Proceedings of the 7th EC-GI&GIS Workshop: EGII: Managing the Mosaic. 2001.

Enhancing Field Service Support in CRM Systems with LBS

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Abstract. This paper describes the infrastructure needed to provide location-based services for supporting field technicians and service order managers in customer relationship management solutions. Customer relationship management systems may be improved integrating location-based services into enterprise applications, including the Web environment. This integration into different contexts requires component-based and Internet-enabled tools that may be easily customized.

1. Introduction

Customer relationship management solutions (CRM) are software applications that allow companies to find, grow and retain customers. For companies using a CRM system, the business strategy is to enhance customer satisfaction and profitability, and therefore the main use of their information systems is oriented to this purpose. Information about location of the customer and the company support services is basic in order to provide a personal service. In fact, location links information about customers with the real world, providing information about their preferences regarding location (where the client lives, where the nearest resources of the company are, etc.) (Sonnen et al. 2000, Gunn 2000, Flower 2000).

CRM applications can include tools to support call centers (these range from the simple maintenance of outbound and inbound calls to the use of a knowledge base for troubleshooting problems (Haley 1999)), sales tracking (the tracking of the relationship with a customer over time, including functionality as the classification of customers by various metrics such as site activity or buying activity (http://www.arsdigita.com/doc/crm.html)) and transactions (the scheduling and supporting of personal and resources to conduct business transactions). Traditionally, CRM systems use location information within sales and marketing activities, doing analytical processes of customer information in order to locate and prioritize opportunities that may have been missed if geographic information is not considered. The use of Geographical Information System (GIS) functionality to manipulate spatial data is necessary to derive this added value.

Nowadays, wireless communications and location devices (GPS (Kaplan 1996, Krakiwsky 1993)) offer the possibility to associate location with each customer service and to track mobile resources of the company in real time. In a broad sense, services or applications that extend spatial information processing, or GIS capabilities to end users via the Internet and/or wireless communications are called Location-Based Services (LBS) (ESRI, 2000). The integration of LBS becomes an interesting opportunity to add value to all aspects of business beyond off-line analysis (OpenGIS Consortium 2000, Niedzwiadek, H. 2000). As a result of this, CRM applications may operate over new sources of location information in order to provide better services, and it is in the area of field support where we will find more promising applications.

Vantive System, from the *PeopleSoft* company (http://www.peoplesoft.com), is a CRM client-server solution that automates and integrates sales, marketing, call center, help desk, inventory, procurement, quality assurance, and field service. *Vantive Field Service* (Vantive 1998 b) is a key software module of the *Vantive* CRM system that schedules for the technicians who perform services at customer sites, managing field service orders and technician assignments (installation or maintenance teams, or third party providers). Additionally, *Vantive* Web *Field Service* (Vantive 1999) gives support for contacting field service technicians through mobile communications (with a laptop computer and a standard Web browser, field technicians are always reachable no matter where travel takes them) and allows them to track and log actions with minimal data entry.

This paper presents, from a technological point of view, the integration of different GIS and location-based components to provide location-based service opportunities within the *Vantive* CRM system. As mentioned before, it is possible, in a broad sense, to find several cases of application of location-based services in CRM systems. This paper focuses on the opportunities that have been found in the integration of LBS with the Field Service module. Firstly, basic ideas of the Vantive architecture and the technological strategy to incorporate LBS are illustrated. In section 3, the basic components that provide the basic functionality are explained. Finally, in section 4 the conclusions and the future work are presented.

2. Strategy to incorporate LBS in Field Service for different users

The Vantive architecture employs a partitioned application client/server model to manage concurrent access to application data from multiple client computers, supporting up to 20 000 user concurrent accesses.

Vantive supports tethered and Web clients (Vantive, 1998). A tethered client is physically connected to the corporate network and communicates with the Vantive application Server (*iwserver*) via Remote Procedure Call (RPC). Each application is stored in the Vantive database, and therefore all tethered clients use the same client program for all Vantive applications. The system also works with the most popular

Internet Browser. The user connects to the Vantive system via the Web Server where Java Server Pages (JSP) are stored. JSP pages use JavaBeans that communicate with the Application Server through the *VAN Java API*.

The use of the Field Service application as template allows developers the customization of forms, used by tethered clients, with the *Vantive Object Studio* tool set (forms represent the interface of the Vantive applications using standard window and dialog boxes). Vantive utilizes Visual Basic for Applications (VBA) programming to modify attributes and behaviors of the Vantive user interface. The use of VBA is appropriate as an event handler that allows developers for a fast customization of Vantive forms. However, location-based services require a GIS infrastructure in order to visualize and manage location information. To solve integration issues, a key part of Vantive's component strategy is to provide developers with a fast, seamless method to integrate Vantive applications into the enterprise infrastructure (PeopleSoft, 2000). The *VanAPI* is an application program interface that allows developers to access the Vantive services from the major software development environments including Java trough language wrappers. From the Vantive forms, it is possible to launch our GIS Java components, which provide the framework for all the major location-based services using the field support information trough the Java VanAPI.

