RESEARCH ARTICLE

TECHNOLOGICAL CRUSADE BETWEEN TIC AND THE AGRICULTURAL SECTOR FOR THE FUTURE OF COLOMBIA USING THE SMS AND USSD

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ABSTRACT

A technological crusade of a computer platform for the meeting between supply and demand that can be used by any user from a cell phone (even if it is a low-end cell phone) and that is complemented by other technologies such as USSD (Unstructured Supplementary Service Data) and SMS (Short Message Service), with the idea of escalating the number of people using the technology in order to look for machinery requirements, employment, news, agricultural alerts, etc. Case study Cooperativa de Ganaderos del Valle del Cauca - Colombia.

INTRODUCTION

In business organizations, marketing plays an important role connecting the organization and the client in order to contribute to the financial performance (Moorman and Rust, 1999). However, it is not easy and a marketing strategy is needed. The best marketing strategy is the one that attracts more new customers or even the competitor's customer (Banta Corporation, 2004). To achieve this goal, the first meeting platform between supply and demand that can be used by any user from a cell phone has been developed (even if it is a low-end cell phone) and that is complemented by other technologies such as USSD and SMS. Reviewing a bit of literature, let's start with SMS technology, because of the growth of mobile phone users it provided a big opportunity as media advertising. One of the basic features of the mobile phone is the Short Message

Service (SMS). This function allows the user to send only 160 characters for each message released (Mobile Messaging: Which Technologies and Applications Will Succeed? 2003). This is a challenge for marketers to be able to provide advertising content only in limited characters. In the context of this study, SMS advertising is defined as the use of SMS to send to clients the promotion of goods, services and the personnel or organization ideas (Kavassalis *et al.*, 2003). SMS advertising can be used as an interactive medium (bidirectional communication) between an organization / staff and clients (Du Plessis *et al.*, 2003). However, the use of SMS is recently used only to promote products by sending massive SMS (unidirectional communication) to the customer, such as sending sales promotions and sending coupons (Dickinger *et al.*, 2004). On the other hand, Unstructured Supplementary Service Data (USSD) is a GSM service that allows high-speed interaction between mobile clients and services, which typically take the form of applications. The USSD gateway is part of the infrastructure that makes this interaction possible by

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acting as an interface between the services and the GSM network, allowing the user interaction. Messaging through the GSM network consists of USSD and SMS, and both are complementary, although they use different gateways. A concrete example of an existing and successful system implementation based on USSD technology is the service of the Barclays Bank in India (Barclays launches 'Hello Money', 2008). The application is simple and intuitive, based on a menu and mobile users do not need to remember any keywords, install proprietary applications or send SMS. The customer just needs to dial \ 1 # and choose the required transaction. Another example: in Kenya, the Txteagle Company, implemented a system that allows the locals to make translations through their mobile phones. The service started in the early 2009 using SMS but was later ported to USSD the same year because it is cheaper and Kenyan people are already very familiar with USSD (Eagle, 2009). Another notable common example is the use of USSD by MTN in South Africa, for antenna time requests (Mobile Services-Me2U, 2011). A remarkable aspect with all these systems is its easiness. On the one hand, the benefits of USSD are multiple. It has a quick interaction time and is available on 99.99% of all mobile phones. Its menu-based interaction through selection makes it accessible to the semi-literate and, more importantly, it is accessible free of charge in different emerging countries (Sanganagouda, 2011).

For this article the project architecture and the crusade of appropriation of the platform developed by the beneficiary community are presented. The Cooperativa de Ganaderosdel Centro and Norte del Valle del Cauca COGANCEVALLE was implemented as a project beneficiary, and the accompanying entity will be the research group TEIN, the executing company is EstratégiasMóviles with the advice of LV consultores S.A.S. This project is funded by the Ministry of ICTS with the audit of Colciencias. The project was presented to the Call for Proposals 732 of Colciencias of 2015, which has been chosen as winner to be financed, and its development process began on September 13, 2016, to be completed in one year. It is important to thank all the cooperation of Dr. Andrés Sandoval, Dr. Andrés Sinisterra and Dr. Pablo Echeverry, with whom all this work was carried out in order to fulfill the goal set by LV consultants and Mobile Strategies, as it is the need for interdisciplinary of agriculture and Tic in Colombia.

