

Using A PDA Interface To Access ARCE

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Abstract : *Mobile devices and wireless networks are a useful technology to support the emergency communication when a catastrophe occurs in a country or countries. In fact, Personal Digital Assistant (PDA) and wireless communications can help the Delegate, an eyewitness who travels to the country affected by disaster mitigation to keep his country informed about the situation which he has been living there, not only receiving and sending information, but also working online with applications. Latin-American Countries often suffer catastrophes that provoke numerous human losses and major economic and social problems. International assistance is necessary to collaborate with the affected country in its recovery. In this paper, we introduce ARCE, an inter-state tool that promotes collaboration among the members of the Latin-American Association of Governmental Organism of Civil Defense and Protection, involving twenty-one Latin-American countries in the event of disaster, and we describe m-ARCE, an application for mobile devices, such as PDA, and wireless networks, which has the goal of helping the Delegate in her task.*

Keywords: PDA, Disaster Mitigation, Multinational Cooperation, Wireless Networks, Mobile Devices.

1. Introduction

In recent years, mobile technology has emerged as an essential platform to support cooperative tasks. It is particularly useful when the users of a system are not at their desk, and they can be geographically scattered. This is the case of multinational disaster response, a process which involves different countries and organisms that provide assistance to mitigate an emergency situation affecting to one or more countries. One of the main concerns of the Latin-American Association of Governmental Organisms of Civil Defence and Protection, involving twenty-one Latin-American countries, is to promote cooperation and mutual assistance in emergency situations. Nowadays, when one or more countries of this association are affected

by a disaster they ask for cooperation from other countries or organisms in a unilateral way. In turn, each requested country or organism supplies assistance according to its possibilities, but without taking into account how the others are contributing. As a result, an affected country can receive a great quantity of perishable food, more in fact than can be consumed by the victims, while the need for clothing is not being addressed by anyone. In this context, the Association in its IV Conference held in Azores in September 2000, committed itself to design a mechanism to make the cooperation and mutual assistance tasks in emergency situations easier and more efficient. As a consequence, the Spanish Civil Protection Department along with the DEI research group at Carlos III University of Madrid started to work on the development of ARCE, a platform that is oriented towards enhancing the management of multinational disaster response within the scope of the Latin-American Association.

When a disaster occurs and almost everything is destroyed, the only way that a Delegate, an eyewitness who travels to the country affected by disaster mitigation to keep his country informed by the situation which he has been living there, can send and receive information is through the use of mobile technologies. The current process to deal with disaster mitigation has a number of drawbacks that can be solved using an application on Personal Digital Assistant (PDA) and wireless communication. In this proposal we introduce ARCE (Aedo et al, 2002), a tool that promotes the collaboration among twenty-one Latin-American countries. ARCE also makes use of role-based access policies (RBAC) and information flow mechanism to offer an efficient and reliable communication channel. RBAC (Ferraiolo, Barkley & Kuhn, 1999) is a security mechanism that regulates the access to resources on the basis of organizational entities called roles. A role represents a job function or a set of responsibilities for a set of users holding that role, together with the privileges granted to them.

The main goal of ARCE is to efficiently support emergency responses in a multinational context, and the main goal of m-ARCE is to keep countries informed by their Delegate with regard to disaster mitigation. In section 2, we describe the ARCE system, and section 3 we present general scenario and multi-tier architecture of m-ARCE. At the end of this paper, we describe some technical conclusions.

2. The ARCE System

ARCE (Aplicación en Red para Casos de Emergencia - Application in Network to Emergency Cases) is an inter-state tool that promotes collaboration among Latin-American countries and provides mechanisms to notify an emergency, request resources and offer assistance. In short, when an emergency happens the affected country or countries, which we will refer to throughout this paper as the emergency owner, can use the system to keep the other associates informed, referred to as the assistance suppliers. The basic requirements for an efficient communication between countries and organisms can be addressed using the web. In order to develop a useful application a number of requirements were taken into account, including: accessibility, multi-user support, inter-state support, multi-purpose application, reliability, efficiency and maintainability.

1. Accessibility. The application can be accessed anytime and anywhere in order to improve the communication among associates.
2. Multi-user support. ARCE is accessed by different users with different responsibilities.
3. Inter-state support. ARCE must be able to provide each associate a certain degree of autonomy and control.
4. Multi-purpose application. ARCE has two operation modes: routine and emergency.
5. Reliability. This is a basic requirement in ARCE, since users have to trust the information and services offered by an application supporting a critical task.
6. Efficiency and maintainability. Through the appropriate role, users will be able to create emergencies, ask for help and coordinate the multinational response in order to avoid redundancies. Moreover, they can invite external organisms or countries to take part in the mitigation of a specific disaster.