In the same way, the use of the Web Field Service application as template allows developers the customization of Web clients by modifying JSP to add or remove the available fields associated with a given page.

Design considerations such as the use of the OO approach, platform independence, and reuse for Internet in our previous work on GIS software projects, led us to make the decision of using the Java programming language in the construction of the GIS software, and the adoption of a component based layered architecture. In this way, these components may be easily reused to configure a Java GIS framework that has access to the Vantive database and gives LBS functionality to the predefined forms, or may be easily incorporate in JSP.

We have identified two different potential kinds of users in order to provide location-based services around the Field Service module (figure 1 shows typical scenarios):

- **Service managers** who receive service orders via telephone or mail and complete the data of the service agreement and provide resources (field personal) in order to complete it. The service manager is connected as a tethered client. The most interesting added functionality for service managers is the visualization of the location of all resources (providers, field technicians, stores, etc.) and service order addresses. Field service allows the scheduling of service orders in accordance with different criteria such as the skills, or the workload and availability of technicians. However, a visualization of the real-time location of field technicians may improve the scheduling. Through our Java GIS framework it is possible to visualize in a digital map the state and location of each service order and the location of field service technicians and their workloads. GIS visualization functionality allows service manager to visualize planned routes and assign the nearest field service personal.
- **Field service personal** who delivers services. Field technicians use standard web browsers to monitor, update and close assigned service orders using Internet.

Service orders may be visualized on a digital map in order to localize client addresses and choose the best route to accomplish the workload. Field technician vehicles or mobile phones may incorporate a GPS device, providing locations in real time to the service manager. It is also possible to notify state changes and consult the Vantive database through Wap.

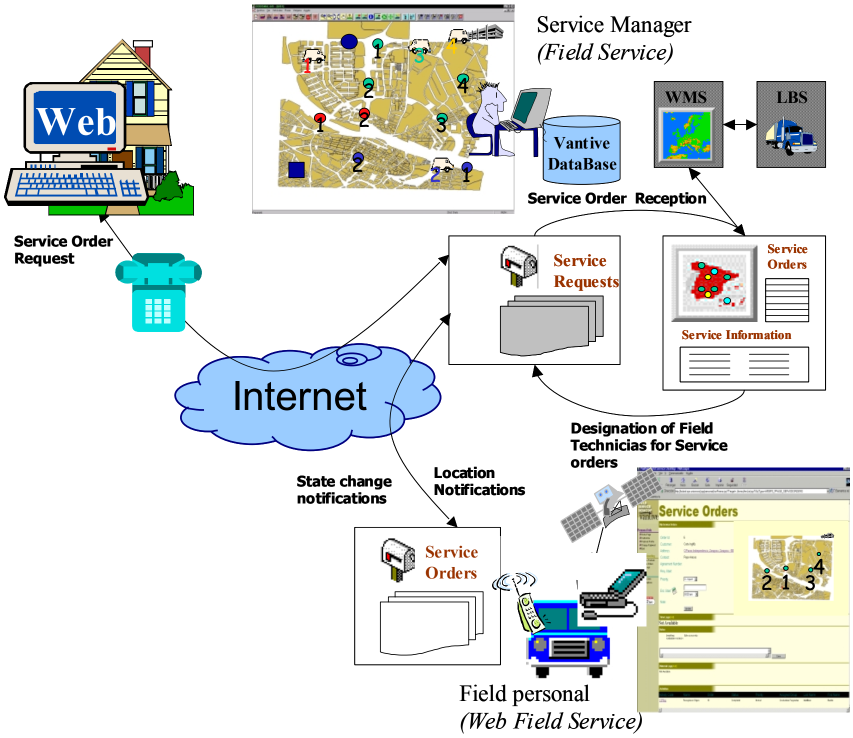

Figure 1. Clients of LBS in the Field Service application.

It is easy to provide information to customers about the state of the transaction, or information about providers depending on their location. Customers who ask for a service (via mail, call center or Web) may be provided with a service identifier and might visualize the state of his request. Although this functionality may be interesting, customers are not really authorized users of the Field service module. Therefore, we do not consider this potential location-based service in this paper.

3. Java Component Based Architecture

In general terms, CRM systems are developed using a set of business objects, libraries and tools given by the system provider, and which must be further customized to satisfy the needs of specific clients. The combination of the flexibility offered by the *Vantive Java* API, the Java Technology Edition and the Java Server

Pages enables this customization of the application to meet specific business requirements.