MATERIALS AND METHODS

- In the project the company Cogancevalle is presented as a beneficiary, where the executor is EstratégiasMóviles with the advice of LV Consultores.
- It is important to give a concise look at who these entities are and Colombia and the ICTs.

Companies linked to the development of the Project

Cogancevalle, is a company of the solidarity sector that began as the Comité de Ganaderos de Tuluá (committee of Livestock of Tuluá) 46 years ago, from where the Cooperativa de GAnaderos del Centro y Norte del Valle Del Cauca – Cogancevalle (Cooperative of Livestock of the Center and North of the Valley of the Cauca) was born, which is an association to the service of the promotion, defense, maintenance and projection of cattle raising in the Valle del Cauca, which groups and represents a large part of the livestock producers union in this area of the country, having become a leading company in livestock development.

Currently Cogancevalle, has four (4) headquarters, the main one in Tuluá, and other offices in the Cities of Cali, Buga and Cartago, and the other municipalities are distributed in these cities. EstratégiasMóviles is part of Aldeamo. Aldeamo, comes from AldeaMovil, since the people in the villages could communicate easily, because everything was a few steps away. Today, Aldeamo wants to make this communication easier again. Aldeamo was founded in 2004 and from the beginning it was characterized by the search of innovative ways to generate value to its users through the use of cell phones. The company started by selling ringtones for each user to personalize its own phone, and today it offers more than 20 different services for people and businesses to connect with their specific audiences through their mobile platform. Aldeamo, headquartered in Bogotá, operates in 13 countries, 11 of them in Latin America, and it is directly connected to more than 25 cellular operators, which allows it to offer a wide variety of services ranging from text messages that bank services users receive after making a transaction, to the interactive menus that some health entities use so that their patients can book medical appointments and evaluate the service. Aldeamo has been using technologies such as SMS and USSD for more than 11 years, ensuring that all its services can be used on any cell phone, regardless of its range or whether they have a data plan or not. Lv Consultores, is a Colombian company that provides corporate solutions in couching, management consulting, formulation, execution and project management for companies of different productive sectors in the different areas of engineering, health, agribusiness education, among others.

Colombia and ICT

The latest "Digitization Index" by Columbia University Professor Raul Katz states that our country passed this year from being a "transitional digitization" country to one of "advanced digitization", a category in which   most members of the OECD are. Since 2010 (Min. Tic. Así cambia Colombia gracias a las TIC. 2015), when the Vive Digital Plan was deployed, we began to advance in Colombia's insertion into the digital age, which opened the door to the new reality: the digital economy. The global economy is moving towards a digital economy and since the beginning of the President Juan Manuel Santos administration we have pushed the technological leap of Colombia forward as never before, thanks to that, we now have 11 million broadband connections, five times more than in 2010 and a mobile penetration of 112%. 1,070 of our municipalities, (96% of the total) already have high speed internet and are connected to fiber optic networks. 74% of MSMEs and 50% of Colombian households can connect to the internet. there was an increment from an average of 24 to 6 children per terminal in public schools and schools to which 2 million computers were donated between computers and tablets.

Colombia is an international referent in online government and a leading country in open data in Latin America. Today, more than 400 transactions with the State can be carried out online, as matter of fact, the fact that it is now possible to request a duplicate of the identification document on the website of the National Registry. This digital revolution produces spectacular effects on the economy. The consulting firm McKinsey estimates that between 2005 and 2013 digitalization contributed to the country's GDP growth by 6.1%. And according to the Dane, the ICTs industry is the second factor that contributes the most to the added value of the services

