

BPM: OVERALL ARCHITECTURE AND BUSINESS PROCESS DESIGN TOOL

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Abstract: Business processes are playing in the last years a very important role in the companies and the explicit introduction of them in the Information System architecture is a must. This requires the introduction of tools and methodologies able to support both business and IT experts in process modelling, analysis and design and to support cooperation between them. Our research work is focused not only on the overall Information System architecture, but also on the tools that support the whole software development cycle from design to development and maintenance. We start our research work from the business process design: we select a notation able to cover the traditional semantic gap between business and IT experts and we provide a powerful tool to support their job.

1 INTRODUCTION

Big efforts have done by companies to improve their Information System (IS) that became, today, not only a tool for activities automation but also a powerful tool that supports managers in the company's analysis and to take timely decisions to correct possible management errors that is to make the IS more flexible in order to cover manager's requirements. To do this, companies abandoned the vertical vision that locates business logic in functional areas and orient them toward a transversal vision that, according to the process logic, tries to improve the management exploiting as much as possible the existing resources. Process vision seems a good way to guarantee to the manager a full business activity control and to increase the flexibility degree in the IS management in order to apply immediately changes: a change to the process must not implicate a re-implementation of the applications but only a different way to manage the existing business logic. The result must be, as BPM (Business Process Management) idea state, a system able to manage the daily flow of business process providing analytical understanding of business process that allows to take timely and coherent decisions. Our effort focuses on the development of tools and methodologies able both to understand and

to represent processes integrating them in the overall IS architecture. The main effort, in our research work, is to think to a methodology that allows to design a Web Information System; the methodology must address two different requirements such as to *take under control the web application design issues* (information, navigation and transactional aspects) and to *represent and to manage business activities according to process logic*. Close to the methodology, we want to provide a set of tools that help in the transition from the process representation to the final web application. BPM tools and methodologies are oriented both to business experts and to IT experts: business experts are interested to define, analyze and optimize processes while IT experts must understand business requirements and develop (or adapt) applications in a rapid and efficient way to meet business user requirements. It is important to cover the traditional semantic gap between IT and business experts (Dieter, 2004). This is an hard task because business and IT competences and goals are different but we want to provide the same tool and it must be simple and efficient for two different kinds of users with different requirements.

2 BACKGROUND

Since '90s, process logic began to affirm through the BPR theory (Business process Reengineering) (Hammer, 1990) that introduced the process as the way to improve the company's management.

A first step towards BPM idea was the workflow idea (proposed and supported by Workflow management coalition (<http://www.wfmc.org>)) but there are two key differences with BPM idea:

- Processes automated by workflow focus on a single department of the company: BPM, instead, allow to have a horizontal view managing processes that involves all company's department. This makes more scalable and more useful BPM than workflow.
- Processes taken into consideration from workflow are processes where only people performed process steps while BPM manages process where steps are performed both by people and systems.

Today, process logic is hidden in the application level and, often, the way that this is made is in the mind of the companies IT experts and it is not well documented. The IS obtained is very hard to maintain. A change to the process logic needs a revision of the business logic with long times and high costs. The processes are not explicit, so it is very difficult to monitor and manage them. The next step after workflow was the introduction of BPM suites that try to make explicit the process definition and management. A recent study (Miers, Harmon, 2005) compares different BPM suites from different point of view such as cost, platform, User Interface etc. As an example, Filenet P8 (<http://www.filenet.com>) allows to represent processes and to manage their execution; Filenet P8

provides administration tools to manage processes and user involved in the system. It focuses on document management and provides a web application (named Workplace) where actors can load their task and work with it. Workplace allows single user to view and work with processes in a web application but each user access to only one page and so the *Web Application paradigm is not taken into consideration*. There are other suites like Filenet P8 such as W4, iLog, PopkinSoftware, Fuego(<http://www.Fuego.com>,<http://www.ilog.com>, <http://www.popkin.com>, <http://www.w4global.com>). The main issues that we can see in these suites are:

- *High cost*: suites are difficult to apply in small-to-medium size companies because; they require high investments both to purchase hardware and to improve the skills of people in the company ;
- *Ad hoc notation* to represents process often hard to read and to understand both from business experts and from IT experts;
- *Lack of methodology* that helps in the transition from process design to the final web application.

Our efforts are oriented to solve these open issues developing tools and methodologies easy to be acquired and applied both by IT and business user.

