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An Architecture for Location Based Mobile Advertising

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***Abstract*– Mobile phone becomes an indispensable medium not only for communication but also for delivering services based on their location and demand. Mobile location data provides wide range of opportunities to the marketers for delivering services to their consumer based on their real world behavior, geographic location, from point of interest to path-to-purchase. Location Based Mobile advertising is a new form mobile advertising combined with location based services. This paper provides a detailed ecosystem of Mobile Advertising along with localization and personalization. The proposed section of this paper LBMA architecture addresses few challenges in the mobile environment by dividing three layer interfaces and it list outs success factors of location services. By implementing this framework leads to significant opportunity for delivering advertising channels through mobile devices.**

***Index Terms*– Mobile, Location, Advertising, Services, Framework and Information**

I. INTRODUCTION

SERVICES based on the mobile users location is a new trend in mobile communication. These services are called as Location Based Services (LBS). A study by Juniper Research says nearly 1.5 billion people used LBS in 2014, with a global market worth $12.7bn worldwide. LBS utilizes GPS, GIS and Mobile Internet where GPS helps to know the device geographic location in terms of Latitude and Longitude, whereas the GIS helps to know the location from geographic to descriptive location. The potential services offered by LBS are: Emergency services, Navigation, Information services, Advertising, Tracking services, Billing services, and other on demand services, etc.

The advertisers demanding to engage consumers on their mobile devices with location-aware, data-driven and highly targeted marketing says Verve, the leader in location-based mobile advertising. Many surveys predict billions of dollars in revenue for mobile advertising [1]. Advertising that changes based on a user's location called as Location Based Mobile Advertising (LBMA). In the present era, it has been one of much-talked-about capabilities of the wireless Internet, the idea being that an advertiser could reach a customer when he was most likely to buy [2]. The one to one Future: building relationships one customer at a time became the catalyst for one-to-one marketing. It has realized the potential that not all customers are equally valuable to companies [3].

Location Based Mobile Advertising is not only a subset to LBS, but also complements to LBS as the schematic view is represented in the Figure 1. On the other way it is strategic use of mobile technology and it is leveraged by various agencies and it is evident from various research agencies. Mobile has changed the ways of advertising and it is capable of doing transactions, helps to get contact information and also creates point of interest. Mobile Ad network giant xAd says, location targeting, whether in search or display, improves performance over standard mobile search and display advertising.

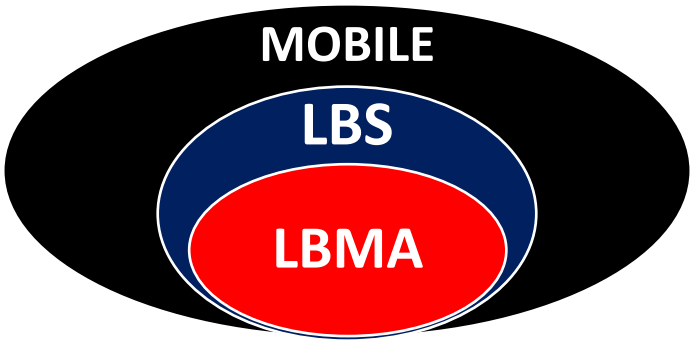

Figure 1: Schematic view of LBMA

The technology transformation in mobile devices brings array of challenges on various dimensions. Though the mobile network operators thought Location Tracking as a third assert besides voice and data services, they had challenges not only in finding users location but also in providing right services to the consumer. On the other hand, advertisers or marketers realized that the mobile marketing is new form of advertising and LBMA has become the new revenue of marketing. For the consumer they utilize location services wherever they go and whenever they want and the biggest challenge for them is privacy and unsolicited messages to their device.

Mobile advertising and other location based services have the potential for becoming more pervasive and resulting in significant revenue for service providers, wireless carriers, and applications developers and integrators. However, the challenges include emerging technologies, suitable applications, and business models [4]. This paper provides a set of new trendy LBMA applications, necessary classification of services, proposes a unified framework, list out the potential factors that should be addressed technical and business challenges in location based mobile advertising.

The rest of the paper is organized as follows: first it describes necessary introduction to understand the Location Based Services and Location based advertising models at large, second it reveals various LBMA applications and demonstrates research issues. The proposed section devises an architecture for LBMA with three layer interfaces perception. Fourth section deals list out the potential benefits of implementing the architecture and the last section concludes with the importance of LBS and in future the framework is a valuable tool for end users, mobile networks operators and advertising agencies.