sector of our economy (25% in 2013). The commitment of the ICTs Ministry is to give continuity and projection to these results and to continue moving towards a more productive and equitable digital economy that leverages national objectives in terms of peace, equity and education. The tool to achieve this, is the Vive Digital Plan for the people which has four main axes of action: to strengthen the ICTs sector as a generator of employment, to contribute with the ICTs to the transformation of education, to make the government more efficient and transparent thanks to the ICTs and to consolidate regional digital ecosystems to transform the lives of our cities and territories. The goal of the ICTs Ministry for the year 2018 is to multiply by three the broadband connections in Colombia, in order to reach 27 million connections. regarding employment the sales of the IT industry is going to be tripled and Colombia will turn into a leading country in the development of applications with social impact, with those it is expected to generate 255,000 new jobs , direct and indirect in the ICTs sector. As for the support in the transformation of education to the year 2018, 320,000 teachers will be part of the staff and one million parents of educated communities in ICTs, other 2 million computers and tablets will be delivered to official primary and high schools. In Digital Government, through the Route of Excellence, the 17 most required processes and services by Colombians will be available and with the greatest social impact totally online, and there will be at least 800,000 citizens and companies making use of and benefiting from the digital citizen folder. The City-Region plan is to promote the development of smart cities and territories. In this area, the goal for 2018 is to consolidate regional ICTs clusters focused on meeting the needs of other productive sectors and regional productive vocations.
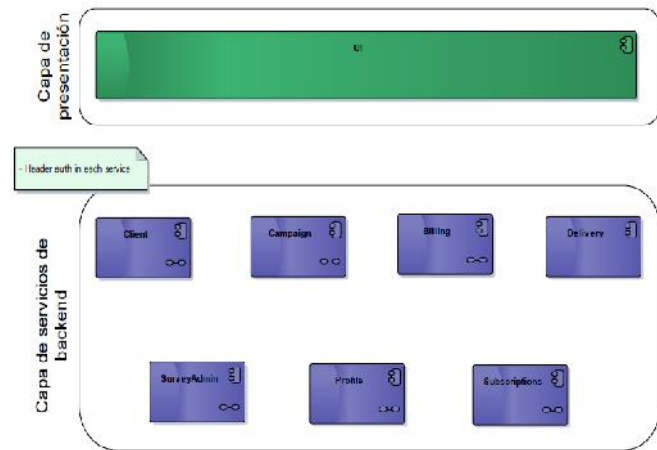

Figure 1. Diagram of the layered component model

Architecture Project Cogancevalle

Website Development and SMS General Architecture

It is specified that the mentioned functionalities and architecture integrate the web with the sending of SMS. The solution consists of a service-oriented architecture composed of two layers that are described below as shown in figure 1: Presentation Layer: In thisone, there are the interfaces with which the user of the system interacts. For its implementation AngularJS technology is used and the Back-end service layer accessed through REST (Representational State Transfer) services with basic authentication. Back-end services layer: Exposes REST services to allow access to business data and

functionality. This layer consists of 7 components that are made up of independent and interoperable services, to provide scalability and flexibility to the system. These components are developed using Spring Boot technology and each one has its own data model in MySQL.

The specific responsibilities of each component of the Back-end services layer are described below.

Billing

- Allows to add or subtract credits that are equivalent to a certain amount of messages.
- Manages the business rules to obtain the credits value associated with a campaign.
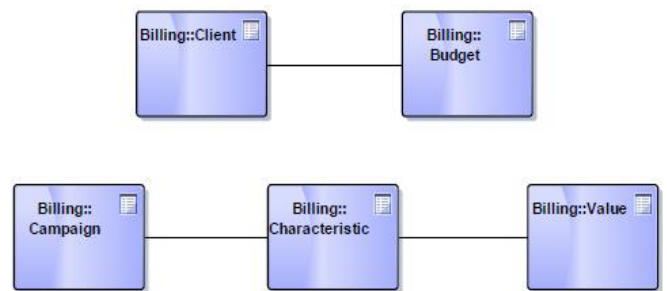

Figure 2. Entity Diagram of the Billing Service

Campaign

- It allows to manage the information of the courier shipments campaigns.
- It allows sending messages to end users, through the Delivery component.
- Handles different types of campaigns according to the sending time:

    1. Immediate: messages are sent immediately.
    2. Scheduled: messages are scheduled to be sent on a given date.
    3. Recurring: Campaigns are created that periodically send scheduled messages. This frequency can be weekly, for example every Monday or monthly, for example, the 23 days of each month.

