

Empowering Mobile Users: Create Your Own Mobile Application for Data Collection in the Cloud

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Abstract. This paper presents a cloud infrastructure that allows users to create mobile applications to collect and visualize data. The system offers simple and intuitive interfaces to create Apps, without the need for any programming skill to develop them. The platform allows the collection of conventional data, such as numbers and text, and also non-conventional data, such as multimedia files, location information, bar-codes, etc. The collected data can be shared among users on a social network, allowing Apps to extract intelligence from the collected data. The system is based on free software and can be accessed at the following address: <http://maritaca.unifesp.br>.

Keywords: Mobile Data Collection, Mobile Devices, Cloud Computing, User Empowerment, Collective Intelligence, Mobile Social Networks.

1 Introduction

The mobile communication market has evolved fast. This evolution is mainly characterized by three factors: reduced smartphone prices, launch of mobile devices with high processing capability, and emergence of new technologies for the development of Mobile Applications (Apps). These factors have created appropriate conditions for the large-scale usage of Mobile Applications.

However, despite the advances in hardware and software, the creation of mobile applications continues to demand programming efforts and involvement of

programmers and IT professionals. In our opinion, this is the main limitation to wider usage of mobile solutions and applications, since most companies have no resources (money or/and programmers) to develop these mobile applications. The same constraint applies to the end users, they cannot pay for the development of customized applications.

We believe that success in the Mobile Market is related to the capacity of delivery applications that can deliver exactly what the user needs. To do this, it is necessary to allow the user to create and customize their own mobile applications. We refer to this concept as **User Empowerment**. To evaluate the concept of User Empowerment (UE) we have developed an infrastructure for Mobile Data Collection [3]; we call it Maritaca¹. The project is open source and was designed to be highly scalable. The tool is available at <http://maritaca.unifesp.br>. The source code can be found at <http://sourceforge.net/p/maritaca>.

2 Maritaca Project: System Architecture

The Maritaca project was developed as a cloud application [1]. The data collected using Android devices are stored in the cloud and can be visualized using standard web browsers. Furthermore, the whole process of data collection can be done without programming skills. The main components are:

- **Application Server:** the server side uses the application server *JBoss* to host the services and web components. All the server side, except for some test scripts, were implemented in Java using *Spring*. All web services were implemented based on the *RESTful* approach.
- **Form Editor:** this is an independent Web application, written using HTML5 and Ajax. It allows the quick and intuitive development of questionnaires by implementing drag-and-drop interfaces. As a result this component generates a questionnaire descriptor, which is persisted in XML format.
- **Mobile component:** this is an Android application that interprets the XML file (questionnaire descriptor) and generates the interfaces automatically. In fact, the mobile component is an engine, based on the design pattern Interpreter [5].
- **Cassandra Data Server:** component used for scalable storage of information. It is based on the paradigm *NoSQL* [6].
- **Hadoop file system:** distributed file system [8] used to store non structured data, such as Apps and multimedia files.
- **Solr Engine:** distributed search engine [7] used to enable searching of Apps. Each App has a description; we used Solr to index the keywords of this description, so that it is possible to search for specific Apps.

In addition to provide for the collection of usual data, such as texts and numbers, the solution also allows collection of unusual data, such as multimedia (audio, video and images) [2], geolocation [4], drawings, barcodes, etc.

¹ MARitaca Is a Tool to creAte Cellular phone Applications.

In summary, the questionnaire can include questions such as: *What is your current location? Take a picture! Record audio!*

The implementation of new types of data captured can be easily performed. To do this, simply extend the class *Question* and make the appropriate changes to the XML parser.

2.1 Automatic Generation of Apps

Every time a form is saved in the Form Editor, the system generates a new Android App (executable APK file format) and stores it in the Hadoop distributed file system.

3 Creating an App for Data Collection

The system allows users to build applications for data collection, which can be installed onto any compatible mobile device that runs Android 2.2, or above. To use it, the user needs to authenticate their identity in the login interface. This can be done in two ways: (i) using the username and password registered in the system (ii) or with OpenID standard. After authentication, the user can visualize the interface for forms management. The interface is automatically rendered in the mobile device.

On the mobile device, the application allows data to be collected using user-friendly interfaces. Data is stored on the mobile device before being transferred to the server. To carry out the data collection, it is not necessary to be connected to the Internet.

The data collection process can be performed many times and it is not necessary to be connected to the Internet. After the data has been collected, the user can connect to the Internet and send the answers to the server, where the data can be visualized.

Currently, the supported types are: text, numeric (simple, double precision and money), date, multiple choice (*radio button and combo box*), multiple selection (*check box*), picture, audio, video, geolocation, barcode, percentage (*slider control*) and draw. New types of question can be easily implemented due to the system design.

Currently, the system allows the creation of three types of forms: private, public and shared.

4 How Can Maritaca Help to Empowering the Mobile Users?

The user can create and modify their own app for data collection. For example, a salesman can coordinate a customer's orders, students can share pictures of a party, and parents can visualize where their children are. There are no costs and no need for programming skills. In addition, the user can define three models

of data sharing and create social networks for specific interests. By combining these features is possible to create effective mobile applications, without cost. That is what was defined as Mobile User Empowerment.

5 Conclusion

This work has explored the concept of user empowerment, which gives the user the power to create, modify and use mobile applications. The project offers tools to collect, share and analyze data, allowing users total customization of software requirements using simple interfaces, without needing knowledge of programming languages or IT infrastructure.

In addition, the work describes a system architecture and its cloud implementation that can be used by any software company needing a Mobile Data Collection solution. The architecture has been developed to cover most mobile applications based in questionnaires, storing both conventional (number, text, etc) and non-conventional data (video, pictures).

In the coming years, predictions point to the increasing usage of mobile devices and the necessity to personalize apps by users with no software development expertise. With Maritaca, we try to solve this necessity by giving power to users.

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