II. RELATED WORK

Bernhard Kölmel, Spiros Alexakis were developed strategy for mobile advertising [10] such as sending a pull request to a remote server where advertisements are stored and then displaying them in a mobile phone. After the technology development Multimedia also used in mobile advertising to make effective advertisement rather than text based Advertising as done Heng Xu,Lih-Bin Oh,Hock-Hai Teo were discussed [11].

Syagnik (Sy) Banerjee et al. were suggested that the perceptions of usefulness of the advertisement, store evaluations, and willingness to respond to the offer which is encouraging further development of location based advertising methodologies [12]. In mobile advertising, the customers attitude also important in this research where some users may not interested to share their location [13] for advertising, Gordon C. Bruner II , Anand Kumar had gone through with the customers attitude towards the Mobile Advertising.

Many Leading Location based Advertising agencies using different filtering mechanisms to find the users location. Following are the different mechanisms used by some of the Leading LBA Agencies. Some Leading LBS Applications Compared below:

FourSquare:

FourSquare is a location based free mobile app that enables users to “check in” their locations, and making the most of where they are at any given moment. It is more a social network complement than a social network as you share and save the places you visit. They also offer personalized recommendations and deals based on where you are and where you have been.

“We believe the places you go are the best indication of who you are,” “We want to provide the marketer with real-world implications and attribution. Once a user was exposed to an ad, where did they go?”, “We’ve been asked to do this for a long time, but we wanted to make sure we could offer quality data,”, “We’ve finally got to a point where we can offer the same level of understanding we have about Foursquare users externally for non-Foursquare users.”, and also “There’s a lot of noise out there about using location data for ad targeting, but we think we can bring quality and accuracy to the market that doesn’t exist today.

Admoove:

Admoove the location based mobile app that uses context relevance, location data quality and precision. Manage geo-fences to deliver tailored offers based on a user location, preferences and profile via opt-in SMS, MMS or push notifications. There is three main products, In Geo-Premium the Dissemination areas are located around the sale of the sign points ("geo-fencing") or around those of one or more competitors ("geo-conquesting").

AdNear:

AdNear's key strength comes from global location data that's powered by their proprietary hybrid geo-location platform. This helps them to translate user's location without the need of GPS or operators. Users can click on Ad Preferences to view and manage what we collect and what they are willing to share. Apart from location information, AdNear collects device information, log information, unique ID numbers and may make use of local storage among other available parameters.

Jiepang:

Jiepang is a Chinese social networking service for mobile devices, such as smartphones. Users can download the Jiepang app to track and share life moments with friends. In July 2013, Jiepang launched an all new design in version 5.0, which evolved from its origins as China's leading location based service (LBS) for the "check in". Jiepang helps users record and track all of their life activities, connect with friends in specific moments and explore communities of people that have similar interests.

From the related work, it is found that Location Based Mobile Advertising are gradually achieving in the smartphone customer segment. Also significant research works were done in the ecosystem of mobile location based systems but there is no established framework for Location Based Mobile Advertising Services. Hence, this paper attempts to devise a framework for LBMA and identifies potential factors towards the global market.

III. LOGGING OF LBA

The location based mobile advertising applications and its corresponding services were based on the present trends of location technologies. In this section, the logging of LBMA refers classification of applications, categorization of services and it also covers the different types of service delivery and business models. The chapter explains different ways of classifying advertising services and necessary parameters in a particular classification. Classification based on business and

service delivery models are discussed in detail. This classification mainly to evaluate the LBMA eco-system on a particular need and in general this logging would help to understand the service better.

Table 1 summarizes the different dimension of logging in LBMA and it also addresses the services types, service models, business models, advertising models, revenue sharing model and on all the classification and service description to the corresponding location applications.

In the logging of LBMA, there are some other appealing features which are growing rapidly in the advertising industry at large, these features are: Personalization and instant access, Mobility and wireless internet connectivity (provisioning), location-aware, context-aware, user-profile and preferences, privacy management, billing, location broker (location standards), rule engine or business intelligence and business model, API, SDK, middleware and other necessary requirements, security [2], [4].

IV. ARCHITECTURE FOR LBMA

The general architecture is strategically designed based on the logging of location based advertising applications and categorization of services. This architecture should consider present trends with respect to location based services. It also supports both location management and data management. It has three clear interfaces client, advertisers and server interface as depicted in the Figure 2. This architecture followed a set of localization standard guidelines to be used for present trends in location based advertising.