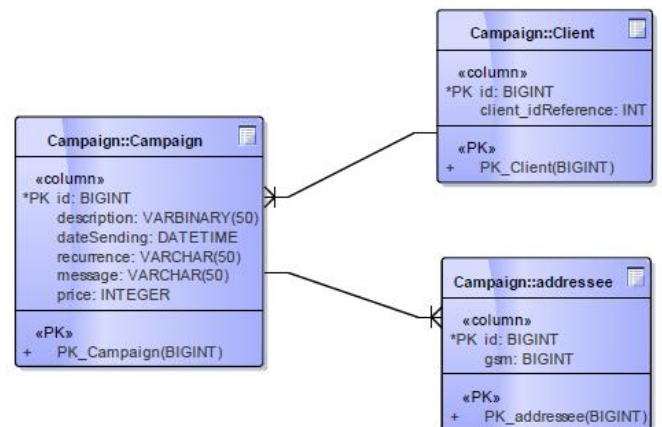For this the module stores the status of the shipments.

Figure 3. Entity Diagram of the Campaign Service

Client

- It allows to manage the information of the users of the system.
- It also handles login, retrieving user authentication information and authorization through role management.
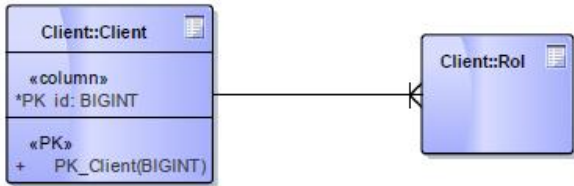

Figure 4. Client Service Entity Diagram

Delivery

- Exposes a Back-end interface through which messages can be sent.
- Determines the broker through which the shipment is made.
- Stores information of shipments made.

Profile

- Allows to associate the given answers by an end user.

Subscriptions

- Module that allows to manage the subscription of a person to a product, service or group

SurveyAdmin

The survey management module is responsible for:

- Manage the questions that can be sent in a survey.
- Allows to configure the types of expected responses for a question. For example, numeric type for the question age or date type for birth.
- A question may have closed answers, which means possible answers correspond to a predetermined list, for example, to the question gender, possible answers are 1.Feminine or 2. Male. These listings are configured through this module.
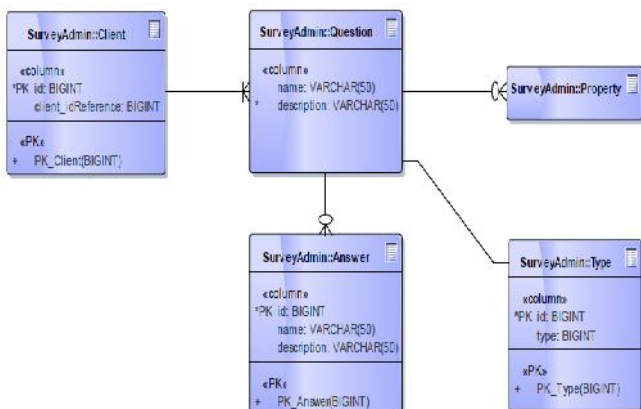

