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ComFrame: A Communication Framework for Data Management in Mobile Location Based Services

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***Abstract*– Recent research in mobile computing has shown that Location Based Services (LBS) is an emerging area in mobile applications. It refers that services provided to the user based on location. LBS become the most promising services of mobile computing besides voice and data services. It's growing in popularity due to the ubiquity of smart phone users. Apart from positioning, LBS is highly dynamic, so that traditional information management techniques are not well suited in LBS. To answer this challenge, we analyze the dynamic nature of the problems and then we propose a framework for data management in LBS, which includes a set of data management techniques to improve the services better with respect to dynamic access. This framework leads for future research by providing significant opportunity for information models in mobile data business.**

***Index Terms*– Mobile Computing, Location Based Services (LBS), Data Management Techniques and Framework for LBS**

I. INTRODUCTION

LOCATION Based Services (LBS) are vibrant and increasingly growing areas of Mobile Computing [2], [3], [4]. LBS refer applications integrating user's current location with the information services. Examples of such applications include emergency services, vehicle navigation systems, tourist tour planning etc... A user can generate a request by using the LBS application to allow the service to know the location of the user or device. LBS have become more popular in the commercial sectors from the year 2000, which allows the user can have an idea of subscription based commercial applications. The global LBS market is enjoying strong growth, revenue is expected to reach US$10.3bn in 2015, up from $2.8bn in 2010 says Pyramid Research, a leading telecom research for market analysis.

The process of LBS mainly comprises of getting the location of the user and to provide a service to the user based on utilizing the information. In short, LBS [5] have actively deals with location management as well as the data management concurrently. Apart from positioning through GPS based or network based mechanisms, data management also plays a vital role in LBS. The challenge of data access for mobile object is that the same query may need to be answered with entirely different results. This proves LBS is purely dynamic in nature and complexity in real time, so that traditional data management methods are not well suited. This paper particularly focuses on data management in LBS [6].

The rest of the paper is organized as follows: Section I provides a survey of related work for LBS, section III presents our communication framework for LBS, section IV deals about the dynamic data management techniques related to the proposed system, section V refers system analysis for the proposed system architecture, and section VI concludes the paper with future enhancement.

II. RELATED WORK

P. Muhamed Ilyas et al. proposed a proxy based dynamic data management using hierarchical database for location based services.

Nikos Pelekis et al. designed a framework called "HERMES" for Location Based Data Management [7].

Yubin Xu et al. proposed a model for LBS based disaster and emergency management [10].

Stevenson G. et al. have done a framework "LOC8", a location model and extensible framework for programming with location [9].

Maria Luisa Damiani et al. proposed a framework "PROBE" for the personalized cloaking of private locations [8].

MobIS: A pragmatic framework for location based services provides portable and easy to use mobile LBS framework for developing mobile applications and maintaining content [16].

Conceptual framework that supports environment-aware positioning and improved QoS for LBS, this framework will allows mobile network operators to compare different location methods to ensure the provision of improved quality of service to the mobile user and optimized usage of infrastructure [17].

Building a framework to characterize location-based services refers feature-based framework to analyze mobile location based services (LBS) with the purpose of shedding some light on relevant aspects that may be relevant when defining sustainable business models [18].

Design of Location-Based Web Service Framework for Context-Aware Applications in Ubiquitous Environments [1] refers Location-based Context-Aware Web Service

Framework, so called LOCA Framework, by applying SOA model [19].

A Unified Framework for Location Privacy refers models mobile networks and applications, threats, location-privacy preserving mechanisms, and metrics. The flow of information between these components links them together and explains their interdependencies.

From the related work, it is found that there are no established frameworks for data management in Mobile Location Based Services. Hence, we are proposing a new framework "ComFrame" in this paper.

III. COMFRAME

Based on the dynamic data management issue, we present a general framework as a solution for existing issues in LBS. The framework has been designed with several principles to replicate the existing and predictable future condition of the wireless communication technologies.

Fig. 2 presents our communication framework design for data management in mobile LBS which consists of mobile device, communication local server and communication central server.

Mobile Device is a user who acts as a client to support for information transfer and to support user interface services. It is composed of LBS application, Navigation/Browsing and Log manager. The LBS application is used to locate the services based on location. The information is displayed in the device by Navigation/Browsing. The log manager locally maintains a log by completely tracing the activities done in the mobile device. The client can change its position at any time, so it is the challenging issue to face both the dynamic data and queries. The client sends query to the communication local server to get response. If there is no proper response, the data will be forwarded to the communication central server.