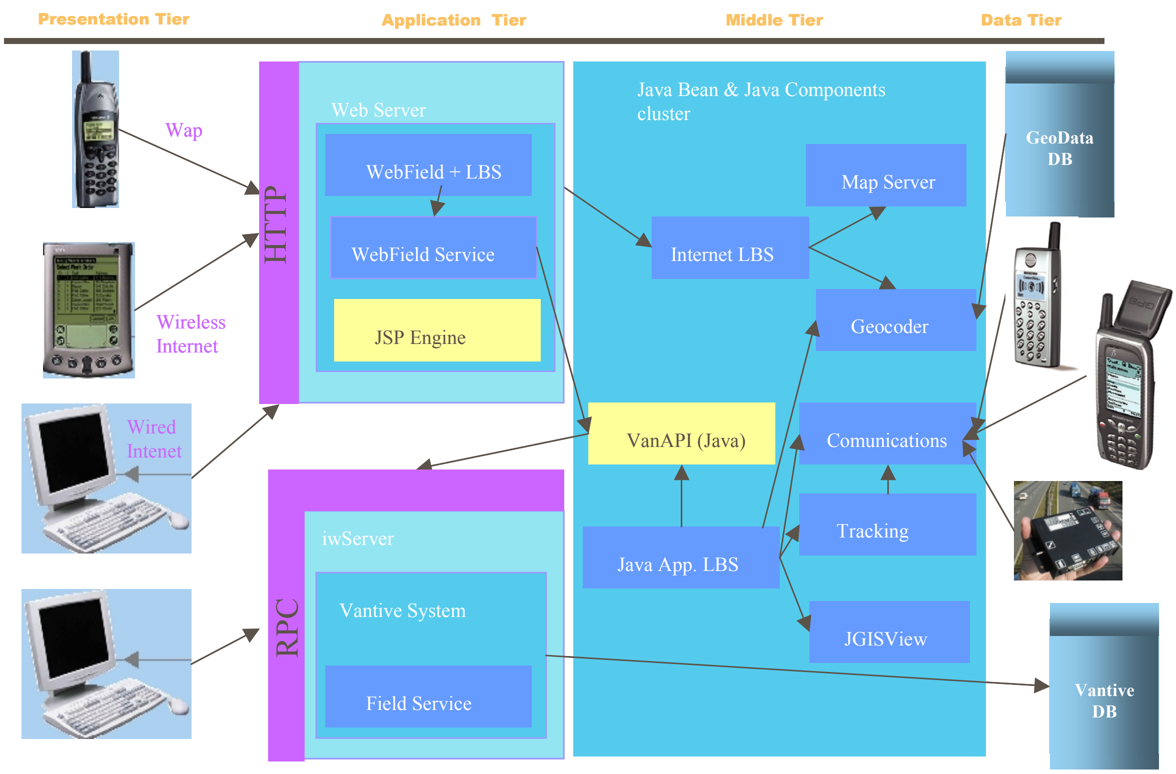

Figure 2. Infrastructure that supports LBS integration in the Field Service application.

Template forms and Active Server Pages provided by the Field application may be easily customized, and it is also possible to interact with external applications through the Vantive Java API for building sophisticated custom applications. Therefore, as illustrated in the previous section, providing *Field Service* with location-based service requires component-based and Internet-enabled tools. In the following section, the functionality of components required to provide LBS is briefly explained. Figure 2 illustrates these components.

3.1 Geocoding

Geocoding (OpenGIS Consortium, 2000) is the process of transforming a textual term or code, such as an address, place name, o telephone number, into a location. This component involves some process of cleaning and standardization of the textual representations of address and place names. This component allows us to obtain the location of a textual term, or finding layers containing the term. In order to find spatial references of a political unit, such as a village, the component uses the knowledge of political subdivisions such as the subdivision of a country into regions, a region into villages, etc. Data at the level of village might not be available, but data referred to superior levels, which include the village, may be sufficient to answer the question.

Our Geocoder component provides the normalization of names, and provides the spatial information of any political unit (address, city, etc.) that has been found in the database. In order to visualize addresses of service orders in a digital map this component provides their coordinates.

3.2 Visualization

Our *Web Map Server* (Fernández 2000) is made in Java and uses the geographical data management rendering capabilities of our GIS kernel to generate and display maps. It adds the functionality needed to fulfill the OpenGIS interfaces. The map server does not receive the requests to show a map directly as an HTTP request, needing thus an intermediate *servlet*. In this way, we can separate the functionality offered by our Web Map Server and the OpenGIS Interfaces. Therefore, the map server may be accessed through its RMI interface by any other Java program.

