Integration of workflow functionalities in an ERP system

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Abstract. Business Process Management Systems (BPMS) were created, in order to respond to a growing concern in organizational management. The concern aroused from the need of being able to have business processes and total control, for the obvious advantages, like gathering indicators related with the execution of the activities that form them and, therefore reducing the risk associated with that execution. This was also due to the growing need to correspond with certain standards or quality certificates, like ISO, CMM, TQM or Six Sigma, in order to put out an image of quality and credibility. The main target of BPMS is to achieve an easy organizational management, not only in an operational level, formed by numerous processes and activities, but also in a broader spectrum, seeing organization as a whole. After a time where it was thought that Enterprise Resource Planning (ERP) could solve all the problems, BPMS appeared, complementing them, driving organizational management in an upper layer and level. As so, it was integrated in Microsoft Navision (ERP focused in small and medium size organizations), a system capable of managing those processes, presenting as its mains characteristics, a great flexibility in process modeling, as the building of the interface responsible for the execution of its activities, but also the control and tracking needed to an efficient managing.

Keywords: Business process, management, control, tracking, workflow, flexibility, execution

1. Introduction

The purpose of this document is to summarize the work developed under an MSc Thesis on Business Process Management Systems. This summary explains all the stages, including the initial proposal and the implementation of the system, followed by the case study analysis.

The main goal was to develop a system capable of managing organizations business processes, and with the ability to communicate with other systems (namely Microsoft Navision (Microsoft Business Soltutions, 2004), an ERP from Microsoft focused in small and medium size organizations).

A process is composed by numerous activities that can be executed in different departments and by different applications, making it impossible to manage its behavior without an appropriate system.

Workflow systems (or Workflow Management Systems), have already some decades of existence, however only now, with the arising of new approaches in Information Systems (IS), there are being appearing solutions capable of fulfill an higher demanding management.

Until some years ago, a system was seen like something isolated from all the rest, responsible for executing some tasks. When Web Services (Leymann, 2002) appeared, they provoked a technological revolution in IS, by making possible different systems to communicate with each other using well defined contracts.

From this point on, new approaches aroused, changing completely the IS paradigm. One of those approaches was SOA (Service Oriented Architecture), where systems publish their services in opposition to the execution of tasks in an independent way.

This new approach enables the creation of different interfaces where different systems can communicate, making possible to develop new systems that are transversal to the whole organization.

BPMS appear in this kind of systems, being able to control and track all the business processes of an organization.

Many organizations don't have any control of their processes, some of them don't even know how they are really being executed (few organizations have their processes documented, and most of them are executed *ad-hoc*).

Therefore, the implementation of a BPMS in an organization makes it possible for the managers and employers to get to know how the organization is really working, and of course, making it possible to redesign those processes in a more efficient and with less risk way. This is called Business Process Re-engineering (Sharp, 2000).

Because organizations are in a constant change, this systems have to provide a very flexible way to design and execute the processes, because even by constructing a process in the same way it is actually being executed, it is very likely to occur some changes as the time goes by.

By flexible, it means providing the appropriate tools for someone who is not an IT expertise, but someone with great business knowledge, to change the behavior of some process, or even to create new processes.

2. Solution Developed

Using the architecture proposed by the Workflow Reference Model (Hollingsworth, 1995), the system developed was structured in three main components: BPM Engine, BPM WebSite and BPM Designer.
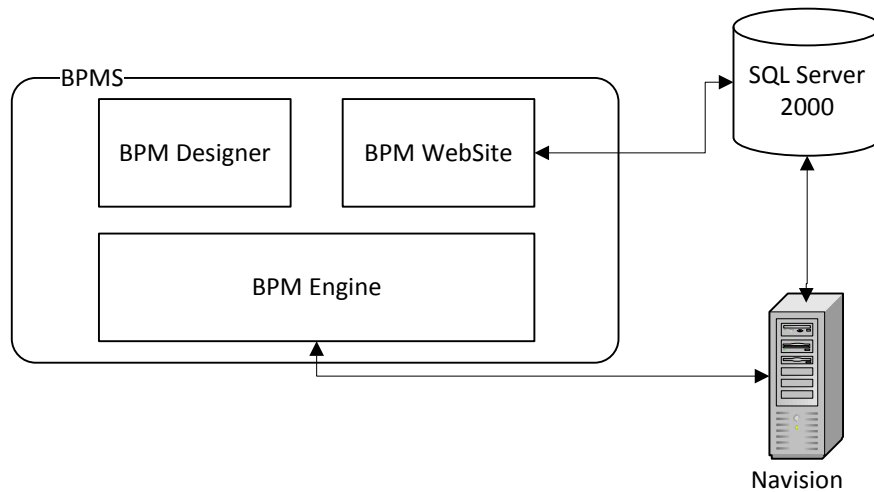

