2007

Workflow Engine for Enterprise Process: System Integration via XML Web Service

Pobsit Kamolvej
Computer Science Department Kasetsart University

Phaophak Sirisuk
Computer Engineering Department Mahanakorn University of Technology

Kolasak Tungchitipunya
Computer Science Department Kasetsart University

Follow this and additional works at: http://scholarworks.lib.csusb.edu/ciima

Workflow Engine for Enterprise Process: System Integration via XML Web Service

Pobsit Kamolvej
Computer Science Department
Kasetsart University, Bangkok, Thailand
Pobsit.k@ku.ac.th

Phaophak Sirisuk
Computer Engineering Department
Mahanakorn University of Technology, Bangkok, Thailand
phaophak@mut.ac.th

Kolasak Tungchitipunya
Computer Science Department
Kasetsart University, Bangkok, 10900. Thailand
kolasak.t@hotmail.com

ABSTRACT

To understand the impacts of business process change or organization restructure though the workflow technology, many enterprises attempt to apply imported software package to manage organization's processes. This includes not only the Enterprise Resource Planning (ERP) but also the Human Resource Management (HRM). Apparently, workflow management is necessary for the organizations to efficiently handle each business transaction. Besides, it also helps employees to understand their own working process in the same direction. Limitation of the imported software package that neither supports the workflow management nor any business processes adaptation.

In this paper, we propose the workflow application for resource organization. The application is a design tool that allows users to create standard workflows, which automatically adjusts parameters of the software package. It is developed using web- services technologies that facilitates multiplatform operation. The proposed research work is a joint project between academia and a consultant company. It is anticipated that the proposed tool can efficiently ease the previous limitations.

INTRODUCTION

In recently year, the software architecture in an enterprise environment has been a challenge to dynamic and cost-effective requirements of the market. To this end, the development of a reliable system with appropriate technologies is vital. Many enterprise attempts to manage their organizations based upon their business processes. Besides, related policies are issued to control data flow and work processes. Reference 6: (Sarkis J., Talluri S., 2004); it is found, however, that their management is still inefficient. Leading software packages can be employed to solve the problems in terms of process standardization, applying best practice, and shortening time for implementation. Currently, there exists wide range of the packages covering essential functions such as Production Planning, Logistic Management and Human Resources Management (HRM).

Although the best practice case and standard software can be applied, implementation of the system in most organizations still needs customization of both business process and software itself. Today, an Enterprise Resource Planning (ERP) system is commonly used in many organizations. Reference 4: (Coest and Lankhprst, 2004); it can significantly improve processes planning and managing resources of the organizations. Each ERP module is responsible for a specific function, such as Human Resource (HR), financial, marketing, etc., that is consistent to the business process the organizations reference 8: (T. Davenport, 1998).

Of interest especially nowadays is the HR system that is important in modern organizations. The system is a key module in ERP that keeps the personnel data and controls the level of an employee. In addition, it contains the data that is used to adjust potential and track performance of the employee. The information from the HR system is sent to other modules for processing. The HR system manages the system knowledge to be updated with a new technology. Moreover, it facilitates organization strategic planning in HR management. In particular, it determines an appropriate qualification for each position and allocates an optimal man-power for present and future work-load. Besides, it defines the tendency of practice and utilizes the human resource in the most beneficial way for the organization. The application assists in determining the standard of personnel data in the organization. For example, an organization, which has several offices, may use the system to strengthen the efficiency in working process each office and announce the welfare details to all of employees in the organization.

So far, many organizations have attempted to design and develop workflow that suits their own work so that theirs employees can understand the business process in the same direction through the software package. However, changes in the business process or organization restructuring regularly affects the workflow. Most software packages do not support the management of workflow and business processes. Most importantly, change in any division will always have an impact on other divisions in organization.

Therefore, this paper presents the development of application-software for applying in a Process Engine of the Human Resource system. The application is a middleware used for communication among related working processes in all the sections of the organization. Reference 2: (Smith, O'Brien and et al., 2002); the employee can conveniently and quickly define the "work flow" from this tool. As a consequence, it leads the executive, employee, system analyst, and system developer to understanding the working processes in the same direction.

