Business architecture for the management of urban incidents: believes the TI government for the legal office of the Sinu University

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Abstract. Currently, business models integrated with the IT architecture become a strategic plan to improve services and be more competitive in a globalized world. This work describes how, from the model-based architecture (MDA), such as the CIM, you can obtain the BPMN language software requirements, obtain the PIM component models, then generate the application code and, subsequently, perform functional tests of the product. The legal office of the Sinu University is presented as a case study, in which an integrated and automated business architecture is proposed.

1. Introduction
An organization can form its own business architecture, to respond to its strategic objectives aligned to its innovation projects, that is the case of the legal office of the Sinu University in Cartagena, which is a space of social practice and extension towards the community for the students of the last semester of the law degree.

The legal office has identified missional processes such as consultancy and legal representation that consists in the legal consultancy and representation before the court, which it’s done with the supervision of the teachers.

The conciliation service aims to promote a culture of peace and co-existence and allows people to solve their conflicts by getting to agreement between the parts a new process is the one of urban incidents, management in which are solved cases related to unmet basic needs of the citizens, which serves like competences in the conflicts resolution. These cases are assigned according to the profiles of the students and they are evaluated by the teachers of the area, who finally measure their resolution capacity.

Due to the high volume of information that is handled, it is necessary to design a business architecture that can describe the business, information, applications and resources of computer technology that allow responding to the changing needs of the context. Models and tools will be used to describe the architecture, which will become a framework for those entities that provide social service to the community.
2. Related work

2.1. The model MDA in the lifecycle of software development

Model Driven Architecture (MDA) proposes the definition and use software development models different models of attraction, the same as the possibility of automatic generation codes from the defined models. The reference models are: Independent Computing Model (ICM), Platform Independent Model (PIM), Platform Specification Model (PSM).

2.1.1. Independent Computing Model (ICM). The fundamental objective of the models that compose this level is to achieve a characterization as real as possible of the environment where the software is going to be displayed. In order to carry out this task the business processes are represented by using BPMN that are developed in the application environment [1].

2.1.2. Platform Independent Model (PIM). Represents the models that describe a software solution which do not contain the details of the concrete platform where the solution will be implemented, hence its name platform independent models. These models arise as the result of the analysis and design [2]. The fundamental purpose is to show how the system components are related among them, in order to comply with the identified functionalities during the business process models.

2.1.3. Platform Specification Model (PSM). The specific models of the platform arise from the (PIM) and are created between the phases of design and coding.

![Figure 1. Traditional model and MDA MODEL. [3]](image)

2.2. Business Architecture Design

A business architecture (BA) can be defined as a complete expression of the organization, which acts as a master plan in collaboration with business planning aspects, business operations, automation, business and technological infrastructure [4]. Another definition according to the IEEE STD -1471 2000 is the fundamental organization of a system, composed of its components, the relationship between them and its environment and the principles that govern its designs and evolution [5]. The basic components of business architecture are:

- **Business process architecture.** It sees about the relationship with the strategy of the organization and the essential business processes. In this block is located the process architecture. Data
architecture describes the physical and logical aspects of the data resources, as well as its corresponding management.

- **Interphases and integration architecture.** Provide the necessary basis in order to identify the apps that the business demands.

- **Technological architecture.** Provides the technological support required by apps, data, and identified processes in the other architectures.

![Diagram of Business Architecture](image)

**Figure 2.** Basic components of business architecture. [5].

An organization has several architectures that models it, the relationship of architectural views that represent them, the whole of an organization, as shown in graph 3

![Diagram of Scope of Different Architectures](image)

**Figure 3.** Scope of the different architectures [7]

The TI architecture is composed of three defined architectures: software applications, infrastructure networks, servers and data.

Besides there is a very strong relationship between them and one depends on the other. Business architecture is composed of three architecture or models which are: organizational, performance and,
processes, where the lifecycle of architecture starts in the business it’s complemented with the technological part [7].

Business architecture is conformed of some business processes (BP) that consists in the logically inter-related arranging of development task in time and space with begging and end, with defined input and output oriented toward the achievement of objective of the business, generating a value result for the owner of the process [8]. In addition, every business process is done through Business Process Model and Notation (BPMN) that consist in a standardized graphic notation that allows modeling of business processes in a workflow format [8].

The BPMN is related to software engineering requirements, since through business modeling we can obtain the requirements of the products, which are defined as the functionalities, features and restrictions that a software must have; and the requirements are defined as all the needs, or wishes ordered by the interested parties and involved in the software [9].

The Open Group gives the following definitions for each.

- Business architecture is the starting point for a software development, it is useful for the development team and analysts understand better the global requirement specification that the future system must satisfy.
- Data architecture is in charge of the interest of the database designers and administrators as well as the systems engineers responsible for developing and integrating the diverse system data components.
- Application architecture defines the necessary application for the management of the business information. The information system must support the availability and maintenance of the integrated information flow through the company, so it can be available in the quantity and quality necessary [10].
- System architecture oversees the buyer’s interest of software and hardware, operation staff and system administrator [7].

