

Development of ERP systems based on workflow management system*

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Abstract

To meet the requirement of flexibility and responsiveness for the enterprises, a workflow based ERP system is put forward. On the bases of workflow management systems and component-based development, the architecture of the ERP built on components is given. The corresponding process management method and the ways of decomposing process into components according to its function are designed. The development and implementation method for this new process oriented application is thoroughly discussed.

Keywords: BPR, ERP, Workflow Management System, and Component.

1. Introduction

In order to win the competition in the electric commerce environment the enterprises must react faster to the market and to be more flexible in their business process than ever before. As the basis of competition changes from cost and quality to flexibility and responsiveness, the value of process management is now being recognised. The role that process management can play in creating sustainable competitive advantage was termed Business Process Reengineering (BPR), and was first introduced by Hammer [1]. BPR has been regarded as the powerful way to meet the requirement of changing market. Nowadays enterprise information systems are mainly implemented through Enterprise Resource Planning (ERP) systems where a comprehensive view addresses all the functions of an enterprise [2]. ERP systems are try to provide all the functions in one software which are function oriented and can't adaptive to a changing process. On the contrary, BPR requires ERP systems to be considered as integration frameworks, on which different dedicated systems could be plugged-in according to the users' needs. To meet this requirement the architecture of the ERP system must be based on the process oriented application instead of function oriented one. Workflow technology and workflow management systems (WfMS), the key technology for process-based application, are now widely used in information systems, either as autonomous systems (like Lotus, Ultimus Workflow, etc.) or as parts of larger systems (like the workflow systems included in the ERPs like SAP, Oracle, etc.) [2]. Workflow management systems provide the foundation for defining and executing business processes.

Thus, building the ERP systems based on workflow technology is essential for the enterprises' requirement. After analyzing the drawbacks of the running ERP systems we provide a workflow based ERP system. On the bases of Workflow management systems and component-based development, the architecture of the ERP built on components is given. The

corresponding process management method and the ways of decomposing process into components according to its function are designed. The development and implementation method for this new process oriented application is thoroughly discussed, which support the whole lifecycle management of the ERP system.

2. Workflow Management System

A workflow is the automation of a business process, in whole or part, during which documents, information or tasks are passed from one participant to another for action, according to a set of procedural rules [3]. The automation of a business process is described within a workflow definition, which identifies the various workflow activities, dependence relationship and associated control data used to manage the workflow. An activity is naturally defined task in a workflow that forms one logical step within a process. A dependence relationship in traditional workflow processes can be of two types: execution dependence for control flow and information dependence for information flow [4]. When modeling an activity the role, input/output data and time duration are designated to describe a real process. While the relationship between activities are also designated which responsible for the sequence when the process is executing. Many works for workflow modeling are based on the Petri Nets approach [5]. The XML based method, i.e. XPDL, is also given by workflow management coalition [6]. Also directed graph can be used to model the workflow process [7], where nodes correspond to activities and edges correspond to dependencies between them.

A workflow management system is a system that completely defines, executes and manages the workflow through the execution of software whose execution order is driven by a computer representation of the workflow logic. From Fig. 1 we can see [3], a workflow management system usually consists of three parts: (1) the build-time functions, which are responsible for defining and managing the workflow processes; (2) the run-time functions, which are responsible for executing, monitoring and

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managing the workflow processes in an operational environment; and (3) the run time interactions with human users and application mechanisms for processing the activities. A workflow management system consists of software components to store and interpret workflow definitions, create and manage workflow instances and control their interaction with workflow participants and applications. A workflow instance is the representation of a single enactment of a process. It is created and managed by a workflow management system [4].