Fig. 1. Main Components

2.1. BPM Engine

The BPM Engine is the component responsible for the execution of the processes. It is here where the business tasks are defined, making it possible to be used during the execution.

The technology used to develop this component was the Windows Workflow Foundation. This tool, is part of the Microsoft .NET Framework (version 3.0), and it offers the main activities, making the development of business processes much easier and simpler.

Business processes can be modeled in two different ways: sequential or state machine. Since business processes are composed by states and events that provoke state transitions, it was chosen the state machine approach.

2.2. Process Definition

One of the main characteristics of a good BPMS is the ability of the system to adapt to the organization, and not the opposite. Business processes keep changing as the organization itself changes.

Therefore, it is crucial that end users may create or change the way processes are being executed, without the need to be an IT expertise.

As so, it was developed an application (BPM Designer) that makes it possible to design a process using drag and drop, of some pre-defined activities.

Beside process definition, it is also desired to configure the user interface in order to execute the process.

2.2.1. Process Definition

The process definition tool is a simple Windows Application, where users can create new processes and change the execution of already existing processes.

With this tool, users have a clear look of how the process is defined, making it easier to detect malfunction behavior and to optimize the process execution.
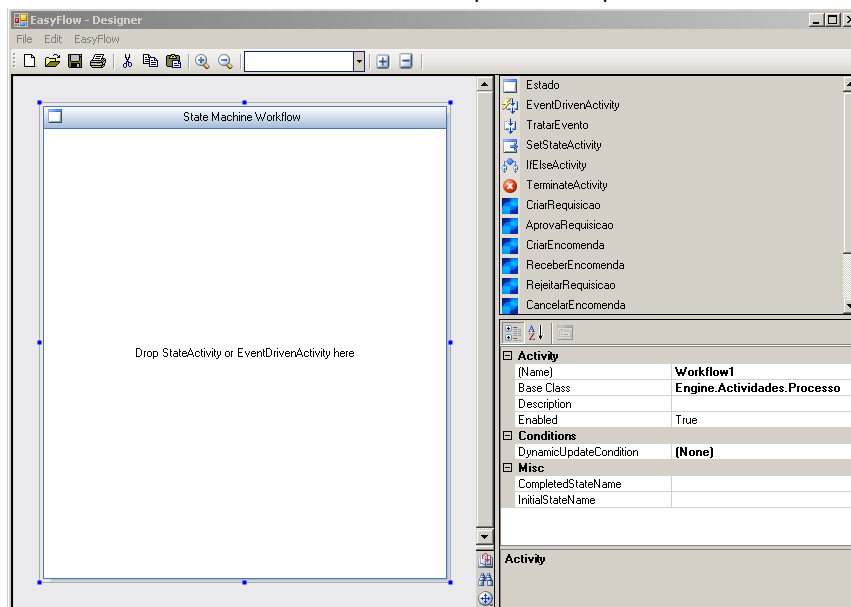

Fig. 2. Process Definition Tool

2.2.2. User Interface

After the process is defined, it is necessary to give the users the interface that will make the process execution possible. Therefore, BPM WebSite offers users with administration rights the possibility to build all the pages that are part of the process execution.

Because processes are made of states and events, the interface of a process will be composed of one web page for each process, and a set of events for each state.

Besides events, users can add to the page all the tables needed to execute the task. This will be explained later in the case study section.

