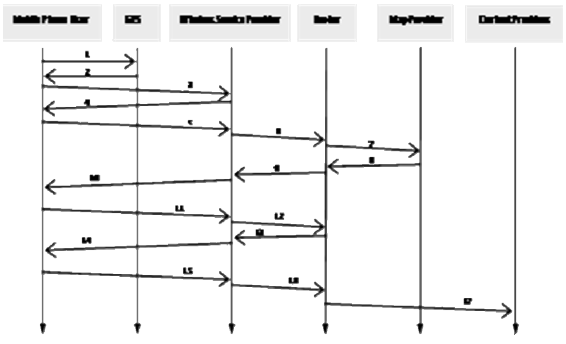

Figure 3: Real-time location based business model time sequence.

The more dominant and widely accepted technology for conveying the messages end-to-end back and forth is web service. The mobile device acts as a Web Service (WS) requestor. The WS client at the mobile device consumes the WS provided by the web service provider. The web service client interacts with the web service provider using web service protocols over a wireless network (e.g., WLAN, WiMax, UMTS, GSM/GPRS). Web services incorporate additional overhead as compared to traditional web interaction. This overhead increases the load on Internet servers. Tian, Voigt, Naumowicz, Ritter and Schiller (2003) conducted some experiments, which showed that the imposed overhead of web services is non-negligible during server overload. The response time for web services is more than 30% higher, and the server throughput is more than 25% lower compared to traditional web interaction using dynamically created HTML pages. In another paper, Tian et al. (2004) evaluated web service performance of handheld resource-constrained clients using different wireless technologies. They stated that due to the usage of XML, message sizes in web services are larger than that in traditional web technologies. They have recommended the compression of web service messages to make them more attractive for mobile clients with poor connectivity and high communication costs.

The following sub-sections describe the main components of our proposed business model.

4.1 Content Provider

Content providers, sometimes referred to as service providers, are the companies who provide the ultimate service to service consumers. Content providers get their value proposition through the direct sales of their products and services. They provide the information related to their products to the broker(s) that advertise for their product. The content providers also benefit from the better and more reliable quality of service provided through real-time availability of information in DLBS. Below is a list of some businesses that might benefit from DLBS (Elliott and Phillops, 2004):

- Travel (e.g., booking online);
- Ticketing and billing;
- Banking (e.g., checking statements online and transferring money between accounts);
- News and sport bulletins (e.g., paying a premium rate to receive tailored news bulletins);
- Health (e.g., check lab results);
- Purchasing goods and services (e.g., e-vending machines, online auctions and indirect online buying and selling);
- Business services (e.g., checking stocks);
- Education (e.g., announcements, attendance, etc.)

4.2 Brokers

Brokerage companies have already started incorporating mobile e-commerce services to their existing conventional web-based services. They utilize this new service to compete with themselves to attract customers and retain them. The value proposition for brokers is complex; it involves sharing revenue with advertisers, content providers and wireless service providers. They can generate their revenue from content providers by advertising for their products and services, and make the products and services available in real-time to consumers. They can charge content providers for every transaction completed by the user or they can charge a fixed monthly amount. They can also share the costs with the WSP. From mobile location-based point of view, we can categorize the services provided by brokers according to the following (Elliott et al., 2004):

- Location-based product retailing.
- Location-based services information.
- Location-based maps.
- Location-based purchasing.
- Location-based access.

In fact, the main motivation to the broker in the DLBS business model comes from the higher volume of mobile phone users as a result of the currency (up-to-date) and reliability of information provided. The up-to-date and reliable information provided also gives the broker a competitive advantage over other brokers using static LBS that currently do not provide up-to-date information.

4.3 Wireless Service Provider

Most wireless operators today operate as brokers, which bypass the role of independent brokers. This is because most of the LBS services offered today are network-based, and network and terminal-based location determination, which means generation of the users' location is mostly controlled by the mobile operators. In addition, operators would like to increase revenue by providing such service, which increase the air-time connection from users. But this situation is likely to change in the near future. Operators alone will not be able to create an

attractive LBS offering. Meanwhile, due to the sensitivity of the user location information, and the lack of relevant legislation, operators prefer to keep this information within their control, leaving less room for other players such as brokers. But due to the rapid development of mobile commerce and LBS applications, operators will lack the expertise and resources to manage such dynamic area. Eventually, they will be forced to outsource these solutions. Again, the higher volume of mobile phone users as a result of currency (up-to-date) and reliability of information provided will encourage WSP to support such service.

4.4 Application Developers

Our business model includes mobile commerce and LBS applications developers as part of the whole process. Common models used by application developers, for example, include a combination of one time set-up fees, revenue sharing and monthly payments for additional services such as technical support and upgrades, customer care, etc. The main value proposition to the application developer in the DLBS business model also comes from the higher volume of mobile phone users as a result of the initial sharing of revenue that will be accruing from the volume users of the system they develop.

4.5 Mobile Phone User

The value proposition for mobile user is to save time and money while searching nearby points of interest. The main value propositions of the mobile phone user are the reliable, up-to-date information and value-for-money. The mobile phone user also has the advantage of responding to emergency situations in a timely function, since information provided is current. For example, if the mobile phone user is looking for a hotel or a gas station in an emergency situation, the system displays the hotel or gas station, where facilities are available. In other words there is better match to mobile user's needs, better quality and more reliable service in the RTLBS business model.

5 CONCLUSIONS

This paper described a unique business model for a dynamic (real-time) location-based services application. It presented the model and highlighted the technical perspective of the model. This business model aimed mainly at presenting the value proposition for each stakeholder involved in the application. The work presented in this paper was a continuation of an ongoing project on dynamic location-based applications, which the authors believe will be the type of applications dominating the wireless world. This paper also explained how web services model may affect the value proposition of the application, but web services are inevitable because of their widely use and connivance for web-based applications. After the successful development of DLBS, and the proof of the usefulness of the business model, the next phase of this project is to conduct usability and adoptability testing of the DLBS by different stakeholders. This involves the development and administering of a questionnaire in a controlled environment to test the acceptance of the DLBS by potential users. As another direction of our future work, we intend to develop a security framework to support the DLBS business model.

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