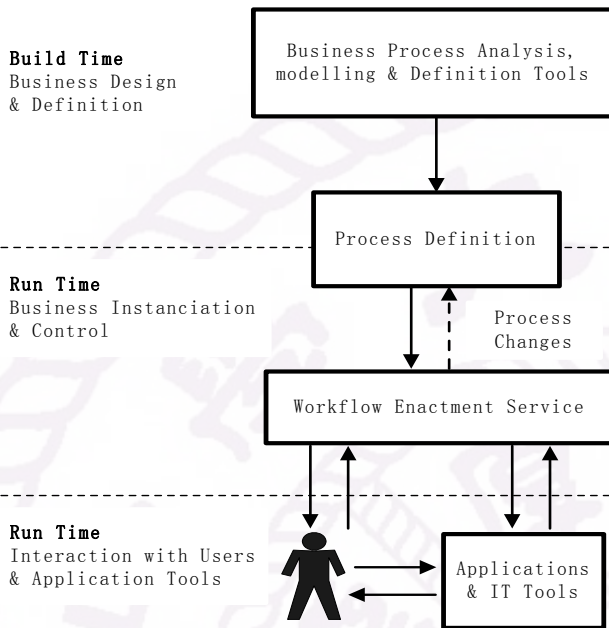


Fig.1 Three parts of workflow management systems

Workflow management systems provide the foundation for defining and executing business processes [8]. Hutton elaborated the application of workflow technology within BT [9]. The ERP system, with the requirement of BPR, can also be built on the bases of workflow management system in which the activities in processes will be realized by software components.

3. Workflow based ERP System

3.1 The architecture of workflow based ERP systems

Nowadays ERP systems are function oriented and can't adaptive to the changing processes. As a matter of fact the designers and developers of ERP systems just take into account of the function of the software instead of how the process would be. When we have to often change our work processes there arise the contradiction. We have to recode the software and compile it again. Thus the normal work will be disturbed and the workers have to take the trouble to learn the newly updated software and the new operation processes that are hided behind the menu. If the ERP systems are built on the bases of workflow management systems the function blocks, realized by software components, could be plugged-in according to the users' needs.

A workflow is a collection of activities and the dependencies between activities. Activities correspond to individual tasks in a business process. Dependencies determine the execution sequence of activities and the data flow between these activities. An

executor is responsible for the execution of an activity and some data and resources are necessary.

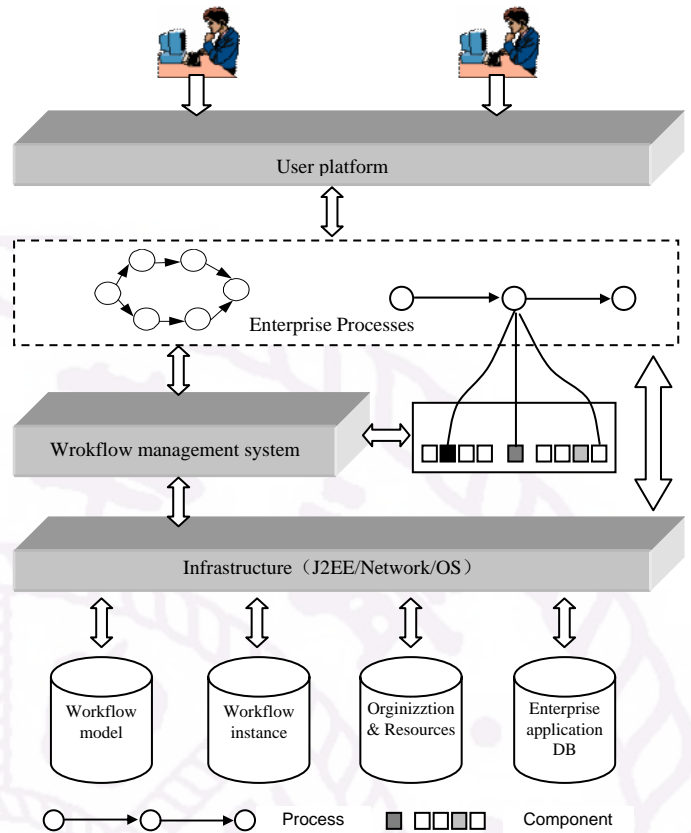


Fig.2 Architecture of workflow based ERP system

The workflow management system itself has to be built on the infrastructure of some kind of software component, i.e. J2EE, .Net, etc. Then the business process of ERP can be decomposed into activities, each of them act as a certain function. These activities, or functions, are also built on the same infrastructure with the workflow management systems.

The architecture of the ERP systems based on workflow management systems is shown in fig. 2. The whole ERP system is built on the bases of the workflow management systems, while the workflow management system is built on the infrastructure of some kind of middle ware, i.e. J2EE, .Net, etc. Thus the ERP system will be built on the same platform. The workflow management systems take the role of manager. It helps building the business process of the whole enterprise and supervises the execution of the processes to complete the function of the ERP systems. Thus the ERP system is made up of a series of business processes. The functions of the system are fulfilled by the component which will be triggered by the workflow engine.