2.3.Rules Engine

Just like process definition, business rules are in constant change, so it is needed to provide a tool that is able to answer those needs, making it easy to define business rules.

There are two types of business rules: authorization and flow execution. The first one decides who is going to execute that task, and the second decides which task will be executed next.
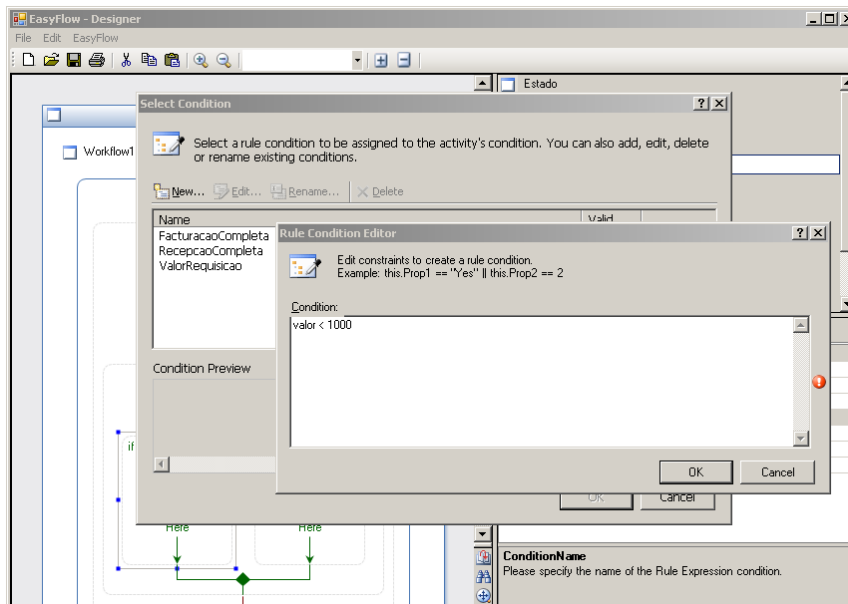

Fig. 3. Business Rules Definition Tool

2.4.Monitoring and Administration

One of the great advantages of a BPMS is that it makes possible to control and monitor all the organization processes, reducing the risk associated with process execution.

Monitoring is composed by two components: observation and control. Observation gives a clear picture of the processes, letting you know what has already been mad and what's left to do.

Control makes it easier to reduce the risk associated with events that were not previewed, providing a set of actions, like changing the state of the process, or even terminate the process.

2.5. Integration

Integration with external applications is an essential part of the system, since most of the tasks execution takes place in those applications.

One of the BPMS goals is to separate the "work" from the "flow", therefore BPMS mission is not to replace ERP's and other systems but to complement them, working as an interface where other systems publish their services.

In this work was used Navision, an ERP from Microsoft that is responsible for all the business logic that is needed in the case study.

The communication is made using Message Queuing, a tool that is responsible for the exchange of messages between the two systems.

The messages are written in Xml, and they carry all the information needed for the task execution.

2.6. User Interface

The user interface of a BPMS has to be very flexible since there can be changes at any giving time.

Just like process definition, user interface may change also. Therefore it is needed to provide the ability to change the user interface in a very flexible way without being needed to program the whole interface every time the process changes.

Another goal was that the interface could be available online. So, it was built a Web Portal that makes possible for the users to configure their own pages in a more personalized way.

The whole user interface was built using ASP.NET (L., 2006) and there were two main components that made it possible to answer the system requirements: WebParts and Personalization.

WebParts can be configured according to the users need. For example, you can have a WebPart that represents a table from the database. You can add it to a web page, and then choose which table you want to be shown.

