Ubiquitous E-management of indicators

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Abstract. The goal of this paper is to present a proposal for collaborative management of indicators within an ubiquitous computing context. The scenario we raise assumes that different groups of people, without a common and unique location, must define and manage in a collaborative way a large number of indicators. The way in which ubiquitous collaboration can also incorporate aspects of knowledge management is shown through the particular case we present. We have coined the term e-management to define the ideas which this notion contains, and which refers to the capacity of a tool to allow a user to manage information in a remote and collaborative way.

1 Introduction

The paradigm of ubiquitous collaboration allows members of a collaborative group to have general access to be able to share services through a variety of interactive devices, irrespective of the physical location of the members of the group [4].

The goal of this paper is to present an ubiquitous e-management Performance Indicators system for Urban Water Services. This application is based on the indicators normalization process set up the IWA (International Water Association) [1] to manage water supply.

The system means that the water supply performance indicators can be controlled, and periodic measurements taken, which is responsibility of different municipal services, located in different places. We proposed the implementation of an Intranet so that the work can be done in a collaborative way.

The necessity of implementing this system in an ubiquitous computing context is born from the fact that the data of some indicators are taken in places which are remote. It is reasonable to consider that in these cases the introduction of data can be made through devices, such as a PDA or a mobile phone.

In addition, the use of a PDA makes possible real time access to the data, irrespective of the physical location. For example, the highest person in charge of the municipal management of the water can show those present at a meeting the values of indicators and their statistics.

In the following section we explain a scenario in which some possible situations are described, where the system will be used in an ubiquitous way. The next section

describes the hardware architecture that we propose for the system. Later we describe the most outstanding characteristics of the system, which will allow us to introduce the e-management notion. The paper ends by indicating the present state of the project.

2 Scenario

We start by describing a typical scenario in which some functionalities related to the ubiquitous use of the system for the management of the water supply performance indicators are shown.

An employee of a certain company, in charge of gathering the data related to the indicator that measures the volume of water, is in a water-treatment plant. In order to register this information he accesses to the system through his mobile phone. After validating itself correctly, a combobox appears on the screen showing variables to be selected. The user selects the wished variable and introduces the value that corresponds to the required reading.

The municipal service, Integral Water Cycle, responsible for the variable Water Supplied decides to change its calculation formula. To perform this change it applies for permission, by means of an SMS to the person in charge of the indicators system. The person in charge, who is on a business trip, receives the message and decides to grant the permission. For to that end, he accesses the application with his mobile phone and, transfers a copy of the corresponding variable to the *work environment*. The system automatically sends an SMS to the municipal service, notifying him that he can already modify the variable. Once this message is received, one of the people in charge at the municipal service makes the changes. When he has completed the task, he sends another SMS to the person in charge of the system to check whether he considers it appropriate to change the old variable for the new one. Once the person in charge is notified he can visualize the proposed change in Internet, to check that they are in agreement with the regulations. Next, he agrees to the change and the system sends another SMS to the municipal service, Integral Water Cycle, to register that the change has been made.

In another situation, the head of a municipal service is at a work meeting, and they need to know the state of some indicators. So, the head of the service accesses the indicators system through his PDA. He connects it to a projector so that the rest of those present at the meeting can visualize a statistic about the state of the indicators (see figure 1).

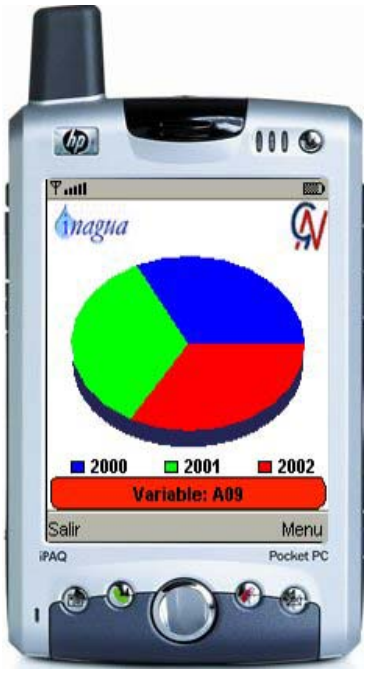

Figure. 1. Graph of values of A09

3 Hardware architecture

For the previous situation we propose the hardware architecture in figure 2, which shows the hardware elements and mobile devices that will be integrated into the system.

The city council has a database server to manage system performance indicators and their values. The city council has also a Web application server used by Intranet, providing the city council with a collaborative working environment.

Mobile devices are included in the system to obtain a collaborative ubiquitous computing environment, making real the scenario previously described.