In a business process, some activities will be controlled and executed by certain people(s), and some others will be executed by the computer software, i.e. a software component which will be triggered by the workflow engine when the process is executed in the workflow management system. These software components have to be designated according to the activities' function when building the process model in the build time, that is, try to build a relationship between the activities and the software components. The software components will be coded and compiled by the ERP system developer. Not only the activities executed by a people but

also triggered by the workflow engine are the parts of the business process. These business processes work together to form the whole function of the ERP systems.

3.2 The advantage of workflow based ERP system

According to F. Leymann [8], The workflow based ERP system show the following three advantages compared with the function based one, i.e. flexibility, reusability and integration capability.

1. Flexibility. The specification of workflow relation information is separated from the specification of the logic of the application functions. The business process and the function of the ERP system can be built separately. The software component can be built according to the function. And the workflow model can be built according to the business process. After that, the process modeler can build the relationship between the software components and the activities in a process later. This separation allows the model of the process underlying the ERP application to change without affecting the associated activity implementations. It is the predominant reason why enterprises are investing in workflow technology today.
 2. Reusability. This advantage is based on the structure of the workflow-based applications themselves. Activity implementations for process models are typically flow-independent and free of assumptions about their usage. Therefore, A particular activity implementation can be used in many different process models.
 3. Integration capabilities. The workflow model integrates the different activities into processes by the flow relationship and information dependency. And heterogeneity information systems can be integrated into one process because the functions are encapsulated into different components.
- The implementation method of the workflow based ERP system will be given in section 4.

4. The Implementation Method

Some basic implementation methods of workflow-based application are discussed in [10]. The application of ERP systems based on workflow management systems can follow some basic steps. The lifecycle management of the software is some kind different from the function oriented ERP systems.

There are four stages in the lifecycle of workflow based ERP systems, namely, requirements definition, design specification, implementation description and running maintenance, see Fig. 3. At present, there are three stages depicted in CIMOSA [11]. We add running maintenance stage to the ERP systems' lifecycle. In the running maintenance stage the enterprise process model can be maintained dynamically and peoples can actualize BPR.

In the stage of **requirement definition**, there are two main jobs: (1) get the workflow model and (2) describe what the component would be. The business process that complete the function of the whole ERP system will be investigated and requirement definition model will be built, i.e. all of this modeling information will be built. The four views, every one is a perspective of the workflow process, will all be built in this stage, i.e., process view, organization view, resource view and information view [10]. The process view, the main part of

workflow model, will be executed and scheduled by the workflow management system. The activities in the workflow process is defined and the flow of control and information between the activities are also defined. The people that perform the activities in the workflow process and the local or client/server programs that support the people are also defined. These programs will be realized by the software components. These components themselves can do some functions and will be mapped to certain activities in certain workflow process. In this stage the component will be designed, i.e. the interface, the API and the function will be defined.