Communication Local Server helps in connecting the mobile device to the Communication Central Server. All local servers must be connected together to provide efficient data management. At first, a user request from mobile device is forwarded to the Communication Local Server to generate request. The user is validated and the authentication work is done based on the request generated. Then the user request is sent to Request Handler by the Request Processor. The Request Handler will handle the data based on the type of the query received. The Request Handler checks the request data at first in Local Data Handler, if the data is available means then it will generate the response to the Mobile Device via Data Response Handler. The User will receive the response as the WML data and it is shown in Mobile Device. Basically, the Communication Local Server is viewed as a single cell. Here, each cell has its own Communication Local Server in the wireless communication.

Communication Central Server is used to handle the data such as the Banking Database. Usually, the request data which is not available in the Communication Local Server will be forwarded to the Communication Central Server. The Communication Central Server has the response of handling many local servers. The Communication Central Server will receive the request and it is processed by the Request Manager.

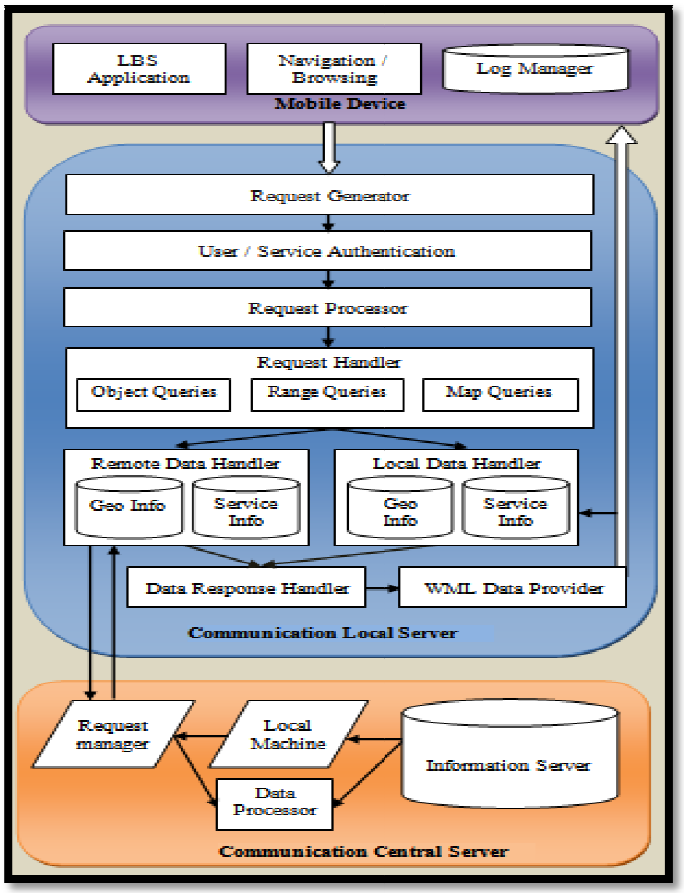

Fig. 2: ComFrame Architecture

The Data Manager and Local Server play an important role in processing data to and from Information Server. The user will receive the response from the Communication Central Server and a copy of the data is stored in the Local Data Handler based on the cache mechanism. Apart from this some techniques like Pushing is used to send selected data items towards the Mobile Device.

At the end, the dynamic data management approaches that can successfully locate the requested objects as well as speedily reply to the location changes.

IV. DATA MANAGEMENT TECHNIQUES

Generally, any information service is a network-accessible and computer-based system to collect, process, filter, transmit, and disseminate data that represents information useful for a specific purpose or individual. Along the same lines, a location-based service (LBS) refers to the additional integration of position location information as part of the data processed by the information service. Thus, an LBS provides and delivers information to its users in a highly selective manner, by taking users' past, present, or future location and other context information into account. LBS is often even more generally defined as any value-added service offered in a wireless environment that exploits mobile terminal location position information.

The data management techniques help us in designing a general service architecture that can be easily adapted to

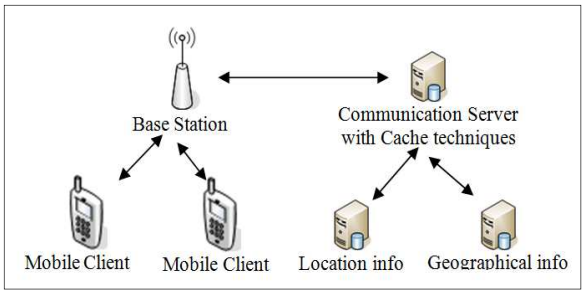

Fig. 1: Cache Management Techniques in Mobile Environment

incorporate different data management strategies to fit the characteristics of different application domains. In mobile computing, the data handling approach is based on both data and queries. One of the main issues in dynamic data handling is indexing and information distribution. In general, the user query is based on object, range and map.