In order to increase the system usability, the user interface has been designed applying HCI principles paying special attention to usability and consistency issues. Moreover, in order to improve this collaborative environment an iterative and user-centered development methodology has been adopted.

ARCE has been developed using ARIADNE (Díaz, Aedo & Montero, 2001), a software engineering method to develop and evaluate hypermedia and web applications, and MARAH (Díaz, Sanz & Aedo, 2004), an access control model that provides security designers with mechanisms to specify security rules using elements and abstractions of the hypermedia domain (nodes, links or contents).

ARCE has two operation modes: routine and emergency. *In the routine mode*, the application is used as a communication channel and to post news. There is a communication module that uses information flow policies to distribute messages among different roles using a RBAC policy. Users are classified into roles identified in the Civil Defence and Protection departments as well as those of the invited organizations (e.g. EU, UN). These policies are aimed at ensuring that users only access the information for which they are authorized (Denning, 1976). For this purpose, information is categorized as strategic, operational, technical, general and public. Thus, when a user wants to send a message, first she has to decide which kind of information is going to send and then she will be able to select who is going to receive it from a list of potential targets. To avoid improper modification of data ARCE relies upon the use of authentication mechanisms, so that only authorized users can modify the information provided by the system according to their roles. *In emergency mode*, countries affected by a disaster can manage the emergency by informing the other associates, preparing a preliminary request for urgent resources, elaborating a more detailed request and coordinating the assistance offered by other countries. Since all the entities involved in an emergency, whether the owners or the assistance suppliers, have access to updated and reliable information about the real needs and how they are being solved, there are no problems of overlapping help. Indeed, before a supplier initiates the protocol to physically send any help its assistance has to be approved by the emergency owner. If assistance is required, the emergency owner can ask for resources which are classified according to a multilingual glossary including more than twenty-five thousand terms and a predefined list of resources. Whenever an assistance request is received in ARCE the rest of the associates are notified by e-mail, so that they can access the application to see what the emergency owner is asking for and how they can help. Moreover the associates can be notified by SMS message and Fax.

For each emergency, the application provides updated information on which resources are requested, as shown in Figure 1, what quantity was originally needed and how many items have been already supplied, as shown in Figure 2. Thus each associate can decide what to contribute taking into account what the others are providing.

ARCE is accessed by different users with different responsibilities. This implies that each user has to be allowed to perform or not perform an operation (e.g. create an emergency, offer assistance or accept assistance) according to the role she plays in a specific organism. To deal with this issue ARCE assumes a Role-Based Access Control (RBAC) as described below. Each user of the application will be assigned one or more roles. This role, along with the country or organism to which the user belongs, determines the information each user receives as well as the tasks she can perform on the system. For example, the Local Manager can add new users to her country structure while the Technician can perform maintenance operations such as create new Local Managers or new entities, and a Delegate can send and receive information when he is in the emergency situation as an eyewitness. This illustrates how different users have different views of the same information.

Solicitud de recursos de Argentina

Lugares de recepción de los recursos

Aeropuerto: Buenos Aires
 Puerto: Puerto La Plata
 Area: Cordoba

Añadir lugar de entrega

Expandir todo | Cerrar todo

	Aportado	Pendiente	Cantidad
1. Medios humanos			
1.1. Personal técnico			
1.1.1. Especialistas en protección civil	0	0	3
1.1.2. Especialista en riesgos naturales			
1.1.2.1. Especialista en hidrología	0	0	4
1.1.2.2. Especialista en sismología	0	0	5

Figure 1. Assistance from the point of view of an emergency owner

Formulario para la realización de aportaciones a Argentina

Lugar de entrega de la aportación: Area: Cordoba

Expandir todo | Cerrar todo

	Solicitado	Aportado	Aprobado	Pendiente
1. Medios humanos				
1.1. Personal técnico				
1.1.1. Especialistas en protección civil	3	0	0	1
1.1.2. Especialista en riesgos naturales				
1.1.2.1. Especialista en hidrología	4	0	0	2
1.1.2.2. Especialista en sismología	5	0	0	3
1.1.2.3. Especialista en incendios forestales	0	0	0	0
1.1.2.4. Especialista en vulcanología	0	0	0	0
1.1.2.5. Especialista en movimientos de laderas	0	0	0	0
1.1.3. Especialista en riesgos tecnológicos				

Figure 2. Assistance from the point of view of an assistance supplier

3. General Scenario and Multi-tier Architecture of m-ARCE

Mobile devices and wireless networks make researchers and designers to define scenarios and architectures to access the system infrastructure permitting users to be more intensely connected, either face-to-face or at distance.

