

A survey of open source Workflow Management systems

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Abstract

In the plethora of workflow management systems, both open source and commercial, a detailed analysis of a set of this is very important. In this article we propose a survey of 5 open source workflow management systems based on the analysis of different key aspects. We propose a set of 8 key aspects useful to evaluate the analyzed workflow management systems. These aspects cover the most important aspects of a workflow management systems from the design to the implementation and monitoring of the business process.

Keywords: Business process, Open source, Workflow Management System.

1. INTRODUCTION

A business process is “a set of logically related tasks performed to achieve a defined business outcome”[1]

The automation of a business process is performed by “workflow”. The workflow can be seen as the automation of procedures: documents, information and tasks go between participants based on a set of rules in order to reach a well defined goal [2]

Workflow management system is a system that completely defines, manages and executes “workflows” [3].

The choice of workflow management system is a strategic choice in the definition of the architecture of a new information system because it is the core of the information system that implements business processes. The choice of the workflow management system is a strategic choice also when company decide to adopt a business process approach inside its own information system. The workflow managements system will be configurable and extensible in order to:

- Communicate to other systems internal or external to the company;
- Allows the reuse of the business process already defined and tested in order to achieve several situations.

There are several workflow management systems both commercial and open source.

In this article we focus on open source workflow management systems and we propose a comparative study of several open source products.

We define some key aspects to analyze in order to make a comparative study as possible objective.

The key aspects are related to several aspects of the workflow management systems: its compliant with a notation; its capability to be integrated in the existing

information system and so on. Details about these key aspects are explained in the next section.

We focus on five open source workflow management systems:

- Intalio BPMS [4]
- BonitaSoft [5]
- JBPM [6]
- Activiti [7]
- Camunda [8]

In this section we present in the section 2 the key aspects useful to make the comparison between open source workflow managements systems and in the section 3 we analyze the 5 selected workflow managements systems. In the section 4 we present our conclusions.

2. WORKFLOW MANAGEMENT SYSTEMS CRITICAL ASPECTS

As explained in the previous section we select several aspects in order to analyze the Workflow Management System tools. These aspects coming from common sense and experience about open source platforms and from several experience about research projects that deal with business process management.

The key aspects are:

- **Process editors:** the possibility to design a business process is the first key point for the evaluation of a workflow management system. A workflow Management system must cover all the aspects of a management starting from the design and until the execution, thus it is important to have an integrated editor avoiding to design the business process in a third party tools and after to import it in the workflow management system.
- **Presence of API:** the presence of API is important in order to customize and enhance the way to use the business process and to execute tasks. For example, the use of API will allow starting and executing a business process directly from the web application and not using the console integrated in the workflow management system. Another important use of API is to customize the worklist or to build a specific user interface for task execution.

- **Presence of connectors:** connectors are very important in order to connect the workflow management system with already existing application. Very often, a workflow management system will be integrated in a pre-existing information system and thus it is very important to have the possibility to connect with other information systems with low effort.
- **BPMN 2.0 compliance:** BPMN 2.0 is a standard in the design of the business process [9]. Business process analyst are skilled in the BPMN notation and thus it is useful to provide a tool that support the designer in the complex task of design a business process.
- **Fast Prototyping:** the possibility to see a prototype of the application that support the business process design and to understand if the designed business process meet the users' requirements is a very important aspect in the selection of the workflow management system tools.
- **Possibility to modify the generated application:** to have the possibility to modify the generated application in order to obtain the application to provide to the final user is a very interesting aspect in the selection of the workflow management system tools because allows to reduce the development effort.
- **Monitoring of the process:** the workflow management system need to have tools useful to monitor the business process in order to understand if there are some critical aspects during the execution of the business process.
- **Possibility to modify the source code of the engine:** often for specific implementation, it is important to modify the source code of the engine in order to answer to specific needs.

3 WORKFLOW MANAGEMENT SYSTEMS

In this section we analyze the selected workflow management systems.