Figure 5. SurveyAdmin Service Entity Diagram

Deployment Specification

The graphical interface is deployed on a web server independent of the Back-end services layer. The user can access the system from a browser on a computer or from the cell phone, through the internet. To provide security, there is a firewall in high availability with an Active / Passive configuration. On the other hand, the services are deployed within dockers that allow to optimize the deployment and provide scalability to the system. In addition, these access your particular databases, which are on another server. All have a replica on an additional server.
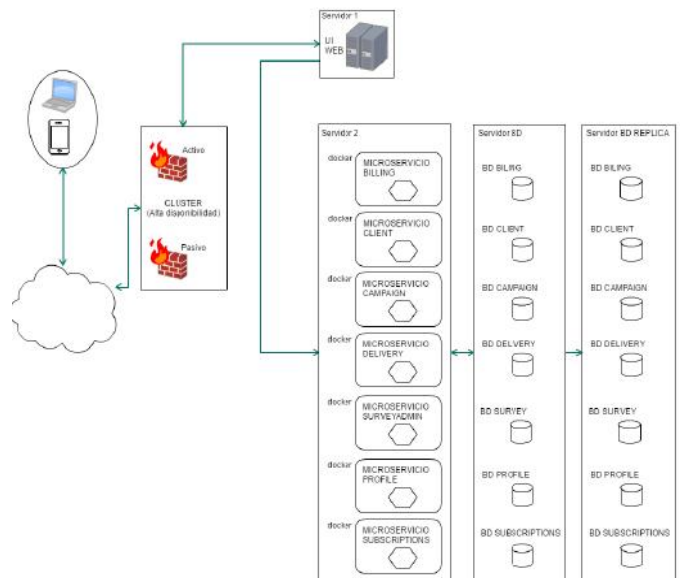

Figure 6. Specification of deployment

Implementation Details

1. The graphical user interface is implemented with AngularJS.
2. Back-end services are implemented with Spring boot
3. The Back-end services expose interfaces REST that allow to realize a CRUD of the entities that manage. The creation is done through method post, reading through get, updating through update and deletion through delete.
4. Back-end services expose interfaces so that the presentation layer can execute business functionalities.
5. Each service handles its own database in MySQL.
6. To access the services, basic authentication is required in the REST request header.

USSD General Development Architecture

The platform for USSD services starts operating when a request is made from a cellular phone, being addressed through the operators' gateways (Tigo, Movistar, etc) to the Aldeamoinfrastructure, where it enters through a firewall and traffic is routed as the load balancer decides toward the platform of the USSD platform provider called UBC. From UBC, which is a platform of a provider called Moobifun, the creation of all USSD menus is handled and the respective data processing of each Aldeamo final customer is managed. The following diagram shows the infrastructure-level communication of the process described above.
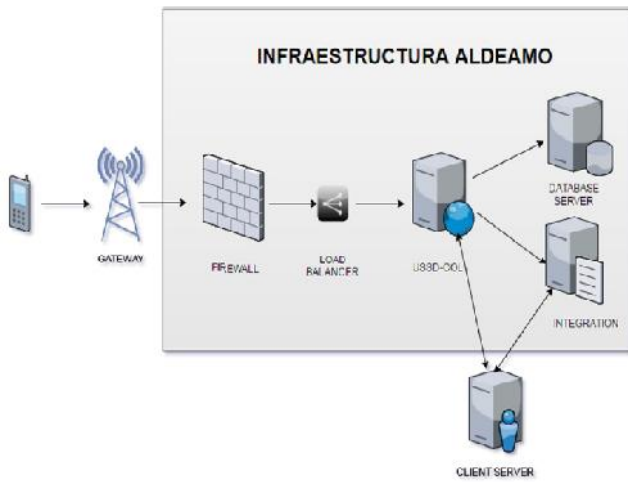
Figure 7. Platform for USSD Services

In the case of Cogancevalle the integration is done in the same way, so that when the Gateway requests arrive at Aldeamo, they are managed through the UBC platform creating a flow according to the menu established by the client. The flow is shown in the following image.
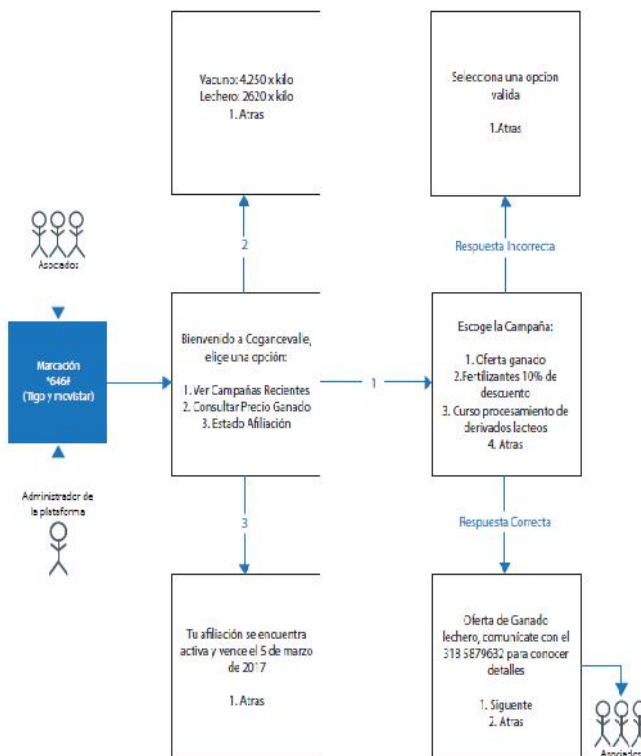