Personalization makes it possible for one user to have its tables and another user have completely different tables, and an administrator can choose which tables will be common to all users.
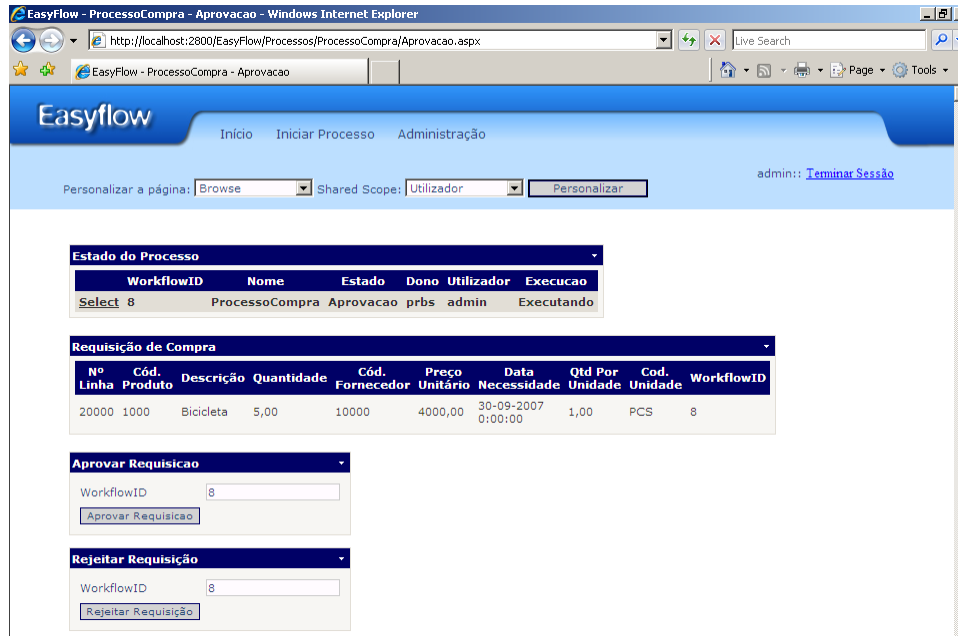
Fig. 4. User Interface

3. Case Study

In order to develop the application, it was designed a simple business process, that could show all the system potential and at the same time use the most common activities in Navision.

It was chosen a purchase process, with one approval level, since it is a process that is common to most of the organizations, and even being very simple and intuitive, it makes it easy to understand the value that a BPMS can bring to an organization.

3.1. Process Description

The process starts with a purchase requisition that is composed by several items to be acquired. Depending on the amount, it can have the need to be approved or it can pass automatically for order placing. In case of rejection the process is terminated. Other way the order is placed and then it waits for the reception of the items.

Once the items are received they have to be validated by the user that ordered them. Then the order is invoiced and paid.
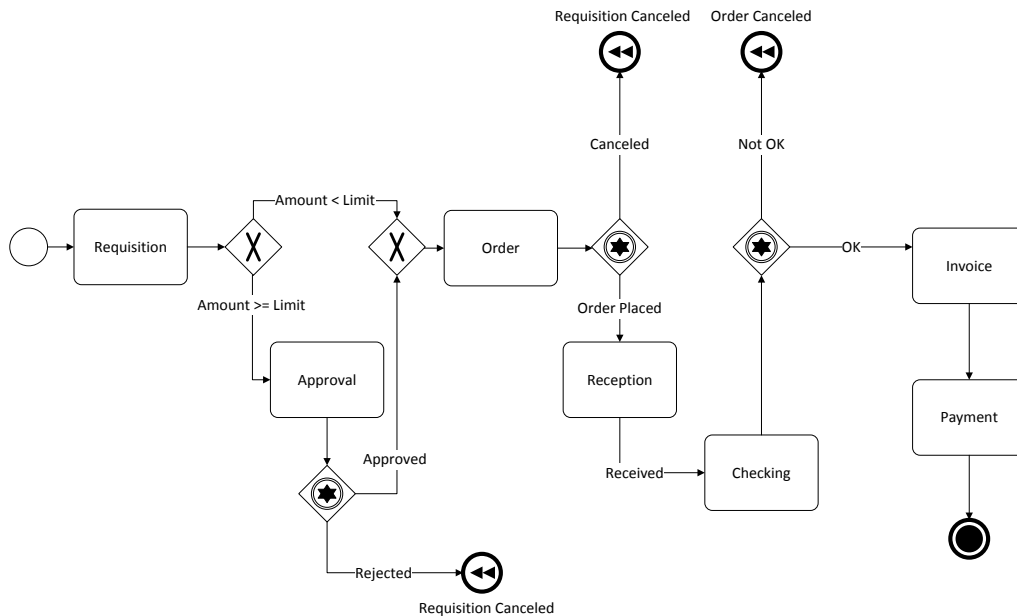

Fig. 5. Purchase Order in BPMN

3.2.Implementation

The implementation of the process is composed by three components: process definition, user interface and integration with ERP.