WEB SERVICE

Web service has established itself as a popular "connection technology" for implementing a Service Oriented Architecture (SOA), these services can communicate with each other system in multiplatform together. Web services are defined as a platform and implementation independent software component that can be reference 6: (Krishnan, Wagstrom and Laszewski, 2002):

- Described using a service description language
- Published to a registry of services
- Discovered through to the standard mechanisms
- Invoke to a declare Application Programming Interface (API)
- Compose with other services

The well-defined interface required for services is described in a Web Service Description Language [6] (WSDL) file. Service exposed as Web Services can be integrated into complex application which may span multiple domains and organizations.
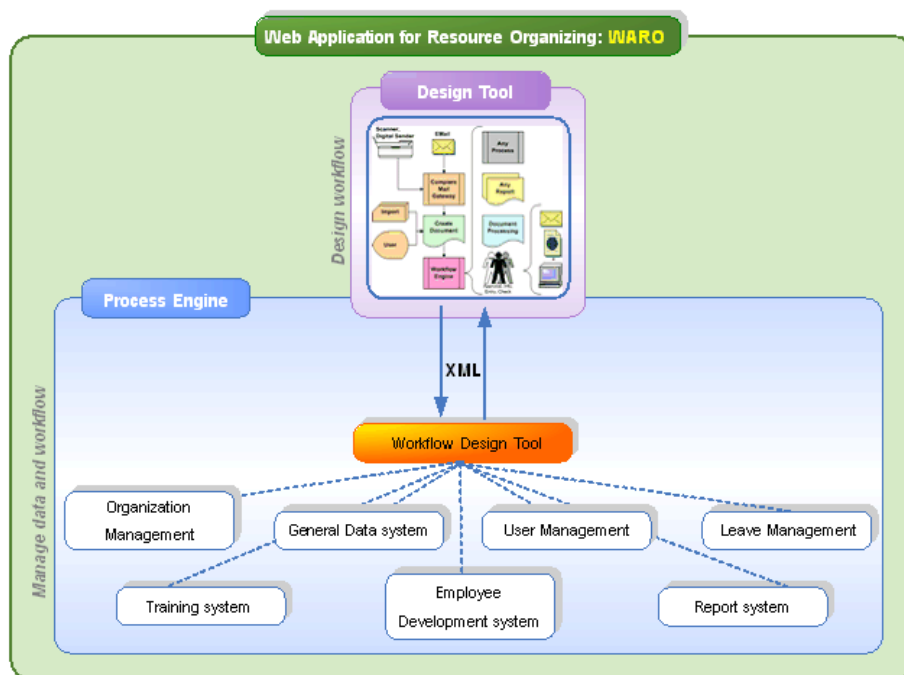
WORK FLOW

In Reference 5: (Kammer, Bolcer, Taylor and Bergnam, 2004), Kammar stated that "the unpredictability of the business processes requires workflow systems supporting the exception handling with the ability to dynamically adapt to the changing environment". A workflow is defined as the automation of procedures where documents, information, or tasks are passed between participants according to a defined set of rules to achieve, or contribute to, an overall business goal. Because of the culture change in workflow, orchestration is essential with stronger consideration being given to data dependencies of participating services during design. Traditional approaches to handle this problem have fallen short, providing support for the change, particularly once the process has begun execution. Dynamic workflows often need to be complemented with execution support at runtime, such as dynamic scheduling, dynamic resource (i.e. data) binding, and infrastructure reconfiguration. These constrain demand flexibility in a workflow language. Traditionally, workflows were solely designed to call different Web Services in a static manner base on their operation semantics only.

CONCEPTUAL FRAMEWORK

Workflow Application for Resource Organizing (WARO) is developed for generating work flows, information exchange among the system and data format standardization. The solution assists all participants. For example, business consultants can adjust, correct and understand the impact of the process changing, the executives can gather the impacts and consequences for their decision, each officer can easily realize and have the same idea on how their work is progressed in structural, evolving responsibility, and also what procedure will be the next. Reference 1: (A. Oberweis, 1996); by defining the processes, specific the functional for each and tilting all together, the tool will automatically correct the effected information, exchange and justify format for each system via the standard protocol. The tool has been separated into two parts of development. These are a Design tool and Process engine as shown in Fig 1. This application also supports the connection with other systems to cooperate the information between them.

**Figure 1: Data communication between Process Engine and Design Tool in the system.**

Design Tool

Design Tool is developed in the form of a web base application which used as tool for design the workflow diagram in business process and generates the workflow definition that sent to Process Engine.