Figure 8. USSD Use Case Diagram | Cogancevalle

Internally, the UBC platform calls for an integration server in which the information is queried for the different options in the web services, on:

1. Recent Campaigns
2. Price of livestock
3. Status of user affiliation

In this way, when this information is obtained, the integration service returns an XML response that the UBC interprets to display on the cell phone screen and to perform the respective interactions according to the flow and the session started.

RESULTS

In order to promote the appropriation of knowledge, specifically to the beneficiary entity, (see figure 9) the project entitled "Development of a technological platform that allows through the cell phone (using the web channel if you have Internet or the SMS channel and USSD if you do not have access to data plan) realize an "intelligent" profiling to allow bid and demand products and services according to the interests and needs".

Figure 9. Cogancevalle Mobile Farmers Community

In the development of the bovine exhibition, the academic event was successfully carried out, (see figure 10) a space for reflection and analysis of livestock issues, where a platform that allows the cell phone to offer and demand livestock services was launched. The presentation was made by the team of EstratégiasMóviles and LV Consultores, where the interest of the centro-vallecaucana community was captivated.

Figure 10. Sixty-second Agricultural, Industrial, Handicraft, Equine and Minor Species Fair of Tuluá

For a second part of appropriation and transfer of knowledge, in July the group of Mobile Strategies, Cogancevalle and LV Consultores, presented the developed platform, in the municipalities of Trujillo, Bolivar, Versalles and Dovio. For these municipalities and farms the presentation was made to different associations and cooperatives, including:

Cooperativa Ganadera de Versalles - Coversalles
BolivarLivestockAssociation - Asoganabol
Cooperativa Agrícola del Dovio – Coagrodovio

Figure 11. Crusade of appropriation and technological transference

In this one the project was exhibited to each of the members of these associations and cooperatives, with an attendance of 30 to 40 people. It is noteworthy that there was considerable empathy for the developed platform and interest in appropriating it for the benefit of its associations and cooperatives. For the end of the process, the strategic plan is the official delivery of the project to Cogancevalle and the transfer of knowledge in a conference in the Servicio Nacional De Aprendizaje (SENA) DEL VALLE DEL CAUCA - BUGA city, and to different sectors of the Valle del Cauca, in the month of September.

DISCUSSION OF RESULTS

This first part is the fruit of all the interdisciplinary collaboration of the partners and technicians from Cogancevalle, with the team of EstrategiasMoviles and the advisor and consultant from LVS.A.S, where the most

important matter is the appropriation of the technology by each one of them. Associates and technicians of Cogancevalle.

Conclusion

This project concludes that mobile technology will facilitate the encounter between the supply and demand of the agricultural and agroindustrial sector, especially for low-income people where, for example, decent jobs have a greater economic and social impact. It is important to highlight that the crusade of social appropriation of knowledge as a cultural activity was important, and it is a commitment on our side to continue to developing this type of activities. It should be noted that this experience will allow to show a clear idea of a leap towards convergence; all this, thanks to this type of calls where new synergy doors are opened such as the university - state - company. Therefore, the idea of working with an entity as recognized as Congancevalle, permits, to strengthen ties for the pursuit of applied and productive research as our country needs with this type of project that was developed (López V Juan *et al.*, 2017).

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