The first one consists in building the process following the flowcharts and state machines, defining the activities and the business rules.

The user interface makes it possible to build the web pages that will be responsible for the execution of each activity, and to display the business logic needed, as well as the way to fire the events that make the transition to another state.

The integration is responsible for the communication between the ERP (Navision) and the BPMS.

3.2.1.Process Definition

BPM Designer makes it possible to modulate the process using a set of activities, like the definition of the business rules or the activities that will communicate with the ERP.

In every state of the process it is possible designate the user that will execute that task and notify him, once the process reaches that state.

It is also possible to define business rules that will determine the sequence that will be taken. As an example, after the requisition is made, it is possible that the requisition needs to be approved if the amount is higher than some value.
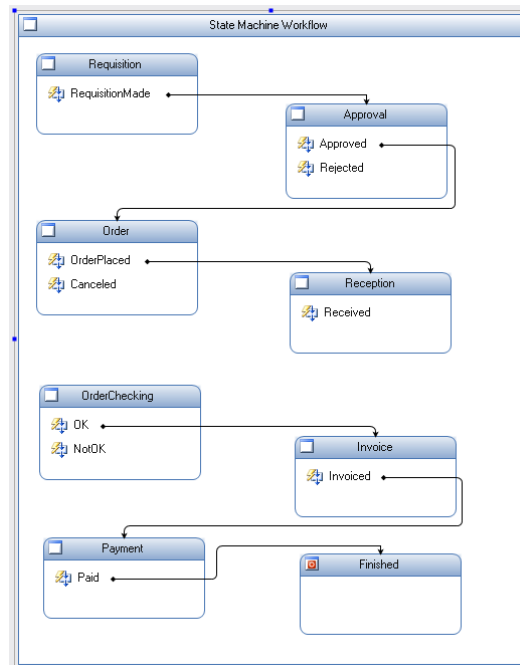
The process will look as follows:

Fig. 6. Purchase Order in the BPM Designer

3.2.2.User Interface

The user interface of each process is composed by: one page for each state, one page for the initial state and a special page that gives information about the status of the process.

The pages may have two components: tables and events.

The tables are responsible for showing the business information, like the Items and their Vendors available. That information is taken from the Navision database.

The events are responsible for the execution of the process making it change its state according to the event fired and its parameters.

3.2.3.Integration

Each business activity is responsible to send to the Navision witch activity needs to be taken and its parameters.

In every part of the process the system is responsible to send a message containing the event and its parameters, and then Navision is responsible for the business logic.

There are three main records that are used through the process: Requisition Line, Purchase Order and Vendor Ledger Entry.

All of those records have associated with them a set of actions that can be taken. For example, when an order is placed for some requisition line, that requisition line is deleted and it is created a purchase order. Navision has a report that is responsible for doing that, so all it is needed is to send the parameters needed and then Navision is responsible for that execution.

4. Conclusion

The initial goals were to develop a system that would be able to manage and control business processes that were executed using Microsoft Navision.

Therefore, the system would be composed by two main components: process management and integration.

The application developed offered most of the tools supported by the vast majority of the most recent applications in this area, such as the controlled execution of processes according to a defined set o business rules, or the ability to track the execution of this processes, either by image or by event logs.

The system was completely coupled with the Microsoft Navision in every part of the process implemented in the case study.

Besides those goals, there were some improvements that took place along the development, like the great flexibility of the system to adapt to an organization, not only in the process definition, but also in the user interface.

So, both of the initial goals were achieved, and even without being implemented and tested in a practical environment, we believe that a tool with these characteristics would be very useful in organizational management.

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