Process Engine

Process Engine manages the connection between the application and workflow to control the business process in step of workflow line which depends on the organization policy as shown in figure 2.

Figure 2: Leave workflow diagram.
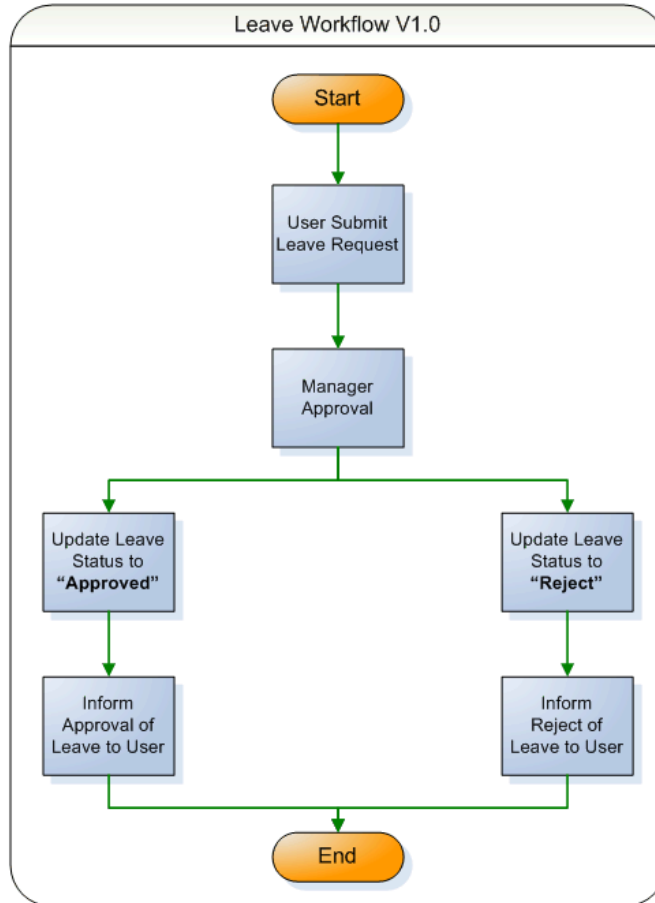

METHODOLOGY

In this section, we study the process of the Workflow Application for Resource Organizing (WARO). In the part of Design Tool, we separate it into four modules. Firstly, WARO Data Access Library connects information between the system file and database. This information is received by WARO Data Sender and is sent to WARO Design Tool for designing the workflow definition by Managing Director. Finally, it is sent to Process Engine by WARO Workflow Service.