3 ARCHITECTURE AND TOOLS FOR PROCESS-ORIENTED WEB INFORMATION SYSTEMS

The architecture that we propose in our research work is showed in Fig. 1 and it is made up of

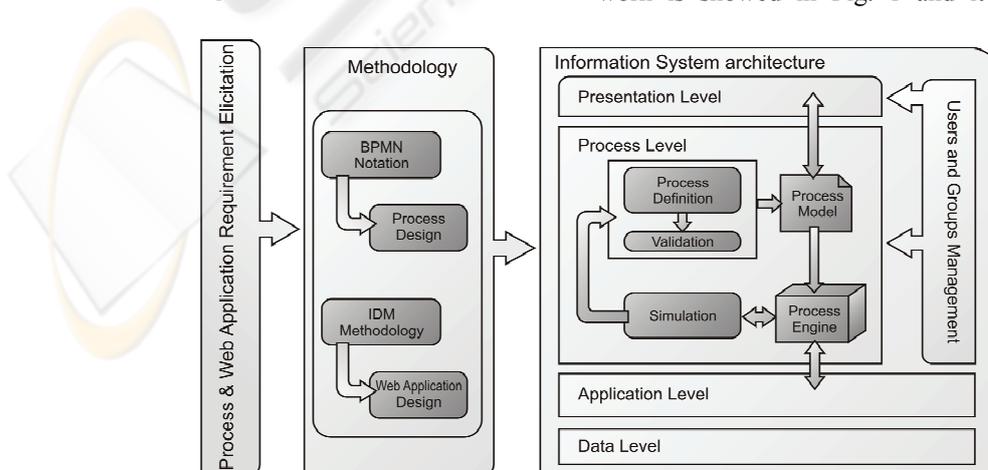


Figure 1: The architecture of our research work.

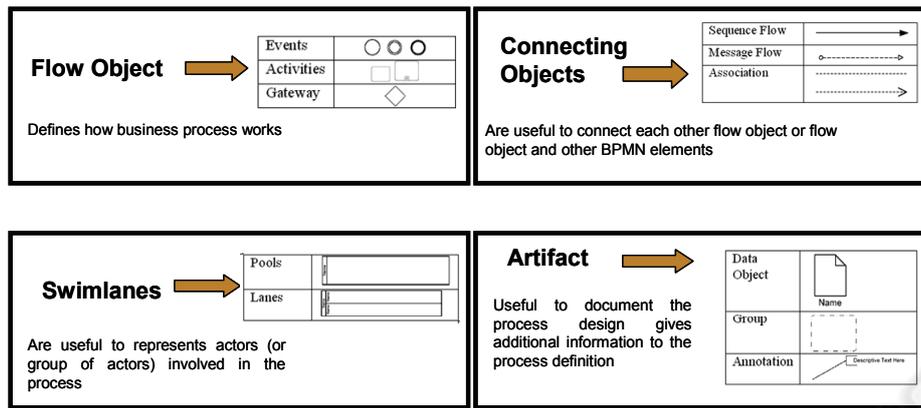


Figure 2: BPMN Core object.

requirement analysis, methodology and the four-level IS architecture. Requirement elicitation phase is the input for Web Information System design methodology that is oriented to integrate in an opportune way the IDM (Perrone, Bolchini, Paolini, 2005) design methodology (that solves information, navigation and transactional problems typical of web applications) with process definition. Methodology is the starting point to obtain the final Web Application that goes over the simple definition of information contents and navigation between them but includes also a process. The introduction of process level is the main effort in our architecture and has two goals:

- Business experts focus on the processes and manage directly them to modify the company work: a change to the process will directly reflect on the application that implements this process without a full re-design and/or re-implementation; to change process means to change the management of the business logic and not the business logic itself;
- From the IT experts point of view the code maintenance is simplified: a change in the business logic means a change in the application level code without any (or with few) changes in the Presentation and Process level; a change in the process will be directly made in the process level without modify the business logic and with some changes in presentation level.

Process definition, followed by *process validation*, allows business experts to obtain the *process model*: a formal representation of the process where it is possible to find all the information about the process. Process model is the input for the *process engine* where process instance are managed. The process engine interacts with the application level and allows to include in the process

management also business logic yet implemented in the company. Finally, the *process simulation* block that allows to define Key Performance Indicator (KPI) and to verify if the process meets the performance requirements. Simulation phases should require the re-definition of the process to obtain the performance required.

4 NOTATION CHOISE: BPMN

We focus on the process level and our first step is the design and implementation of the business process editor that support both the business experts' work (understand and design process) and the IT experts work (understands requirements and implements the application). We know that there are on the market several business process editor but they are expensive and many of them does not support BPMN notation. Moreover, we observe that there is not a standard language machine readable to represent process design but, in our overall architecture the process model in a machine readable format is a must. Therefore, we choose an ontological language to represent process design and in our business process it is supported the export from the graphical design to the machine readable ontological language. The business process notation to adopt must be simple, easy to use and to understand both by business experts and by IT experts: it must cover the semantic gap between business and IT experts.