Caching is a key technique to improve data retrieval performance in mobile environments. The Cache management techniques in mobile environments support privacy preserving spatial queries. The Mobile Clients connects to the base station and the Base Station will communicate with the Communication Server where the cache techniques are stored. The Location information and the Geographical information are stored in the Communication Server. The fundamental concept behind this is to leverage the cached results from prior spatial queries for answering future queries at the communication central server.

V. SYSTEM ANALYSIS

The user changes their location and the access patterns can shift rapidly as well in mobile environments and it leads to the dynamism and mobility issue. The Analysis recommends that different approaches are effective for different types of data in response to different patterns of user change the location and information access. The traditional frameworks and simulation are faces several problems to monitor the mobility and dynamism in LBS. So, the system analysis of the proposed system is done by identifying the cost of having the problem or the value to solving it. The priority is given it against other problems faced during implementation and maintenance. When it is the top priority, the solution could be found that solves the problem with a proportional cost.

There are some standards considered in analyzing the framework. They are Utility, Accuracy, Propriety and Feasibility. The *Utility* of the framework is defined in a way which is used for storing the Geographical information and the Location information which refers to the state or quality of being useful to consume a good service by a mobile client. The framework has the ability to perform a task with precision which shows the *Accuracy*. The state or quality of framework conforming to conventionally accepted standards of behavior or morals shows the *Propriety*. The framework could be used in the present technology to make practically useful to the mobile users which shows the *Feasibility*.

Although each method would have its own strengths and weaknesses, the ComFrame is a great place for dynamic data management. It provides a standard interface for collections that stores the Geographical information and the Service Info in Communication Local Server and Communication Central Server. We need not to worry about the multiple users are accessing the same data. It reduces the effort required to design and implement APIs by displaying the data in the common method WML data. It provides the useful Request Handling methods that reduce the effort due to which we need not to write them ourselves. It provides high-performance implementation of useful Cache Management techniques that

Table I: The categorization of Critical Success Factors and their Descriptions

Success Factor	Description
Data Volume	It is designed to handle the Geographical and Service information both in Local Server and Central Server.
Direct Support for Security	To perform a privileged task on behalf of a non privileged user, security is much more important as the application is accessing data from a remote machine. The user query is authenticated to prove the quality of the user.
Time	The time is saved in the way of accessing the data from the Local Server which is the most valuable one by storing the data locally, because it will not always disturb the Central Server.
Simplified Development Efforts	It simplifies the development by separating the information based on Geographical and Service information making it easier to maintain the data. The WML Language simplifies the debugging to track down bugs and also helps to determine how well an LBS application performs.
Easy Application Maintenance	The user accesses the data by using LBS Application. The Browser helps in displaying the data to the user.
Easy Deployment	It handles details of locating and loading components and application needs, several versions of the same application exist on the Central Server and it ensures that all the components the application depends on are available on the Mobile Device before the application begins to execute.
File Handling	Every time the user access the data from Central Server, the data is stored in Local Server to deliver the file to the user in future by classifying the data.
Scalability	It shows the ability of this framework to continue to function well when it (or its context) is changed in size or volume in order to meet a user need.
Accessibility	The user gets the frequently accessed data from the Local Server itself to avoid data loss and to maintain efficiency.
Event Logging	The Log Manager in Mobile Device maintains a personal log to list out the work carried out by the user.
Query Handling	The Request Handler helps in such a way to classify the query based on its types like Object Query, Range Query and Map Query.

increases the performance. The authentication process helps in establishing a common method to allow the authenticated user that provides interoperability. The number of users using the framework is resizable and it can grow. It offers reduced risk and reduced cost of data storage which assured tried and true quality. The WML data uses the common method to display the content and it reduces risk by dramatically lowering the amount of low-level issues.

It has several advantages when it is considered for practical usage. The Table I represents the categorization of Critical Success Factors and their Descriptions.

The information's are evaluated and the framework is developed based on real Return On Investment (ROI) which reduces the resources required to accomplish the given dynamic data management principles.

VI. CONCLUSION

We have made a literature survey related to the dynamic data management in mobile LBS. The different data management techniques are present to support for the dynamism. Our focus is on dynamic data management rather than evaluation and simulation. We therefore have taken an approach to design a framework that suits for existing issues in mobile environments. The system is evaluated under different criteria to prove the effectiveness of the research. Here, we discuss only about the dynamic data management in mobile LBS. The most distinctive feature of the proposed system is its capability to respond dynamically whenever a target moves or the user changes their location. The future scope is to extend our system framework on various data management techniques under different criteria's. We are also simulating the framework to support the dynamism and location management.

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