Figure 3: Design Tool Component.
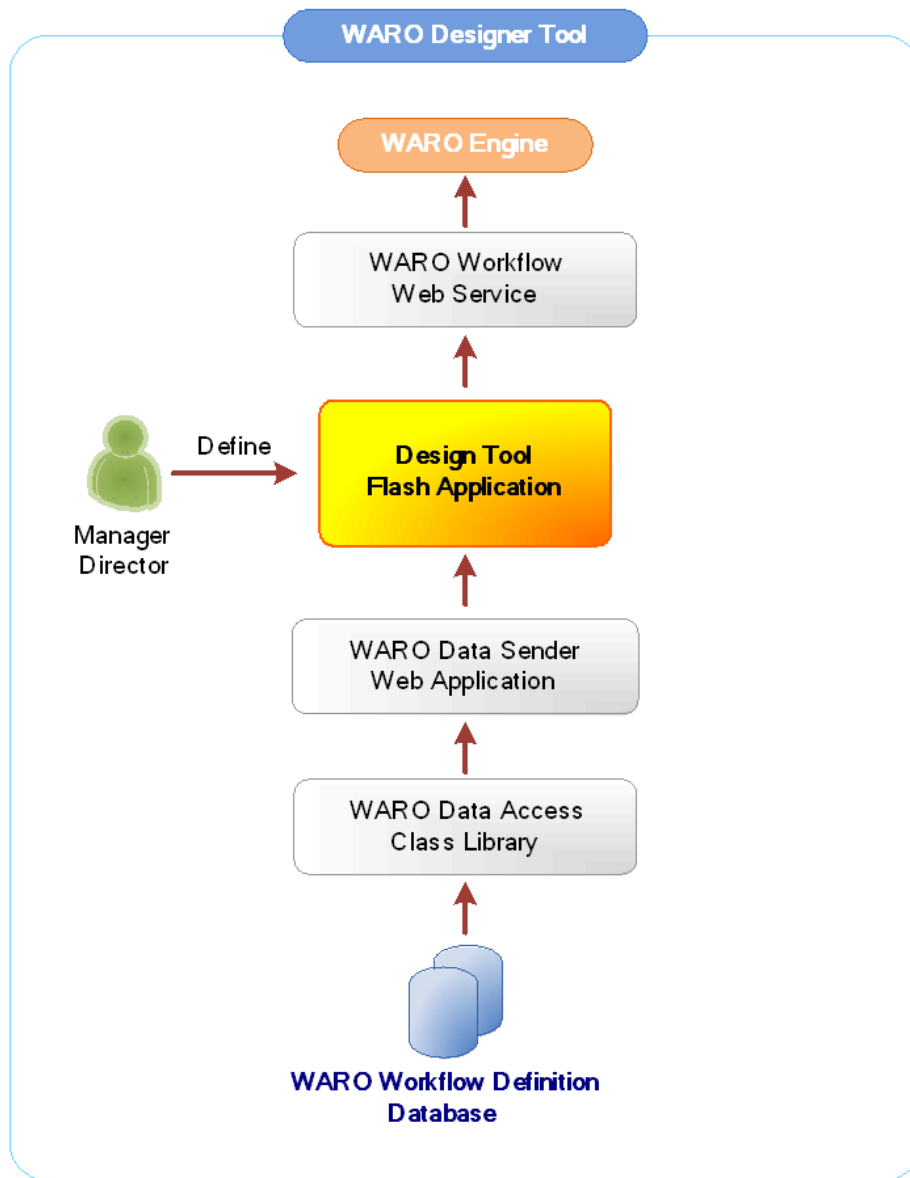
Workflow Application for Resource Organization (Process engine) separates in two parts. There are WARO Application and WARO Process Engine. WARO Application manages application data and basic data which depend on organization policy. WARO Engine controls activity flow by checking what activity done or not and what activity should be next as shown in Figure 4.

Figure 4: Process of WARO Process Engine.
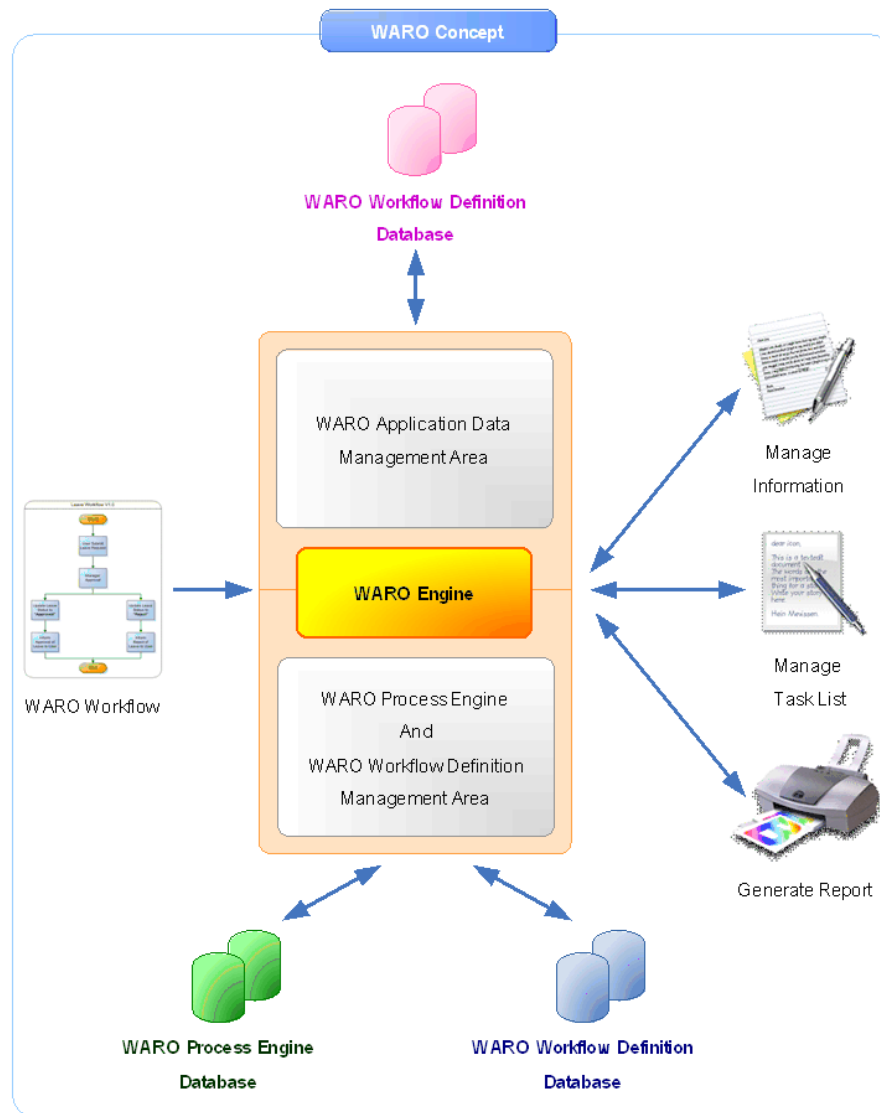
Furthermore, WARO Engine is able to record workflow detail from user. Data recorded by WARO Engine is important because it can be used for checking and searching about Workflow detail.