3.1 IntalioBPMS

Intalio is an Open Source Workflow Management System for the management of the business process.

It is independent of any other proprietary technology and provides all the components useful for the design, deployment and management of complex business processes including business activity monitoring, rules management, document management and system integration. Intalio also has a tool for the management of web applications. Intalio is created to be used by business users who will have access to a business process management platform.

In order to have an application aligned with the business process it is important that IT experts will customize the obtained business process and to configure the system.

The Intalio engine is a BPEL open source engine named Orchestration Director Engine (ODE). It provides a complete support to all BPEL version and thus it can play with BPEL code coming from other systems. Intalio supports also BPEL4People.

Intalio has a business process editor that support BPMN. The editor provides the ability to make the documentation for the business process and to export the design in image format. The editor is based on Eclipse and able the designer to define the business process and to use already defined business process in new business process.

Intalio includes a form editor useful for the design of the form that support the business process execution starting from the business process design already defined. In order to modify the generated form, it is important to have the support of IT experts and it is not a task that business analyst can take without IT expert help.

Intalio allows to interact with other systems using web services. It allows to integrate in the business process user query. Intalio has the API useful to manage and to change the designed business process but Intalio does not have the possibility to customize the engine.

Intalio supports the business process monitoring made up using a specific Dashboard editor that allows to define and to monitor the key performance indicator. The Dashboard is customizable.

3.2 BonitaSoft

Bonita is able to combine three solutions in only one.

Bonita is characterized by the speed with which it is possible to create applications based on business process processes and is oriented to business users who can manage independently and without the help of experienced users their business process, from design to implementation

The Bonita architecture is oriented to the services. Bonita has a set of API useful to integrate the engine with application implemented using Bonita or other custom application. Bonita engine has a set of connector that allow to integrate the business process with other applications.

The main engine characteristics are:

- Stable and solid engine that also allows you to run multiple process instances simultaneously;
- Native support for BPMN 2.0 modeling and execution of business processes;
- Highly scalable Bonita BPM Engine can be used in different contexts, from simple processes at the departmental level to the most critical processes with deployment across the enterprise;
- Use asynchronous execution to prevent blocking of instances of the process caused by pending operations;
- APIs available include EJB2, EJB3, REST API and Java-based, for custom application development and easy integration;
- Assigning tasks to users based on roles
- Bonita BPM Engine is a fully transactional, that groups of calls and the definition of units for error handling;

- It is possible to access processes also from smartphones and tablets;
- Allows to create process simulation using parameters such as cost, time and resource consumption.

Bonita allows to manage business process design versioning in order to facilitate the design phase.

The editor has export features in several image format in order to address documentation task.

The editor checks the design in order to check for the compliant of the business process design with BPMN notation.

Bonita has API useful to customize application and has several connectors that allow to extend the framework with an external application. There are more than 100 connectors for open source and proprietary systems. There is a tool for the development of the connectors.

Bonita has tool for the business process monitoring both for the real time monitoring and for the definition and analysis of the Key performance indicator. It is possible to define Key Performance indicator in any point of the system and to monitor them inside a dashboard.

Using Bonita Portal, it is possible to obtain the web application that allow the user to execute business process. The obtained web application is a light application useful to integrate in existing company portal. The interface for the user is like "inbox" but it is possible to modify this interface through a specific customization.

3.3 jBPM

jBPM 6.0 is a flexible Workflow Management System (WFMS) Suite based on BPMN 2.0 notation. It makes the bridge between business analysts and developers. Traditional workflow engines have a focus that is limited to non-technical people only. jBPM has a dual focus: it offers process management features in a way that both business users and developers like it.

jBPM has several features and tools able to design and execute the business process. The jBPM tools manage the complete business process lifecycle: design and deploy, runtime management (test and debug) to trace the execution parameter, reporting, The main tools of jBPM environment are:

- Web-based process design tool that allows to the designer to model the business process using graphical and intuitive interface and that allows to simulate the process execution. The designer has a customizable design palette and provide the capability to explore the several elements of the model such as the organization units, repository, projects and files (project explorer).
- Data modeler allows the creation of data model that will be used in the business process solution;
- Form modeler allows the designer to create web forms that the final user will use when he/she execute the business process. The creation of the web form doesn't need technical skills; thus, the form modeler could be used by process analyst but also by software

developer that could customize the layouts and the behaviors of the modeled web forms;

Moreover, the suite allows to the software developer to create specific dashboards and reports for the final user. Also the jBPM provides a full support to the persistent data (based on Java Persistent API[10]) and to the transaction (based on Java Transaction API[11]). The main developer framework such as Maven, Spring, OSGi,.. are integrated in the design tool.

The runtime management of the business process is based on two tools: Process Instance (that shows the list of the process instance in execution and shows the specific status of an instance) and the Task Management (that allows to the final user to see and to complete his/her assigned tasks). The Business Activity Monitoring was created to allow the no-technical designer to create corporate dashboard. This tool is a graphic tool that allows to customize predefined dashboard and to create graphical representations of business indexes.

jBPM provides a full support to the manual activities through a specific design element called Human Task. The HumanTask allows to model specific properties such as:

- **Actors:** This property describes who has to do the manual task;
- **Group:** It describes the group of the users that have to complete the manual task;
- **DataInputSet:** It describes all the input variables to the task;
- **DataOutputSet:** It describes all the output variables to the task;
- **Assignment:** It describes the data mapping;
- **Content:** It describes the information connected to the task;
- **Priority:** it is the priority level of the task;

jBPM integrates a powerful tool of process simulation based on Drools [12] and a graphical interface to view and understand the data collected during the simulation. The simulator provides also a complete timeline of the execution of the process that includes all the specific simulation events and data.

3.4 Activiti BPMN 2.0

Activiti BPMN 2.9 is an engine to manage the business process used inside the Alfresco Framework [13]. Activiti is open-source based on Apache license. Activiti is been projected to provides a full support to Java developer and its architecture minimizes the required resources. Activiti has no user interface tool. Its main components are:

- **Activiti Engine** – it is the core of the activiti project. The engine can be used in any java project and integrated in any java framework (Spring, JTA). It allows a complete system scalability also in cloud

environment. Moreover, it has a complete implementation of Java Persistence API and Java Transaction API. All the modelled process can be tested using Java Unit Test.

- **Activiti Modeler** – It is a web based editor. It models the business process and stores the process in a specific directory on the server.
- **Activiti Engine Designer** – it is an Eclipse plug-in that could be used to create the model of the process in BPMN2.0 notation. This tool allows to add more details to the business process model. For this reasons, the Activiti suggests to use the Modeler to design the process without many detail and the Designer to model the specific information.
- **Activiti Explorer** – It is the web-based monitoring console. It allows the users to know the assigned tasks.
- **Activiti Probe** - Activiti Probe is a web application that provide the possibility to monitor and to manage the business process execution. Also provide tool to add an instance of the process and to make it executable. This application is oriented to the expert that manage the system that has the task to guarantee that the system always works. This application allows to have important information from the system such as the time need to execute a task or a process.
- **Activiti Cycle** - Activiti Cycle is a web based application that improves the collaboration in the company. Allows to obtain a BPMN 2.0 code starting from processes made up by Activiti Modeler

3.5 Camunda

Camunda is a java-based framework for the business process automation. The Camunda process engine is a java library for the business process execution.

The process engine uses POJO technology and it uses a relational database to implement the persistence.

A ORM mapping is provided by mybatis framework [14]. There is the possibility to integrate the process engine with a Spring Framework, Contexts and Dependency Injection in Java EE and an integration with the server infrastructure of the application (Runtime Container).

In addition to the process engine, Camunda has the **camunda Modeler** (an eclipse plugin for the process design) and the **camunda-bpmn.js** (a JavaScript framework for parsing, rendering and execution of the BPMN 2.0 process described in XML format).