Table 1: Logging of Location Based Mobile Advertising

Logging Model	Service Types	Services Model	Description
Elementary Location Services	Based on Services	Push	Directly sent to the user
		Pull	Based on users request message sent
	Location Techniques	Device Based	Using GPS and AGPS
		Network Based	Using Triangulation and Trilateration
		Hybrid	Using both device and network based techniques
Composite Location Services	Location Tactics	Geo-aware	Location is detected and a location-appropriate message is served
		Geo-fencing	Targeting devices within a specified radius of particular location
		Geo-conquesting	Targeting devices within proximity of competitor locations
	Services Delivery Model	Location based text advertising	Advertising through text messages
		Location based banner advertising	Advertising through banners, posts
		Location based vouchering	Advertising through promotional coupons
Revenue Services	On benefit model	For consumers	Revenue benefit for customers
		For Advertisers	Revenue benefit for advertisers
	Revenue sharing models	Operator dependent	Mobile Network Operator fully dependent application
		Operator assisted	Mobile Network Operator partial support and advertiser partial dependent application
		Operator independent	MNO Independent
Marketing Services	Advertising Services	Click-to-call	A call back number will be provided which is hyperlinked by the Advertisers.
		SMS, USSD based	The advertisement channel to receive information.
	Advertising Models	Subscription based	Regular advertising service
		In-house sales revenue	Standard service
		Advertising by keyword auctioning	Attractive service

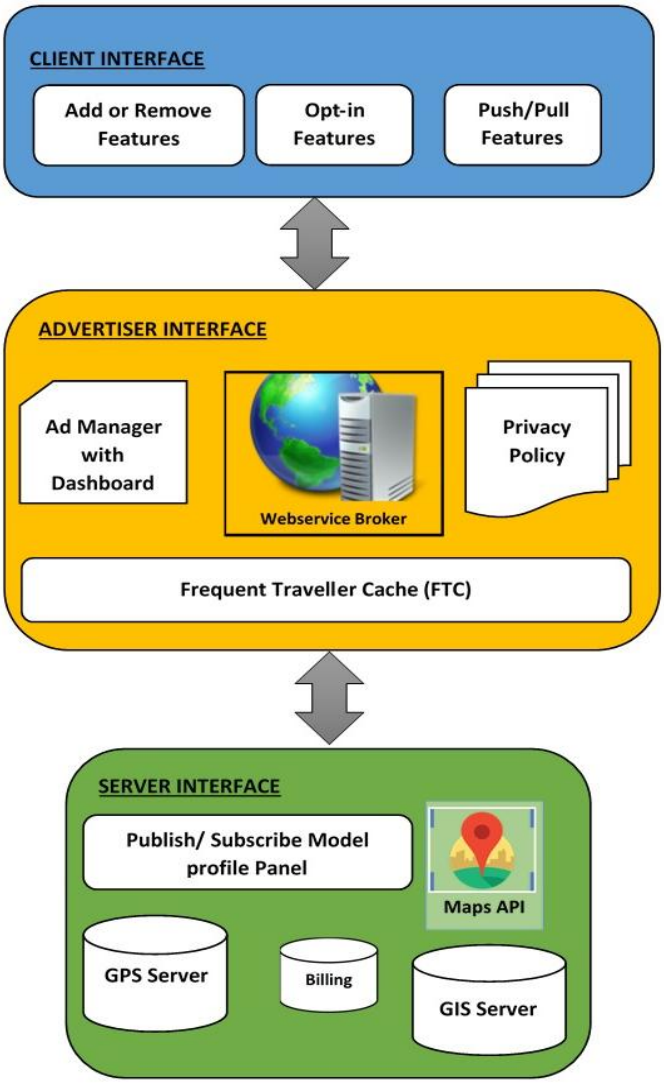

Figure 2: LBMA Architecture

The server interface performs centralized functions such as spatial location mapping through GPS (Global Positioning System) in the form of latitude and longitude, it also performs descriptive location mapping with the help of GIS (Geographical Information Systems) servers. Both GPS and GIS information is collected and represented by using an Application Programming Interface (API) called Maps API. In addition to that, the server interface has Publish/ Subscribe model which works like a repository to maintain subscribers profile based on the advertiser's business model it will send the data items to the client through the advertiser interface. The server interface is managing billing information with customers, though the ad manager in the above layer interface is performing the advertising functionalities the billing server accomplishes user related bill payment, bill for advertiser business model and other revenue related tasks.