For the completion of two systems, the design of their working-efficiency is separated into two parts which are quite dependent. The database has two parts for organizing its own data in each system. Although there is less reference for two systems but it has the relationship between them that is able to define format by the rule and the policy of organization. The objective of design is the system able to work accuracy and appropriate for achieve in the goal of organization.

EXPERIMENTAL RESULTS

In this section, we present experimental result for Workflow Application for Resource Organization. We implement XML reference 11; Web Service technology reference 9; that connects system in multi-platform together. Then, it also combines with workflow technology to manage business process of standard software package that didn't support the process changing or organization restructure. First, we design workflow to define business process. Reference 3: (Casati, S.Ilnicki, et al., 2000); the system will generate XML data set from workflow for making process

done automatically reference 10;. Finally, the organization's employee able to work follows the adaptation to understand their business process in the same direction and decrease impact to other division in organization.

Figures 5-6 shows the graphic user interface for design workflow by drag and drop. The workflow is generated able to send automatically to Process Engine.

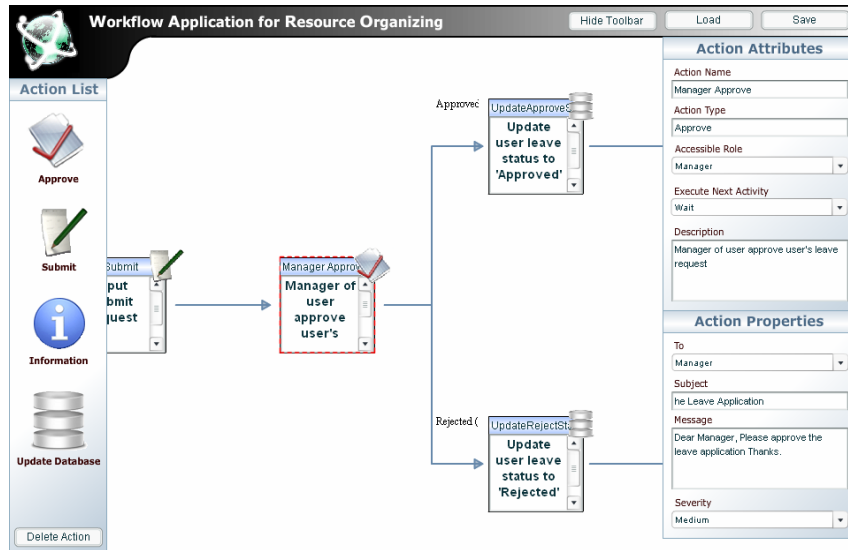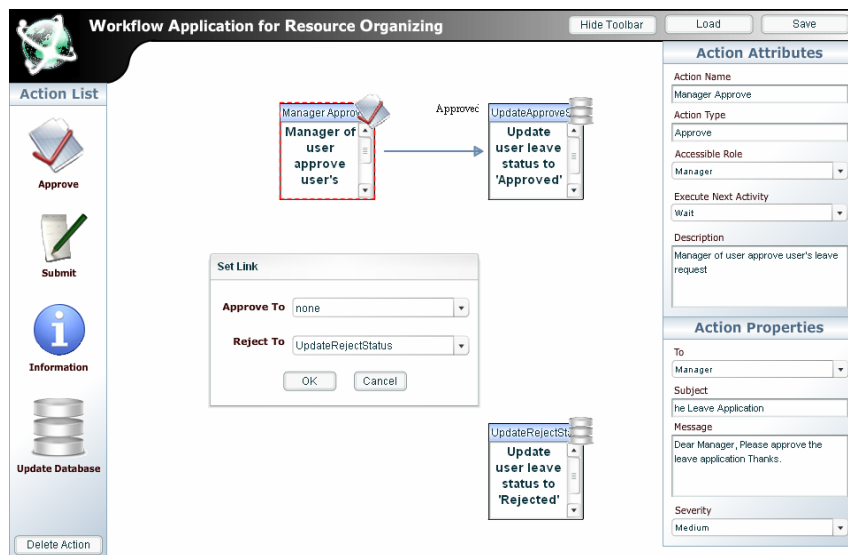**Figure 5: Graphic User Interface of Design Tool.**