ARCE system has a mobile scenario: m-ARCE and we have developed architecture to solve it. The objective of m-ARCE is to make ARCE system be present since a simple template in any mobile device until a robust computation in any desktop. On the other hand, since m-ARCE is a mobile environment, it

offers different channels of communication (synchronous and asynchronous) to the user. The principal user of m-ARCE scenario is a Delegate, an eyewitness who travels to the country affected by disaster mitigation to keep his country informed about the situation which he has been living there. Because ARCE assumes Role-Based Access Control (RBAC) as described below, a Delegate has N4C role. N4C role is a controller / operator user of UAD (Unidad de Apoyo Ante Desastres – Unit of Support before disasters). UAD is a mobile office, where a Delegate interacts with mobile technologies such as PDAs, Laptops, and wireless networks to work in his task of giving the emergency information to his country in an mobile environment. The UAD location is outdoor environment in the emergency situation. Sometimes a Delegate can be N3 role – technical role - or N4B role - operational role - depending of the action that he is developing. If Delegate is taking note about the emergency situation with any mobile device moving around the catastrophe, he can be N4C role. If Delegate is synchronizing the information of his mobile device with laptop device in the UAD environment, he can be N3 role. If Delegate is synchronizing database of UAD with database of operation center, he can be N4B. An operation center is the central server and database that works ARCE system in both operation modes: routine and emergency described in the section two. The operation center is indoor environment in Spain.

The general process of m-ARCE is described in three steps:

1. Countries, which are assistance suppliers, send a Delegate as an observer to the catastrophe situation with his UAD mobile office.
2. The Delegate is in charge of sending information to his country on what the assistance suppliers have done, what the relevant needs are, and what the problems are in disaster mitigation.
3. Countries make decisions with the Delegate’s information.

Figure 3 shows multi-tier architecture of m-ARCE structured in three layers: Client tier allows mobile and graphical interface just for mobile devices such as PDAs. m-ARCE Resources Tier offers all types of mobile resources, using PDAs as well as other client and server devices available in the mobile environment. Finally, ARCE Resources tier resides ARCE system.