There are different notations to represent business process. UML (OMG, 2003) activity diagram, for example, allows to define process but it is not simple to understand; another example is the traditional workflow representation that is not

intuitive and allows to define only the process flow without take into consideration human and/or system interaction.

Exploring different notations, our choice is on a recent notation: BPMN (Business Process Management notation) (Stephen A., 2004) proposed by BPMI (Business Process Management Initiative) that, thanks to its readability and completeness seems the best way to represent a process. The main BPMN goal is to cover the semantic gap between IT and Business experts. BPMN, today, is not a standard but several companies support it. The design obtained is clear and it is easy to understand the actors (human or system) involved in the process and the relationships between them. BPMN notation is made up of two different details level:

- core objects made up of base elements that allow to define a process in the large;
- details may be provided adding properties to obtain a detail level close to the detail needed in the implementation phase.

These different details level makes the design easy to understand not only by experts of the notation but also by not experts. At the same time, BPMN allows to provide in the design phase all the details needed for implementation phase. Core Objects are made up of four different groups of primitives (fig.2): each group is made up of different elements and for each element, there are different variants. BPMN defines also the context where each element may be used. As an example, it is not “legal” the use of Sequence Flow between Lane and it is imposed to use Message Flow. Starting from core object it is possible to define another detail level. As an example, there are different types of Start event depending on the context where it is used; each type of start event has its own icon inside of the general start event icon.

5 PROCESS DEFINITION: A BPMN PROCESS EDITOR

A look to the business process design tools market brought us about an important consideration: the only free way to design a process using BPMN notation is the use of Visio palette (<http://www.workflowresearch.de/Downloads/BPMN>) but this design is far from an integrate environment. In this context, we developed a design tool for process definition with several goals:

- *To hide to the user the notation complexity* and to support the user in the choose of the right

BPMN element in the right context (useful for business experts);

- *To support BPMN notation* in all its complexity (useful for IT experts);
- *To export* the process design in a machine readable format (we choose OWL (W3C, 2004) an ontological language machine readable);
- To provide the same tool to two different type of user: business experts and IT experts.
- The BPMN editor must be *accessible on the web*.

To reach these goals, we started our research work with the design and implementation of a BPMN editor. Our effort is oriented to hide to the final user the complexity of the notation due to the several primitives and their properties.

The editor, never show all BPMN elements to the user but drives the user in the choice of the correct elements in the correct context.

To understand this, in fig. 3 we can see an overview of possible type of “Events” and related icons that will be used inside (the same is for other BPMN elements). Our effort in the design and implementation of BPMN editor has been oriented to support user design: *the right stereotype depends on the user action*. For example, if the user chooses an event from the palette (the palette shows only a circle without start, intermediate or end distinction) it became automatically a Start Event without any icon inside. If the Event becomes a target for a sequence flow and the same Event is a source for another sequence flow it automatically became an Intermediate Event (without icon inside). In the same way if the Event is target for a sequence flow and it is not a source for any other sequence flow, it became End Event (without icon inside). Another feature of the BPMN editor is the support to the design of the flow. BPMN defines connecting rules both for Sequence Flow and for Message Flow. User without experience on BPMN has some problems to know what kind of connection is legal between two BPMN elements. To solve this problem our editor provides only the *right interconnection tool*: depending on the context and on the connecting rules the editor automatically provide the correct connection. As it regards properties of each BPMN element, our efforts has been oriented to provide the user with the capability to insert a property, using a property form, by the right click of mouse on the BPMN element icon. In this way, the work area is only for the process design.

This is an innovative idea because tools on the market only present all the properties in a single form and the user may be disoriented. In fig.4,we

Start Events	
Intermediate Events	
End Events	

Figure 3: Different type of event.

can see the property form related to the BPMN Activity: all the properties are editable (through a text box) and, for each property, there is a short description of its use.

For complex property (as “Type of Sub-Process” in fig. 4) there is another property form strictly connected with the first.

The editor allows business user to reach the detail level necessary to achieve its goal; at the same time IT experts may read in the first step all the process design and then read all process details in the property form. Some details unknown to the business user (as an example implementation details) may be added from the IT experts in the same business process design where business experts work.

Our business process editor allows to see, thanks to the BPMN notation, all actors (human and/or system) involved in the process and the overall flow. An OWL machine-readable representation of the business process model may be obtained thanks to the export function.