In general, the Colombian government recommends six business architecture components: strategy, TI government, information systems, technology service, use and appropriation were adopted to describe this architecture.

3. Methods and Materials
For the realization of this work a series of methods, software, tools and materials were used.

3.1. Strategy
From the previous strategies, we can identify the participants, or the ones interested in the legal office their processes missions, and the applications and services that support those products.

- To advise the community in the different areas of the law: criminal, labor, civil, administrative and family law.
- To train the practitioner students who act as attorneys of the cases that arrive to legal office, personal and virtual.
- To connect and communicate the legal office with the urban environment where it operates and offers its academy services.

3.2. Business architecture
The diagram of the urban incident management process will be done as an example which is modeled in BPMN (Business process model notation) in which they involve the captures of an ordered sequences of the activities and information. Modeling a business process implies to represent how the company carries out its central objectives and activities [11]. The diagram shows which activities demand a web interface and the activities of delivering and receiving messages and the decisions made in the process.
The citizens can report urban incidents and problems of different kinds, collecting important information for its management and solutions. Such as geographic and geolocation, typology level of risk, graphs, videos and detailed description of the incident.

The system in turn assigns the incident automatically to a specialized teamwork (teachers and students of the law school) that is, availability to solve the incident, if the assignment is successful, it notifies the team and increases the incidents score. Every member of the teamwork must check the incident and report the relevant and necessary proceedings to solve the urban problem or incident, saving every evidence in the system (Documentary, photographic, videos, etc.) that allows later to do the tracking and traceability about the management of such solutions.

![Figure 4. Diagram of the urban incident management process (CIM).](Image)

The citizens who report incidents receive notifications in real time about every one of the proceedings that the team-work carries out as an answer to the management done to solve the incident, and besides, they can consult and qualify the management done by the team-work assigned to solve the incident.

Finally, the system generates statistical reports with the information generated by the citizen interaction through the legal office, around the problems of incidents that occur inside the urban core of the city, such information is of high importance now of making decisions of planning of the city.

3.3. **Information Architecture**

In order to represent the necessary information architecture to the legal office, a model entity relationship is represented, where the most important entities and their relationships between them: incidents, users, teams, typologies, incident files suggestions and answers to the suggestions.

4. **Results**

UniLab is the Digital Services Platform that supports all the mission processes of the Legal Office. It is integrated by the CityApp which is initially developed to be used from mobile devices with Android Operational Systems minimum 2.0 on. Its architecture is based on the integration of multiple articulation and communication online tools, in its great majority based on Restful Web Services technology, including: among them, Storage service on SQL Relational BD, Non SQL, unstructured and based in files, Post delivery service, Push Notification service in real time, geolocation and georeferencing service and integration with social networks.
The Register Incident option allows to report any anomalous or irregular situation that has occurred or potentially to occur within an urban or rural context, which can be classified in several classes or typologies depending on its nature or characteristics. These incidents are traffic problems, road accidents or buildings, with the roads, with street lighting, with the sewer system and public toilet, green zones, with historic cultural patrimony (heritage), safety and delinquency in public spaces, among others.

Figure 5. Data Model for Unilab (CIM).
These incidents generally provide useful information at the time of carrying out the necessary procedures for their resolution, such as: information on the geographical location, a detailed description, images or videos that allow us to observe in detail and expand the information about the incident.

This information is sent to a work team willing to carry out the necessary measures that allow it to be resolved. If the incident user was reported by an Anonymous user or Citizen user, it must be first reviewed to determine its validity and relevance, this review or evaluation is carried out by user students, community leaders or teachers. In case of not considering that it is not relevant (as it may be false information or SPAM) this incident will be rejected and cannot be visualized in the system by any type of user. If approved, it can be consulted by any user, especially by the users who were assigned the responsibility of making the respective management that allows obtaining a solution.

Figure 6. Company architecture legal office (PIM).

Figure 7. Unilab interface. CIM to PIM transformation.
5. Conclusions and recommendations

The selected architecture for the development of CityApp is through processes by using the notations of BPMN, which permits a standardized graphic notation of workflow. Easy to understand and to communicate among the users of every level of the office. The BPMN that allows to obtain elicitation of requirements in a much easier and efficient way. Through model allowing to pass from CIM to PIM for the development of computer product, using the philosophy of MDA; going through every one of the stages of the lifecycle of the software development from the moment of the capture of the requirement to the deployment of the app.

The development of CityApps makes an integration between the different services, optimizing the resources that they have in the majority of mobile devices, in addition, it takes advantage of the massive use at a global level, connectivity, portability, calculation capacity, integration to the context.

From the architecture directed by models, where applied in the development of software the models CIM and PIM, since from PSM cannot be done the transformation from the PIM to a block code (appinventor), because there is not a tool that can permit to generate the block code of the appinventor applications at the moment. It advises that a migration be made up to another tool that permit to apply all the MDA models for the development of a software product.

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