

Actor-driven approach for business process. How to take into account the work environment?

Kahina Bessai¹, Selmin Nurcan^{1,2}

¹ Centre de Recherche en Informatique
Université Paris I - Panthéon Sorbonne
90, rue Tolbiac - 75013 Paris

² IAE de Paris, 21 rue Broca - 75005 Paris
{Kahina.Bessai,Selmin.Nurcan}@univ-paris1.fr

Abstract. Over the last decade there was a high interest in business process modeling in organizations. In their majority workflow systems support a role-based allocation of work to actors. This allocation does not consider the additional work which comes from the actors environment and which is not visible to the workflow management system. In fact, the WFMS is not aware of the real workload of human resources in the organization. In this paper we propose an *actor-driven approach* for business processes management which aims at taking into account the additional work generated by the environment (telephone, fax, mail, verbally) and thus the the real workload of actors.

1 Introduction

Business process models are recognized as indispensable artefacts to drive business management and evolution [18], [1],[8]. Even if workflow technology became a standard component of many enterprise information systems, the introduction of this technology set also several problems[11].

Failures have been observed in organization during the operation of workflow applications. Such failures are mainly consequences of the modeling of business processes as flows of activities, without any estimation of the availability of human resources (we will call them shortly resources in the following). Often this led to stack parallel processes on resources, considering that they would be always available. The issue of the concurrent solicitation of multiple processes and process instances for the same resource was never dealt with to our knowledge.

This issue is relatively recent and was grown with the proliferation of new information and communication technologies (email, telephone, fax), which allow to address directly to the resources the work to perform. In service companies, the lack of ability to deal with the dynamic allocation of work to resources by taking into account comprehensively the actors environment leads to non mastered and uncontrolled delays. These observations led us to the conclusion that the real workload of actors is opaque for the workflow management system and also for the supervisors of the involved actors.

The majority of the workflow management systems(WFMS) are role-based and provide activity-driven modeling capabilities[5]. We focus in this paper on the comprehensive environment of the WFMS users, and more precisely on work allocations taking place outside the WFMS. Figure 1 shows the global picture of our proposition.

We propose an *actor-driven approach* for business processes enactment to deal with the following questions:

- How to capture the work coming from the environment?
- How to integrate the work from the environment in the workloads of resources which are dealt with by the workflow engine and the worklist handler of the WFMS [17]?
- How to take into account the availability of those resources?

This paper is organized as follows. Section 2 presents related works on resource modelling. In section 3, we present our approach for a smooth management of resources taking into account their comprehensive environment. Section 4 concludes the paper.

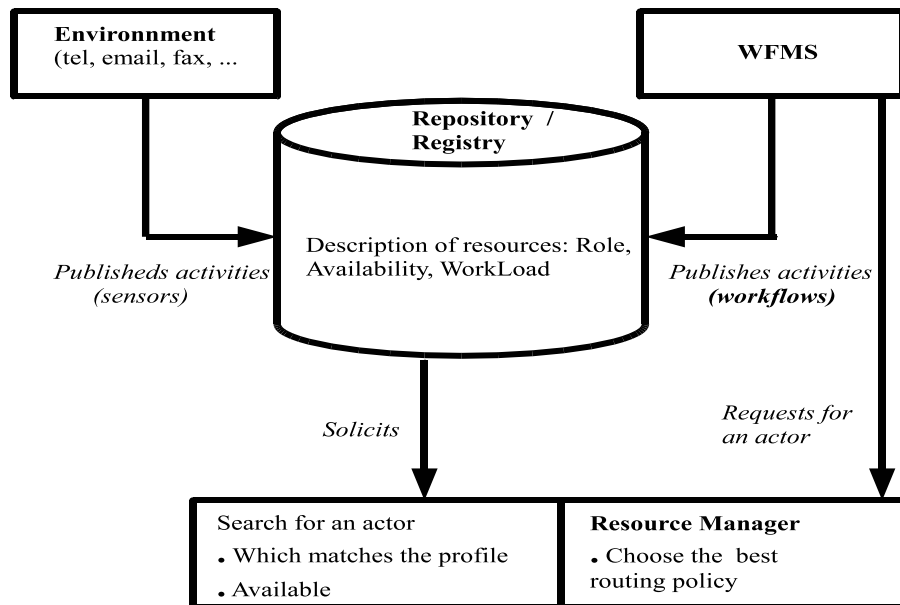


Fig. 1. The approach components

2 Related works

In this section we provide a short survey of research on workflow resources. Zur Muhlen [19] presents a meta model which incorporates a technology-driven ap-

proach and an organizational-driven approach for resource modeling. In [3] an organizational reference meta model is presented; authors specify users requirements for WFMS, and compare the meta models of two WFMS WorkParty and FlowMark. While the process modeling capabilities of the current WFMS seem to be at a high level, the organizational models provided by these systems are very elementary [19]. In [16] authors characterize a role-based environment focusing on the concepts which need separation of duty. They also define different variations of separation of duty.

