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Urban Location Based Services using Mobile Clients: The ICiNG Approach

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1 Introduction

The ICING project is conducting research into eGovernment and Location Based Services and also into two-way interaction with the physical environment. The research focuses on the areas of embedded intelligence, tighter integration of operator platforms and city infrastructure to enable novel services, empowerment of citizens to evolve systems of interaction with the city via social software, input from citizens and sensors for management systems and decision modelling, and a combination of city systems and multi-modal, multi-device communications to provide enhanced services. The technology platforms are gathering indicators from the City, processing the information, proposing actions to be taken with human intervention and supervision and connecting the City with its constituency. Services and information are delivered on a range of commodity devices, providing greater reach and accessibility to local government and communities.

Solutions are being tested in 'City Laboratories' in strategic city regeneration districts, 22@ in Barcelona, the Grangegorman area of Dublin and Arabianranta in Helsinki, where users will trial and evaluate technologies and services.

2 Icing Mobile Client (IMC)

There are many Location Based Services (LBS) identified in the ICiNG project. These range from providing a location tracking sensor network to retrieving data based on a mobile devices location. While these services are heterogeneous in nature they all require a method of determining the location of a device or sensor. There are many systems available to provide this location information, many using cell services provided by mobile operators or using satellite location technology such as GPS.

However, each of these technologies and services have advantages and disadvantages.[1-4]. Some services operate well in urban areas and in areas of high cellular radio density while others perform well where line of sight to satellites in the GPS system is easily established. Furthermore beyond the purely technical or technological considerations to be taken into account in location determination are issues of privacy and safety which location technologies raise [5].

The issue of which of these technologies to use is however being somewhat obviated by the increasing trend in mobile devices to incorporate multiple access technologies in the same platform [6]. The availability of GSM, WiFi, Bluetooth and GPS on the same device offers the possibility of using all these technologies in combination to improve location availability and accuracy.

The proposed IMC system will perform this positioning task, allowing other software components to query for device and user location. It will provide this location service through a simple software interface on the mobile device which allows the component to be reused by other mobile device applications (MDA).

3 IMC Architecture

The *Icing Mobile Client (IMC)* refers to the complete set of application components on a mobile device. The IMC is comprised of,

- The *ICING Location Client (ILC)* which purpose is to calculate and make available the device location based on wireless beacon information.[1]
- A number of *Mobile Device Applications (MDA).* An example of an MDA is an accessibility application that enables users of the icing system to report problems and issues to city authorities using a mobile device Jabber (XMPP) client extension.

The *ILC* is designed as a provider network independent, privacy sensitive and low cost (in terms of network resource usage) software component to allow mobile devices (especially mobile phones) to determine by a 'best guess' method the device's current location. The prototype ILC software uses a variety of location determination methods. These include (in order of increased location accuracy (see figure 1);

- Using GSM cell phone masts to triangulate position
- Using Global Positioning Satellite (GPS) location (where the device supports this method)
- Using WiFi access point triangulation (where supported)
- Using Bluetooth beacon proximity (where supported)
- Using Semacode (2D bar code) tags

The phone also requires a RMS mapper database to be stored on the phone; this file provides cell phone mast, wi-fi AP and Bluetooth beacon co-ordinates which allows the application to determine position. The application then stores location information, together with time and method information. The application provides a local interface to other applications running on the mobile device to access this information. DIT and Telefonica (Spain) are developing a demonstrator Mobile Device Applications to showcase the technology. This consists of an accessibility issue reporter application whereby a user can report an issue by taking a photo of it and uploading it to Dublin City Council office for accessibility [2].

This prototype will be a Symbian Series 60 (3rd Edition) application. The Symbian mobile device Operating System defines a Server Application Framework (SAF) that allows applications to communicate through client/server inter-process communications (IPC). A client application will launch and connect to a server application. The server application can carry out functions for the client application, with user interaction. The server application may provide new variants of functionality that the client already uses. The server application can also provide functionality that cannot be performed by the client application due to capabilities restrictions, as the server application runs in a separate process [8]. Clients and servers also need to know how to communicate. The Server Application Framework allows them to use well defined services, which encapsulate the IPC messages and provide easy-to-use APIs.

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[1] The ILC owes this approach to the Placelabs project. URL:http://www.placelab.org/

[2] Under the Irish Disability Act, 2005, Dublin City Council are required to make Dublin City accessible for all citizens. The following public domains must be audited to ensure they are accessible for people with disabilities; all buildings to which the public has access, public parks, amenities, open spaces and streets.

In the case of Icing, MIDlets are used in the development of the ILC and MDA's. A MIDlet is a Java program for embedded devices, more specifically the Java ME virtual machine. A MIDlet requires a device that implements Java Mobile Edition, MIDP [7].