The advertiser interface plays dynamic functions and acts as local server for the advertising communication channel. Every localized region is expected to have this ad manager, which plays as a bridge between the client and server interface. Privacy policy enhanced with this architecture which gets approval from the user who are installed this application in their device and this service won't be shared for some other services. General location agreement policies were also followed in this proposed system. This advertiser model receives location information from the neighboring GPS, GIS of the server interface with the support of Maps API. It has the following key functionalities:

- *Ad manager*

It is a centralized manager for advertising management. It has dashboard where the advertising channels are performing administrative tasks like adding new adds, updating tag information, create or change add snippet. This particular module is periodically updated and given to the advertisers and they will charged based on the user using that particular ads. The user behavior is counted from the clickstream.

- *Web service Broker*

Technically, mobile devices are recognized as resource-constraint devices so the web service broker architecture was built on the advertisers interface have to take additional constraints in order to reduce the overloading of mobile applications. Since the mobile web services are the fundamental entity in the location based mobile advertising it should be tailored according to smartphone requirement. In this LBMA, the web service broker uses service oriented architecture (SOA) for mobile environments for better reuse and inter-operability. The location based advertising applications has tremendous scope with mobile web services, here in this architecture it uses REST (REpresentational State Transfer) based middleware because REST supports unified interfaces , scalability, generalization of interactions and independent application deployments [6]. The proposed architecture uses syntax based description framework in the SOA environment.

- *Frequent Traveller Cache (FTC)*

Caching techniques specially tailored for LBS or mobile computing environments in general have also been a major research area [7], [8]. In the advertiser interface, the frequent traveller cache repository stores the traveler information and frequency of the user travel, user interest areas to receive advertising information. FTC leverages query handler for Push/Pull based services and it is responsible to manage both frequent location tracking and frequency of their advertising service usage. The Replacement Policy for the frequent traveler cache is periodically updated with server interface.

The client interface refers smartphone application and it directly deals with the users. It will be provided to the user who accepts the privacy policy to share their location and service agreement to deliver services to their devices. It has complete features to control the application and with distinguished features to add or remove advertising panels, withdraw option, adding new location, adding notifications enabler with toggle to enable/disable. The client interface has option to receive messages via Pull/Push features and it has flexible opt-in facility to enable based on desired location.

The information service applications are delivered to the user from advertiser interface with the help of server interface, where it maintains log information and location dependent information.

V. SYSTEM ANALYSIS

In this section details the architecture and its correspondence to the required finding and implementation changes to the three interfaces client, advertiser and server. The key features are the mobile services are dynamism and mobility are fully utilized in the location based mobile advertising applications, but the access patterns are totally different with respect to traditional information access techniques. By developing this architecture by underlying advertising framework, the advertisers should have the ability to create / publish advertisements through the interfaces. The consumers of this application will receive information dynamically based on the location within designated advertisement area.

Table 2: LBMA potential factors

Factors	Description
Billing	Should be tailored based on the usage of advertising services, models need to be followed for application integrator, MNOs
Provisioning	Incorporate as part of Data Management services of location based services so that dynamic issues will be addressed.
Location finding	Location finding mechanisms followed as per the telecommunication standards.
Reliability	The user gets information frequently and to make decision quickly in order to get satisfaction towards the personalized service.
Redundancy	Available location data that is additional to the actual data and permits correction of errors in stored which leads to detection of errors.
Security	It is much more important as the application is accessing personal data from an advertising interface. The users' interest and personal choices are continuously stored so safety must be ensured at all levels.
Privacy concern	Privacy preserving policies enforced then and there to ensure users trust into the advertising services

The potential factors mentioned in the Table 2, list outs the estimated success factors for location based mobile advertising. These factors purely influenced by various factors apart from the mentioned above it should be necessary coupled with successful technologies, platforms, programming environment and suitable test cases. The fundamental requirements of this LBMA architecture and associated development reduce the effort of present day practice and should yield real ROI by utilizing less number of resources. The other depending factors are simplify Client (user) interface, social rationale and culture of defined geographic location, quality of reviews, degree of accuracy, service integration and deployment model.

VI. CONCLUSION

Location based mobile advertising services have potential to become user preferred services to make purchase decisions anytime and anywhere. In this research paper, ecosystem of Location Based Mobile advertising discussed in detail with schematic view of location services and it has logging models with services classification and service categorization to understand the services better. The proposed Location Based Mobile Advertising (LBMA) framework may be valuable architecture to understand better and source of insight to drive mobile advertising into highly profitable one. The architecture has three interfaces with well-defined tasks in each layer. This also list outs the potential factors into billing, provisioning, privacy, security and other concerns. The comprehensive outcome of this paper is to extend the architecture and implementation by addressing the real time challenges, which could lead LBMA as smartphone customer desired channel and generate revenues with successful business models.

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