In [2] Kumar et al propose a systematic approach to create dynamically an equilibrium between quality and performance issues in workflow systems. Russell et al [11] describe a series of workflow resource patterns that aim at capturing the various ways resources can be represented and used in workflow technologies. They distinguish a series of specific categories of these patterns. Creation patterns are specific to the built time, and limit the resources that can execute an activity. Push patterns characterize situations where work items which are created are gradually allocated to resources by the WFMS. Pull patterns describe situations where individual resources are informed of a set of work items that must be executed. These resource patterns provided a big advance in the resource modeling for business processes, nevertheless they do not consider the external environment of the WFMS. In [17], the usage of the concept of role is investigated in the context of flexible business process modelling. In, [18] a situational approach for flexible business processes modelling and engineering is suggested in order to deal with the variability problem (which impacts directly human resources) at the meta-model level. Our contribution in this work is the integration of the work items coming from the environment in the workload of resources, and the definition of a resource manager for the orchestration of the dynamic resource allocation.

3 An actor-driven approach for Business Process Enactment

In this section we present an *actor-driven approach* in order to deal with the real workload of human resources. This approach is composed of two main steps. The former aims to capture and identify the work coming from the environment. The later is the dynamic work allocation itself as described below. The principal concepts of the approach are shown in Figure 2:

- Resource: human actors involved in the organization.
- Role: the responsibility that an actor holds when performing an activity.
- Activity: the individual work realized by actors; we distinguish between internal and external activities. *Internal activities* represent work items allocated to the actors by the worklist handler of the WFMS. *External activities* represent the work coming from the environment (telephone, fax, email, verbally).
- Process: any business process in which the actor is involved.

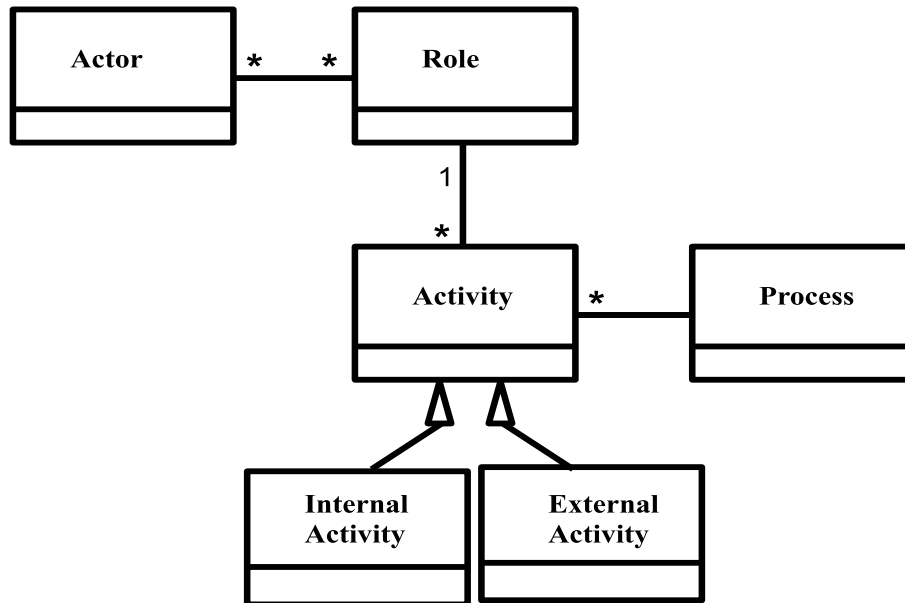


Fig. 2. The approach concepts

3.1 Description of the environment

In our approach, the environment represents all factors that influence either directly or indirectly the WFMS and more particularly the resource manager. Workflow management systems orchestrate resources without having a comprehensive information on their real workload. Numerous interactions between resources and the business environment make this workload opaque for the WFMS. Solicitations from the environment for the performance of a given work can be on different kinds: telephone, fax, email,... These communication channels affect the majority of resources in organizations, although they are not visible by the WFMS. The main purpose of our approach is to define the capability to capture the work items coming from the environment and to perform the resource allocation accordingly. We characterize and describe the environment using a set of factors called contingency factors. These factors will be used to identify the sensors which are necessary to catch the task-flow originated from the environment. Eventually, this will allow us to include those activities in the repository of resources in order to be aware of the real workload of all actors.

Contingency factors They are linked to the *external activities* and to *actors*.

- *The contingency factors linked to the environment:* define the communication channels which are used to assign activities to resources and specify some characteristics of these activities.

- Communication channels : the external activities discussed below can be transported on different channels, such as:

Email: during the last decade the importance of electronic messages was grown within organizations, for the transmission of information as well as a tool for work assignment to resources.

Written documents: they correspond to the most often used way to allocate activities to resources. This is also the typical way to delegate a work and can be based on different forms such as fax, memo etc.

Verbally: this is the less formalized channel, such as telephone communications, nevertheless this is a very usual way to solicit resources for doing "something".

- The description of external activities: we determined some significant attributes such as: content, priority, impact on other activities, and frequency of occurrence.

- *The contingency factors linked to actors* define in some way the status of the latter. In fact, a resource can be not available for doing something for different reasons like vacancy, illness, vacation etc. This kind of information about availability must be captured and transmitted to the resource manager.