Figure 6: User Interface of Design Tool in workflow's property.

After already design workflow, system will deploy workflow and generate data into the database system.
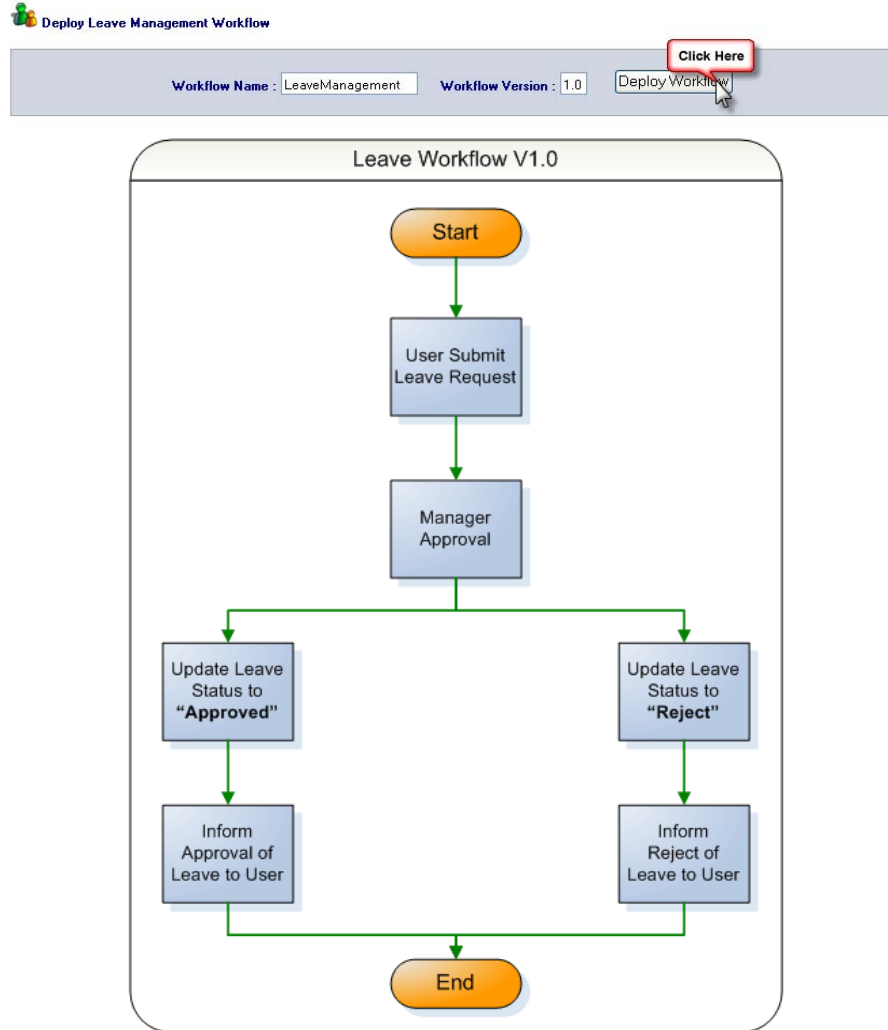
Figure 6: Sequence of deploying workflow.

Figure 7: Sequence of deploying workflow.