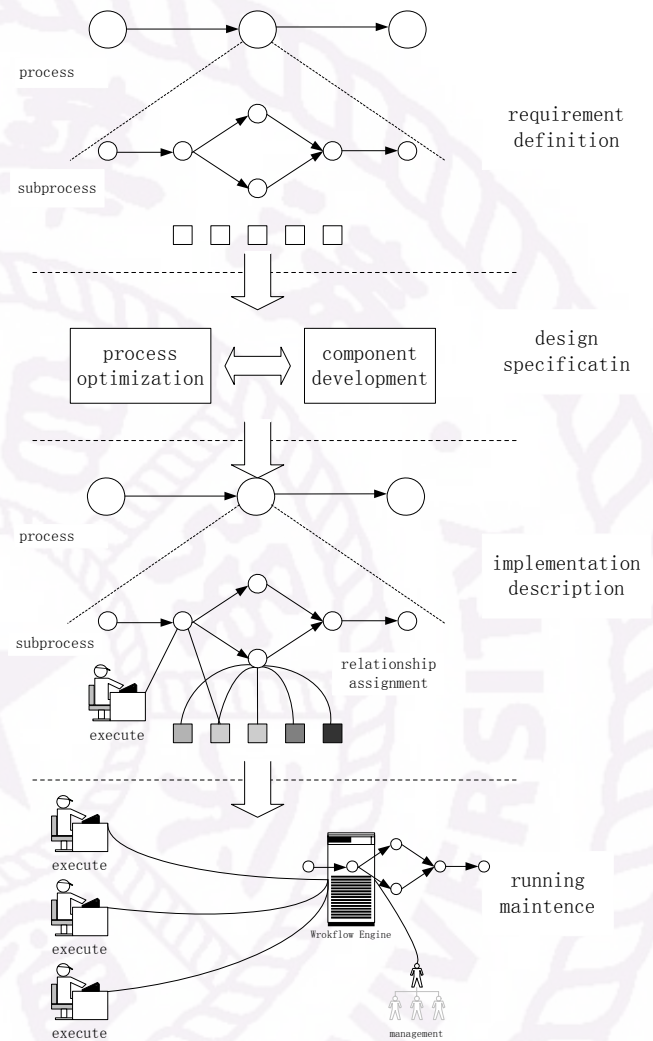


Fig.3 The lifecycle of ERP system

In the stage of **design specification**, the model gained in requirement definition will be analyzed and optimized. The organization and resource will be reassigned if necessary. In the same way, information model will be perfected too. After these operations the basic components will be developed.

In the stage of **implementation description**, the relationship between the activities in the processes and software component will be determined. So, we can see, the whole ERP system is built

up. Then some simulation will be done to detect potential errors. With the workflow simulation we can determine whether the organization is capable of handling the workload and whether the IT resources are sufficient to cope with the system, database, and communications load. After the simulation work the ERP system is ready for run. Then the process model will be instantiated, namely, the person or unit act as executer is assigned, the machine or equipment will be allocated to certain activities and processes and the enterprise database will be built. Thus, the process is ready for use, namely, the workflow-based ERP system is built up.

In the stage of **running maintenance** the ERP system will be running and be managed and monitored by the workflow system. In the workflow management system the implementation of every process will be monitored and controlled. The performance of time and cost will be analyzed. Also the running records of workflow instances provide the references for dynamic BPR and next modeling process. The traditional function based ERP system can't change the model when it is running. Whereas using process-based modeling method we can do the change conveniently and easily. Because (1) the workflow management system supports the dynamic change of model [12] and (2) the workflow model and the software component are independent, we can change the model in every stage of its life cycle. Especially in the stage of running maintenance the model can be changed in time. The model change method is shown in Fig. 4.

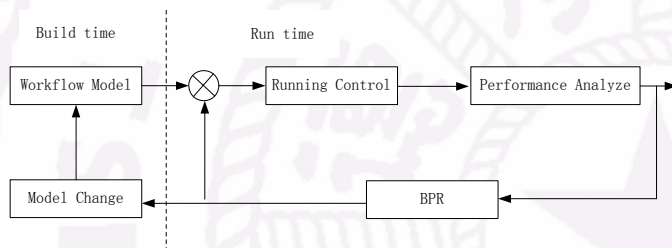


Fig.4 The ERP process model dynamic change method

In the run time, people can watch and see if the flow is going on obeying the predefined workflow model, if the time constraints are violated, if the cost is exceed the budget, if some activities are doing well, if the workload of a certain person is reasonable, or even if the performance of any kind (time, cost, quality and service) is satisfied. Thus, if anything wrong occurs, the administrator can

give some advise and change the process model to remedy the errors, namely, business process reengineering. After the operation of BPR, online or offline, we can modify the workflow model and get a correct one or a perfect one.

5. Conclusions

In order to overcome the drawback of now days ERP systems, a workflow based ERP system is given in this paper. On the bases of Workflow management systems and component-based development, the architecture of the ERP built on components is elaborated. The corresponding process management method and the ways of decomposing process into components according to its function are designed. The development and implementation method for this new process oriented application is thoroughly discussed. With this new kind of architecture the implementation of ERP system will be more convenient and the management and maintenance of the system is more flexible.

To support the workflow-based ERP system our future work focus on building a workflow management system, which is built on the basis of J2EE component and supporting the strict time management and dynamic workflow model management.

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