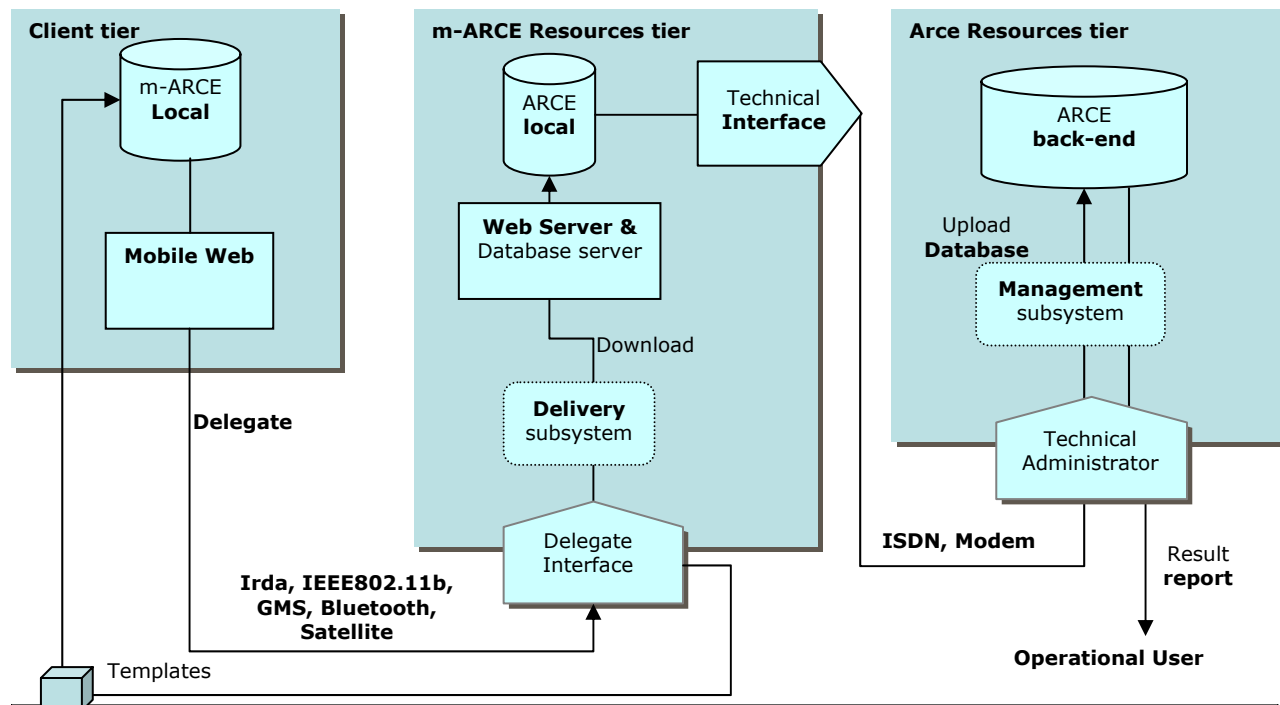


Figure 3. Multi-tier architecture of m-ARCE

3.1. m-ARCE Interface

The aim of this article is to describe m-ARCE using an interface on personal digital assistant (PDA)¹. PDAs (Personal Digital Assistants) are affordable, mobile (can be taken anywhere, anytime), accessible, readily available, and hold limitless possibilities. We chose PDAs to achieve a goal called “Calm Computing” (Weiser, 1996), where the devices move into the background. One of the research lines within the m-ARCE interface concerns with mobile devices that will permit to maintain a continuous communication with the world. PDAs should be good candidates as they follow wireless communication (Irda, IEEE802.11b, GSM, Bluetooth) and provide processing power to perform several useful tasks. Nevertheless they currently pose important shortcomings: large size and weight, poor user interaction mechanism and high cost. Enrolling in m-ARCE interface using a PDA, as shown in Figure 4(a), the Delegate needs to enter his user and password making an authentication protocol on the PDA. Every page of m-ARCE interface includes three main sections, which are news board, messages, and conversation as shown in Figure 4(b).



Figure 4. (a) Enrolling in m-ARCE

(b) The main menu of m-ARCE

3.2. News board section

After a Delegate enters his user name and his password in m-ARCE, he can access the News board section and select an option from the menu as shown in Figure 5. The options are (1) the latest news from the past seven days (Últimas noticias 7 días), (2) News per country (Noticias por países), (3) News per events (Noticias por eventos), (4) Search (Búsqueda), (5) Press Release (Comunicados), (6) Iberoamericana Association (Asociación Iberoamericana), (7) Insert News (Insertar noticia), (8) Insert bulletin (Insertar comunicado), and a “Volver” button to return the main menu, which shows the three sections as shown in Figure 4(b).

This section refers not only to emergency information, such as the latest news (from the past seven days), but also to the general information, such as news per country, press release, Latin American Association and events. If the Delegate needs to send a new, he selects the “insert news” option, and can write the title, the summary, the event, and an URL of the news. If the Delegate needs to find specific information, he selects the “Search” option, and can search for the information by event, countries, and period. If the Delegate wants to create a bulletin, he can select the “Insert bulletin” option.

¹ http://arce.dei.inf.uc3m.es/arce_ultimo/pda/index_pda



Figure 5. News board menu

3.3. Messages section

The Delegate can use the messages section to send alerts with regard to disaster mitigation to his country. To write a message in m-ARCE, the Delegate clicks on the “Write a message” (Escribir mensaje) option as shown in Figure 6, and can write the title and text of the message.



Figure 6. Message snapshot

3.4. Conversation section

The Delegate can access conversations on the ARCE system using m-ARCE interface. In this section, the Delegate can access information on observations, opinions, and ideas about disaster mitigation. On the other hand, the Delegate has two types of conversations: opened conversations (Conversaciones abiertas) and closed conversations (Conversaciones cerradas) as shown in Figure 7. Opened conversations mean there is still no solution for it. Closed conversations mean that an arrangement has been made.



Figure 7. Conversation menu

4. Conclusions

When we developed the PDA interface to access ARCE, we found some technical issues as follows:

- Resources need to focus on maximizing onscreen readability. For instance, material design and a colour screen. While there is also a requirement to either improve the speed of text or design the material so that it reduces the need for free text entry.
- Instructions and other similar text should be used sparingly and only when necessary
- Links should be brief and contain only necessary key words
- As with web pages, specific options should be presented before general options
- PDA users expect to find web-like interfaces on their devices
- Due to low screen resolution and small screen size, long narrative descriptions are not effective

Building m-ARCE, we have experimented different technical issues not only in computing but also in networking, architecture of information, human computer interaction, and software engineering. We would like to share this experience of the transition from e-government to m-government giving a framework for conducting the development of mobile applications on an Internet infrastructure. The goal of the framework is to make it easier for researchers and designers to learn from each other's mobile government applications, and to transform e-experience to m-experience from lessons learnt from previous experience.

Furthermore, we expect m-ARCE to provide feedback to the framework development, that will integrate different information types: formal (i.e structured) or informal (i.e semi- or unstructured) information, procedures, rules, and policies a Delegate has to use to inform his country, authentication on the mobile device, diversity of workspaces to get communication between the Delegate and his country, and open and closed scenarios to deal with the different situations a Delegate should be able to face.

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