Table Name : WARO_WORKFLOW , All **1** records

Workflow Name	Workflow Version	Last Modified
LeaveManagement	1.0	23/9/2549 14:19:04

Table Name : WARO_ACTIVITY , All **6** records

Workflow Name	Workflow Version	Activity Name	Activity Type	Role	Require do next Activity	Activity Description	Last Modified
LeaveManagement	1.0	AddLeave	Submit	WAROUser	Wait	User submit leave request	23/9/2549 14:19:04
LeaveManagement	1.0	ManagerApprove	Approve	Manager	Suddenly	Manager of user approve user's leave request	23/9/2549 14:19:04
LeaveManagement	1.0	UpdateApproveStatus	UpdateDatabase	Manager	Suddenly	Update user leave status to 'Approved'	23/9/2549 14:19:04
LeaveManagement	1.0	UpdateRejectStatus	UpdateDatabase	Manager	Suddenly	Update user leave status to 'Rejected'	23/9/2549 14:19:04
LeaveManagement	1.0	InformApproveStatus	Information	Manager	Suddenly	Inform 'Approved' of user's leave	23/9/2549 14:19:04
LeaveManagement	1.0	InformApproveStatus	Information	Manager	Suddenly	Inform 'Approved' of user's leave	23/9/2549 14:19:04

Table Name : WARO_PROPERTIES , All **6** records

Properties ID	Workflow Name	Workflow Version	Activity Name	Last Modified
ec4dacca-d34a-db11-90de-00016ccfa24c	LeaveManagement	1.0	AddLeave	23/9/2549 14:19:04
ef4dacca-d34a-db11-90de-00016ccfa24c	LeaveManagement	1.0	ManagerApprove	23/9/2549 14:19:04
f54dacca-d34a-db11-90de-00016ccfa24c	LeaveManagement	1.0	UpdateApproveStatus	23/9/2549 14:19:04
f84dacca-d34a-db11-90de-00016ccfa24c	LeaveManagement	1.0	UpdateRejectStatus	23/9/2549 14:19:04
fb4dacca-d34a-db11-90de-00016ccfa24c	LeaveManagement	1.0	InformApproveStatus	23/9/2549 14:19:04
014eacca-d34a-db11-90de-00016ccfa24c	LeaveManagement	1.0	InformApproveStatus	23/9/2549 14:19:04

Table Name : WARO_PROPERTY , All **15** records

Activity Name	Properties ID	Property Name	Property Value	Last Modified
AddLeave	ec4dacca-d34a-db11-90de-00016ccfa24c	Target Database	Application Data	23/9/2549 14:19:04
ManagerApprove	ef4dacca-d34a-db11-90de-00016ccfa24c	Severity	Medium	23/9/2549 14:19:04
ManagerApprove	ef4dacca-d34a-db11-90de-00016ccfa24c	To	Manager	23/9/2549 14:19:04
ManagerApprove	ef4dacca-d34a-db11-90de-00016ccfa24c	Subject	Approve the Leave Application	23/9/2549 14:19:04
ManagerApprove	ef4dacca-d34a-db11-90de-00016ccfa24c	Note	Dear Manager, Please approve the leave application Thanks.	23/9/2549 14:19:04
UpdateApproveStatus	f54dacca-d34a-db11-90de-00016ccfa24c	Target Database	Workflow Engine	23/9/2549 14:19:04
UpdateRejectStatus	f84dacca-d34a-db11-90de-00016ccfa24c	Target Database	Workflow Engine	23/9/2549 14:19:04
InformApproveStatus	fb4dacca-d34a-db11-90de-00016ccfa24c	Severity	High	23/9/2549 14:19:04
InformApproveStatus	fb4dacca-d34a-db11-90de-00016ccfa24c	To	Sender	23/9/2549 14:19:04
InformApproveStatus	fb4dacca-d34a-db11-90de-00016ccfa24c	Subject	Your leave application has been approved	23/9/2549 14:19:04
InformApproveStatus	fb4dacca-d34a-db11-90de-00016ccfa24c	Note	Your leave application hase been approved. Best Reguard.	23/9/2549 14:19:04
InformApproveStatus	014eacca-d34a-db11-90de-00016ccfa24c	Severity	High	23/9/2549 14:19:04
InformApproveStatus	014eacca-d34a-db11-90de-00016ccfa24c	To	Sender	23/9/2549 14:19:04
InformApproveStatus	014eacca-d34a-db11-90de-00016ccfa24c	Subject	Your leave application has been rejected	23/9/2549 14:19:04
InformApproveStatus	014eacca-d34a-db11-90de-00016ccfa24c	Note	Your leave application hase been rejected. Best Reguard.	23/9/2549 14:19:04