The management of the users and the management of the flow is made up using the web application Tasklist. There is in addition the Camunda Cockpit a web application useful to monitor and to manage the business process instances.

Camunda can be used both in a standalone mode or it can be integrated inside java application. There are a set of java API that allow a simple and quick integration with

the Camunda engine. Camunda allows a set of services for developers:

RepositoryService: it manages deployment of package and process definition

RuntimeService: allow to start new process instance, to obtain new process variable, to query the business process during execution

Task service: allow to make query about task assigned to users or group, to create new task, to manage users that have a specific task

IdentityService: allow the management of groups and users. It is possible to use this service with LDAP, active directory and so on;

FormService: add to the Camunda the start form (the form that the user can see before the business process start) and task form (the form that helps the user to complete a form task).

4 CONCLUSION

This article allows to understand some key aspects of the analyzed open source workflow managements systems.

A comparison analysis about tools allow us to observe that Bonita is oriented to the business analyst and does not require a collaboration effort with IT expert. Other tools are oriented to the technical user (Activiti and Camunda) or to business expert with a constant support to the technical user (jBPM and Intalio).

All the analyzed workflow management systems have API in order to integrate with other systems. The presence of API is an important aspect because provide the possibility to extend the workflow management system. Each analyzed tool has API that allows to customize several aspects of the implementation:

- Activiti and Camunda has API useful to modify the workflow engine. It is clear that this functionality is oriented to IT expert that are able to modify source code.
- jBPM has both API for IT expert and API for non-expert. It is possible to modify both the source code of the workflow and the source code of the generated application.
- Bonita has both API to interact with system and the concept of connector that is a software component that can be designed and developed in order to extend the tool with other external application.
- Intalio uses web service in order to connect with external application and has the API but it is no possible to interact with the engine.

Another aspect is the possibility to customize the user interface of the generated application. Bonita is different from other tools because has an advanced fast prototyping tool that allows to modify the generated prototype. Intalio allow the customization of the generated application but is not a fast prototyping tool. In Activiti, Camunda and jBPM there are not fast prototyping tools.

All analyzed tools have had a design tool compliant with BPMN notation and the generated file will be open using an XML editor. Activiti and Intalio has a specific web interface useful to add technical detail to the business process design and this is the proof of a strength orientation to the technical user and not to the business analyst. Intalio, Bonita and jBPM has a web form editor useful to design the final web application.

jBPM is oriented both to the business expert and to the IT expert and it offer a full web based workbench.

All the Workflow Management Systems tools has a suite to monitor business processes.

Only Camunda and jBPM allow to download the source code and it is possible to compile the source code. Both workflow management systems have a good support service. jBPM has an open community with several active users.

In the table 1 there are is a summary of the characteristics of the analyzed software related to the critical aspects defined in the section 2.

Table 1: Summary of the analyzed tools

	Intalio	Bonita	jBPM	Activiti	Camunda
Process editors	Oriented to business expert with support of IT expert	Oriented to business expert	Oriented to business expert	Oriented to IT expert	Oriented to IT expert
Presence of API	Non-expert user (it is not possible to modify engine)	It expert	IT expert and Business expert	IT expert (it is not possible to modify only the engine)	IT expert
Presence of connectors	Available	Available	Not Available	Not Available	Not Available
BPMN 2.0 compliance	Compliant	Compliant	Compliant	Compliant	
Fast Prototyping	Yes but with the support of IT expert	Yes	Yes but with the support of IT expert	Yes but with the support of IT experts	Yes but with the support of IT expert
Possibility to modify the generated application	Yes	Yes	No	No	No
Monitoring of the process	Yes – oriented to the business expert	Yes – oriented to the business expert	Yes – oriented to the business and IT expert	Yes – oriented to the IT expert	Yes – oriented to the IT expert

Possibility to modify the source code of the engine	--	--	YES	YES	YES-active support from the community
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