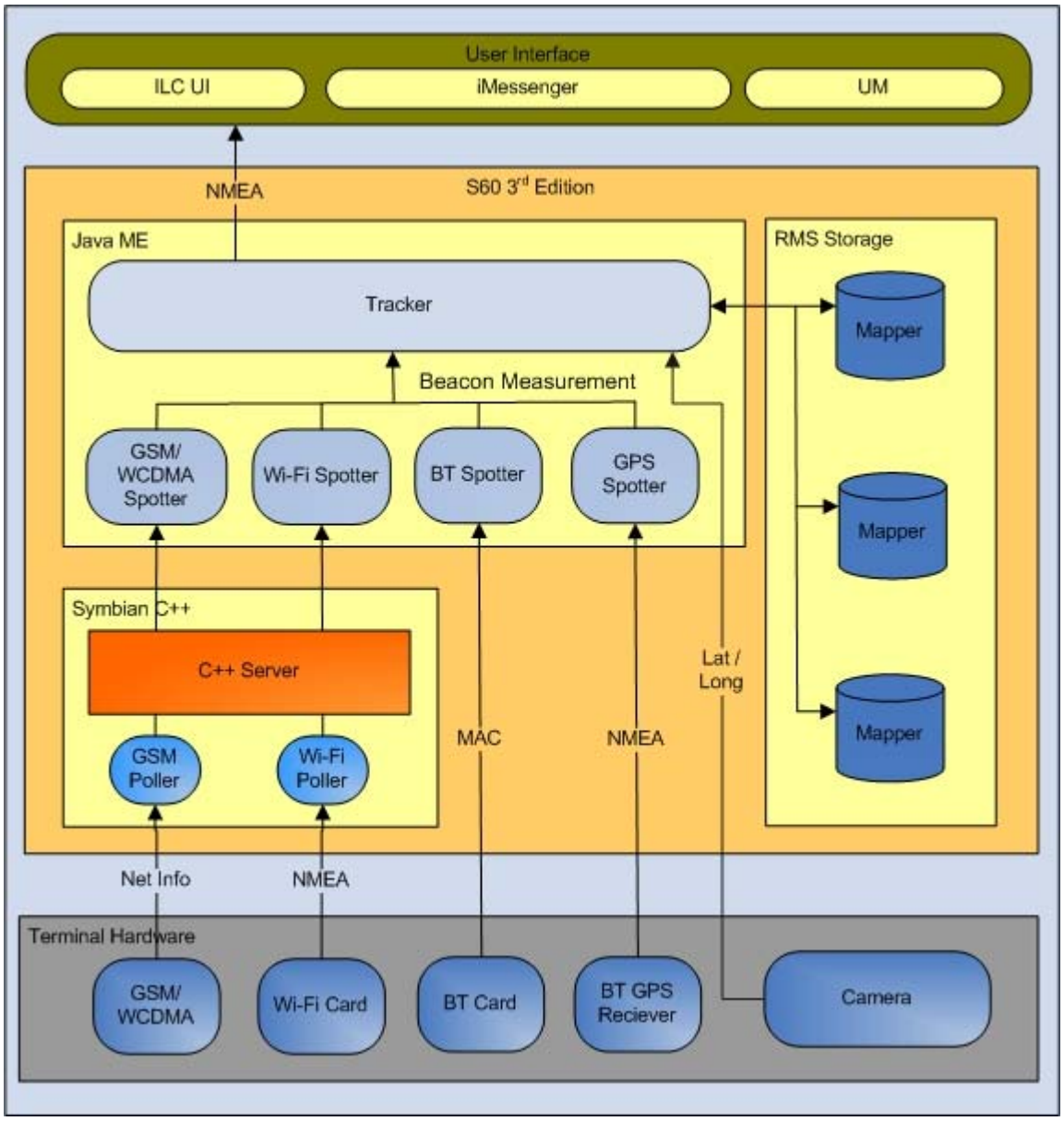

Figure 1: IMC Architecture

The messenger platform consists of a client-server architecture based on existing Open Source solutions. For the communication between parties we use the Extensible Messaging and Presence Protocol (XMPP) which is an open protocol for instant messaging, also called Jabber.

For the server side we will use the XMPP-based solution Wildfire. Wildfire Server is an instant messaging server platform, based on XMPP/Jabber protocol and written in Java that has been released dual-licensed under both a commercial and the GPL license. However we will adapt/enhance the standard functionality, by using some already available plug-ins and by developing our own to support some functionalities required for the ICING project (such as terminal location).

For the client-side application we are using Smack, which is an Open Source XMPP (Jabber) client library for instant messaging and presence. A pure Java library, it can be embedded into applications to extend the XMPP client to report location.

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