Table Name : WARO_LINK , All **5** records

Workflow Name	Workflow Version	From	To	Condition	Description	Last Modified
LeaveManagement	1.0	AddLeave	ManagerApprove			23/9/2549 14:19:04
LeaveManagement	1.0	ManagerApprove	UpdateApproveStatus	Approve		23/9/2549 14:19:04
LeaveManagement	1.0	ManagerApprove	UpdateRejectStatus	Reject		23/9/2549 14:19:04
LeaveManagement	1.0	UpdateApproveStatus	InformApproveStatus			23/9/2549 14:19:04
LeaveManagement	1.0	UpdateRejectStatus	InformApproveStatus			23/9/2549 14:19:04

Step of working is in line with workflow. An employee wants to create leave process. He able to retrieve all his leave data after that it is sent to his manager. When manager receive it, he will approve or reject and send back to the employee. It is shown in Figure 8 to Figure 10.

Figure 8: Leave data sent to manager.

Figure 9: Manager must approve or reject request.

Figure 10: Approve or reject data sent to the employee.

SYSTEM INTEGRATION

The researcher cooperates with the IT consulting firm to develop the application to solve the problems existing in the standard software package. Previously, changes in the business process severely affect the standard software package, especially when the new requirement arises and is not supported by the package. The software package will cause impact to many operations and departments. Thus, we attempt to implement WARO to the human resource application of the organization to manage the workflow and business process. It also manages business process changing or organization restructure successfully instead of the workflow of standard software package. In the future, full-scale implementation such as realizing software that runs asynchronously for powerful responding in a multi-user system, limiting number of active users per activity in each workflow while executing their activities in workflow, will provide more security on the module.

CONCLUSION

In this paper, development of workflow application and design tool for Workflow Application for Resource Organizing (WARO) has been presented. The aim is to assist the human resource and organization process by generating the workflow software tool which has been separated into two parts that consists of workflow application and design tool. The IT consulting firm that has implemented WARO in the company also well defines the business process through the workflow and solves the standard software package problem. The employee who works in each part of organization should understand the process, policy and workflow in the same direction through the application which operates follow by define activities step from workflow design tool. This application is the centre of communication for all employees. The executive or head of human resource department able to design workflow by using tool in the application as rapidly, reliably and conveniently.

REFERENCES

A. Oberweis. (1996). An Integrated approach for the specification of processes and related complex structured objects in business applications. *Decision Support Systems*, vol.17

Dennis Smith, Liam O'Brien, Mario Barbacci, Francois Coallier. (2002). A Roadmap for Enterprise Integration. step, 10th International Workshop on Software Technology and Engineering Practice

F. Casati, S.Ilnicki, L.-J. Jin, V. Krishnamoorthy, and M. C. Shan. (2000). Adaptive and dynamic service composition in eFlow. Proc. Of the International Conference on Advanced Information Systems Engineering (CAiSE), Stockholm, Sweden.

H. ter Coest and M.M. Lankhprst. (2004). Tool Support for Enterprise Architecture – A Vision. Telematica Institute, Enschede, 2004.

Peter J.Kammer, Gregory Alan Bolcer, Richard N. Taylor, Mark Bergnam. (2004). Techniques for Supporting Dynamic and Adaptive Workflow. Computer Support Cooperative Work (CSCW)

Sarkis J., Talluri S. (2004). Evaluating and selectione-commerce software and communication systems for a Enterprise. *European Journal of Operation Reseach* 159.

Siram Krishnan, Patrick Wagstrom and Gregor von Laszewski. (2002). A Workflow Framework for Grid Services. Technical report, Argonne National Laboratory.

T. Davenport. (1998). Putting the Enterprise into the Enterprise System", *Harvard Business Review* 76(4).

Business Process Execution Language for Web Service Version 1.1, available at: http://www.106.ibm.com/developerworks/library/ws-bpel, 2003

Web Services Description Language (WSDL) 1.1, available at: http://www.w3.org/TR/wsdl.

XML and Web Service Security, available at: http://www.java.sun.com/webservices/xwss/index.jsp