5.1 BPMN Editor Architecture

The BPMN editor developed in this research work is delivered on the web. This choice requires an effort in the design and implementation phase and the necessity to provide a *rich client* with several functionalities and with graphic tool.

The tool designed and implemented is a *three-tier application*, made up of

- **Client Tier:** a rich client where the user works.
- **Web Tier:** where the servlet container allows to implements web services.
- **Ontology Tier:** the infrastructure to manage the ontological metamodel that allows to export the business process model in an OWL format.

The introduction of BPMN notation in a graphical web application tool requires to provide a real short time response to each user operation so it is necessary to have a final web application of small dimension. On the client-side there is an applet implementing the editor graphical aspect. To have low download time the ontological metamodel is on the server because to manage the ontology metamodel we use very large software containers. Web services provide the communications between the client side and the ontological metamodel. The architecture of the editor is a client-side architecture where the client-side manages the user interaction and the graphical aspects (icons and property) while server-side manages the ontological metamodel.

5.2 BPMN Editor: A Case Study

To understand the functionality of the Business process editor, we use it to model the business process “personal credit” (with several actors and several tasks) for a local bank. (Fig. 5) We can see the “*User*” who require, through an Agent, a personal credit, the “*bank employee*” that makes a few control activity, the “*Credit Analyst*” that provides the first evaluation to the request, the

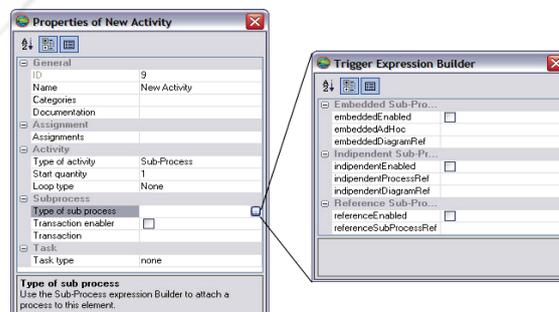


Figure 4: Property Form and sub-property form.

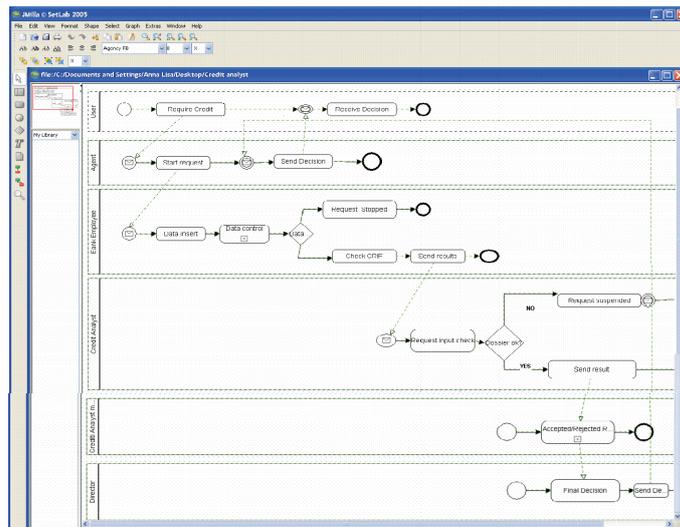


Figure 5: Part of Credit Analyst case study designed with BPMN Editor.

“Credit analyst manager” that provides its own evaluation, finally the “Director” who provides the final evaluation but only in a few special case. The process designer, with our editor, can define, through the toolbar, one pool for each actor involved and, for each pool, can define its own property (by right click). The business process editor provides a toolbar where it is possible to select the event, the activities and gateways. Selecting one of them, depending on the context, the correct icon is inserted in the design. The design obtained with this editor has been obtained in a few hours (the previous analysis of the process has been made first) by people not expert in BPMN notation.

6 CONCLUSION & FUTURE WORKS

Modern IS will be more flexible and able to answer “on the fly” to the manager innovation requirements; this is taken by explicit introduction of process level in Web Information System architecture. The only process analysis and re-definition is not too much to meet the IS flexibility and, as consequence, it is necessary to integrate the process in the IS architecture making explicit the management of it. Our research work aims to introduce process level in the overall IS architecture. This paper focus on the first step of our work that is on the development of the Business Process editor according to the BPMN notation. The editor, delivered on the web, simplifies the designer work thanks to the possibility to interact only with core objects of the BPMN notation that

adapt themselves depending on the design context. In this way, the final design will not contain errors due to the notation misunderstanding. Our next step is the definition of a methodology that allows obtaining a final web application starting from Process design.

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