We have developed three different client applications that may satisfy all potential user Field Server applications:

- An *HTML page* is the simplest client. It is a light page that gives access to the map server. Its download time is small, and it is simple enough to allow home clients of the company who may visualize the location of the company services and contact field service technicians, or third party providers to see some useful. The available layers are fixed in the HTML page. Here, the kind of information each kind of user (client, field service technician, or third provider) can visualize is restricted.
- A *Java applet* that gives access to the map server. It implements the same map tools as the HTML page, like zoom or pan, and adds some others, like the display of coordinates of the mouse over the map, the possibility of changing the scale of the map, or a distance measure. The applet shows also a selectable list of layers and styles available in the map server. The advantages of the Java applet are the increase in functionality and the flexibility in the access to the data because all the parameters, for example, the layers to visualize, are obtained dynamically. This client may be more appropriate for call-centre staff to locate and prioritize task.
- A visualization tool called JGISview. This visualization application may be installed in a user's computer to give access to the web map server, in the same way as the applet. Local deployment involves improvements in the functionality for specialized users. Now, the user can gain access to several OpenGIS web map servers, as well as local files. This third client may be useful for sales and marketing individuals in order to locate and prioritize opportunities, using thematic mapping, layer control and online analytical processing. The first two clients are more appropriate for Web clients, while

the third one is more appropriate for tethered clients, such as service managers, and for the customization of particular requirements.

3.3 Catalog

The OpenGIS Consortium uses the term "Catalog" to describe the set of service interfaces, which supports organization, discovery, and access to geospatial information (Zarazaga, Lopez et al. 2000). Catalog services help users or application software to find information that exists anywhere in a distributed computing environment. A Catalog can be thought of as a specialized database of information about geospatial resources available to a group or community of users. This component allows different branches of an enterprise to share geospatial information, which may be accessed and visualized by authorized staff.

Geospatial information is an expensive resource; therefore the catalog is a necessary resource to share this information in a distributed environment. The catalog component helps the Geocoder find available geodata and provides maps to the MapServer.

3.4 Tracking Services

As we have said before, *Field Service* gives support for contact field service technicians through mobile communications (with a laptop computer and a standard Web browser) and allows technicians to track and log actions with minimal data entry. Field service technicians may also gain access to the Vantive server through a simple WAP device and update the state of a service or consult new requests.

The tracking of service orders may be improved using location information (Zarazaga, Álvarez et al. 2000). Field technicians tracking assists service managers with the scheduling task.

It is possible to track vehicles and field service technicians by means of mobile communications and GPS devices. A mobile device may be a simple GPS device that provides GPS data to the information system via wireless communications (trunking, GSM (see http://www.benefon.com/)), or more sophisticated vehicle computers with GPS, that may provide accumulated data.

Fleet tracking infrastructure (Muro-Medrano et al. 1999) may directly provide mobile locations to the *Vantive* system and then the *Web Map server* may build maps that include a dynamic layer showing the location of mobile devices. An HTML client may ask periodically for a new map that includes the new locations, or an applet client may periodically update the layer of mobile devices.

4. Conclusions and future work

The integration of LBS with field support components allows field technicians and service managers to improve their working conditions. This paper has presented the first steps to integrate location-based services as a set of Java components into field support applications. One of the most relevant problems we have found is to provide LBS functionality to enterprise applications and Web users. The integration of location-based service into different contexts requires component-based and Internet-enabled tools. Our decision to use the Java programming language in the construction of the GIS software, and the adoption of a component based layered architecture has made the incorporation of LBS functionality easier.

The process to provide LBS began (1) developing JavaBeans to be included in JSP of *Web Field Service* in order to visualize maps that show service order addresses, and (2) building the GIS framework that allows service managers to visualize resources and track field technicians. In the future, we will consider the incorporation of LBS functionality to the rest of *Vantive* CRM modules. The developed functionality may be easily customized to different client requisites such as the Vantive CRM system.

Acknowledgements

This work has been partially supported by the Spanish Comisión Interministerial de Ciencia y Tecnología (CICYT) through the projects TIC2000-1568-C03-01 and PROFIT FIT-0700002000B270827.

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European Commission

SPE 01.150 – Proceedings of the 7th EC-GI & GIS Workshop 'EGII - Managing the Mosaic'

Editors: Karen Fullerton & Alison Munro

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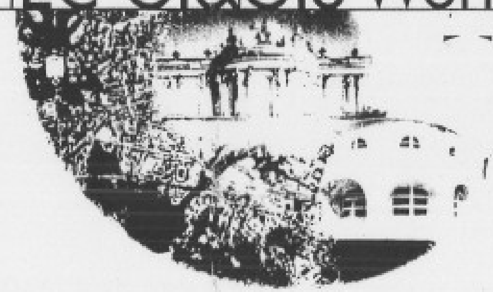

Potsdam, Germany
13-15 June 2001