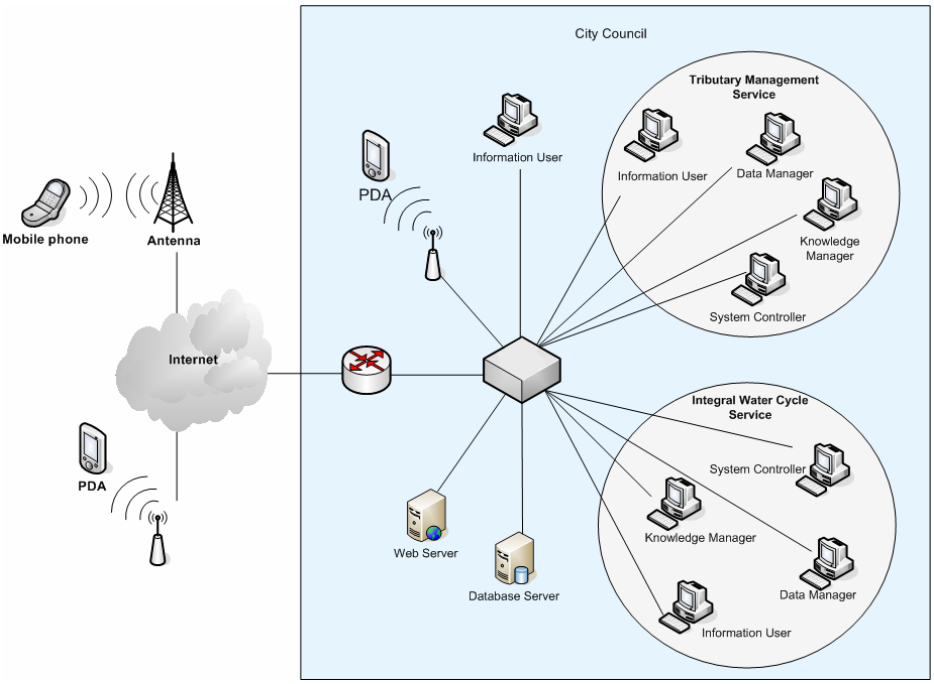

Figure. 2. Hardware architecture

4 Metadata and e-management

The concept of e-management has been used in the literature by several authors [3], nevertheless it is different from the notion of e-management that we present.

In general, in a collaborative application the participants in the collaboration must be able to create, access, modify and erase a set of data [2]. In the particular case of the water supply performance indicators, the application must allow you to manipulate the values of indicators that have been defined previously. Through this type of application, users can generate reports which include concrete values of indicators or results obtained from data analysis, such as for example statistical analysis. If the system has only this type of functionality, it will be a collaborative system orientated towards producing information.

Nevertheless, another possibility is that the collaborative application not only allows data to be managed but that it also allows the participants in the collaboration to create, access, modify and erase the definition of the indicators. This is the case of the Inagua application, in which users can manage metadata relative to the water supply performance indicators. They can define the indicators, modify the definition of the existing ones, adapt them to new circumstances or eliminate those that, for some reason, have been declared obsolete. A system of this type is a system prepared for the generation of knowledge.

At this moment, people who can define and manage the water supply performance indicators belong to different services of the city council with neither a common nor unique location. Therefore, we have considered how to enable remote management of the performance indicators through mobile and heterogeneous devices.

The data and the definition of indicators are managed by an organized system of users. Each user has different management responsibilities, depending on their role. In this way, the users can collaborate together. The tool controls the responsibility protocols of the real system. One of the metaphors we have used to obtain this characteristic, lies in differentiating two environments of work in the tool: *production environment*, where there are data of performance indicators and *work environment*, where the users with the required privileges are able to modify these indicators. The access to the tool is made by restricted access through Internet . This tool presents the information in a dynamic way.

We considered that some of the characteristics, that we have described, globally configure a type of application that can be differentiated from the rest. For that reason, we have considered it appropriate to gather together this idea in the concept of *e-management*, which refers to the capacity of a tool to allow the management of information remotely and in a collaborative way.

5 State of the project

The database that stores the information referring to the indicators is implemented in Oracle 9i. Oracle 10g Application Server(9.0.4) is being used as the Web applications' server. The application has been implemented using JSP. Zaragoza City Council has already installed all this, except the part referring to the mobile devices.

Currently, the functionalities, previously described, which are to operate in the mobile devices, are being implemented.

For related mobile devices, we have chosen .NET to implement functionalities in PDAs and J2ME for mobile phones.

In order to facilitate the communication by means of SMS messages between the Web server and a mobile phone, the chosen option is to use a service provided by a mobile phone operator that allows us to implement such requests from our application.

We considered that all the elements that comprise the raised scenario are innovative in the sense that the system behaves like an ubiquitous e-management environment.

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