The contingency factors allow thus to formalize the work originated from the environment and to be assigned to resources. They will be used in conjunction with rules for the integration of the external "black box" activities into the resource repository making them "glass box" activities. In that way, the resource manager will have the comprehensive knowledge about the human resource requirements of those external activities without any responsibility for controlling their execution.

Capture and integration of the work from the environment Sensors will allow us listening/capturing, transforming and integrating *external activities* from the environment to the *repository/registry* of resources. The capture and the integration of *external activities* is mainly dependent on the communication channel and the nature of those activities. This dependence determines the type of sensor to use: automatic, semi- automatic, or manual.

- Automatic capture. As described above emails are frequently used in organizations to assign work to resources. This additional work can be integrated in the *repository of resources* automatically. Emails can be captured automatically if they are formalized in a structured way (key word=value) for instance: (TaskName= write an unexpected report), (Startdate= 14/04/09).

- Semi-automatic capture. Some times emails are not well formalized. In this case, the resource him/herself has to root the email to the resource repository. She can also add additional information, in order to include it more easily into the repository.
- Manual capture. This way will be used when a resource is solicited by telephone, fax or verbally. In these cases, the resource has to complete a form describing the requested work. Once submitted, the repository state is updated.

In most cases, the capture of the external work requires validation before the integration in the *resource repository*. This validation can be performed by a supervisor. The responsibility required for the validation of an activity originated from the environment is determined by the hierarchical position of the resource in the organization. For instance the external activities of a senior manager can be automatically validated, whereas a medium level team member will need the approbation of his/her supervisor for the *external activities* arrived in one of his/her external worklists.. The information about the activity to be included in the resource repository will play an important role in the validation process. Depending on their nature, some activities may be automatically validated like activities of high priority. In some other cases, if information on external activities are missing, the latter will be automatically rejected. A form will be returned to the resource, which is called to perform the activity, to retrieve the missing information. Eventually, the completed information will help the resource who will validate the activity.

The validation of an *external activity* leads to it's integration into the *resource repository*, i.e the update of the workload of the corresponding resource. This makes all *external activities* "glass boxes", and addresses thus the opacity problem presented at the beginning.

3.2 Work allocation

In this paper we present an approach for improving the resource allocation in workflow management systems. Our proposition consists of developing a *resource manager* which purpose is to dynamically orchestrate the work allocation. We also suggest assembling necessary information about actors and their real workload into a *resource repository*. In the following sections we will describe this *repository* and the criteria defined for allocating work to the resources.

Resources repository Our aim is to construct a *resource repository* which should contain all information about actors and their real workload, the latter being a set of *external and workflow/internal activities*. This *repository* will be the cornerstone of our approach. It will be solicited by workflow management systems, the *resource manager*, resources themselves and the environment through sensors.

- Workflow management systems: the system will update the *repository*, when it will assign an activity to a resource chosen by the *resource manager*. Each time a resource starts or terminates the execution of an activity instance, the WFMS should update the resource repository to modify the *internal/workflow activity* state. The aim is to make the workload of resources as transparent as possible.
- Resource manager: The resource management is based on the information and data available in the repository. The resource manager reacts to the requests of the WFMS by providing the adequate resource for the realization of a given activity instance. Then the WFMS solicits the resource chosen by the resource manager for performing the activity.
- Resources: they integrate their own external activities in the repository and update their state. Otherwise, some other resources, such as supervisors, can integrate be requested for validating the *external activities* of the operational resources which will perform these activities. Thus, the repository has the knowledge about the organizational structure and manages access rights of all resources.
- Sensors: some external activities can be integrated automatically without validation. To realize this, we have to define rules for the repository based on what is listened on these sensors.

The description above sums up the requirements necessary for the implementation of the resource repository, and surveys its functionalities and roles in relation to the other actors (human or software) of the system .

Criteria for work allocation The work allocation in our approach is done by the *resource manager* based on the information stored in the *repository*. This search for the most appropriate actor or the work allocation will be further based on a set of criteria: organizational (roles of resources), real workloads (*external and internal activities*) and the resource availabilities.

4 A Map illustration of the way of working

In this section we use the Map formalism [17] [10] [4] for visualizing the suggested approach. A map as a directed graph from *Start* to *Stop* with intentions as nodes and strategies as edges between them. An *intention* is a goal that can be achieved by the performance of a process. Each map has two special *intentions*, *Start* and *Stop*, to respectively begin and end the process. A strategy is a manner to achieve a goal. The graph is directed because the *strategy* shows the flow from a source to a target *intention*. Each path from *Start* to *Stop* describes a way to reach the result i.e. each of them is a process model.

The map is a navigational structure which supports the dynamic selection of the intention to be achieved next and the appropriate strategy to achieve it whereas guidelines help in the operationalization of the selected intention [17].

We use the map formalism (see Figure 3) to represent the different methodological intentions targeted by our approach and the strategies which can be used for their achievement.

Intentions The map describing the approach has three intentions other than *Start* and *Stop* : *Capture external activity*, *validate external activity* and *Update the workload of a resource*.

Strategies For the realization of these intentions (except *Start*) we can use the set of strategies, shown in table 1.

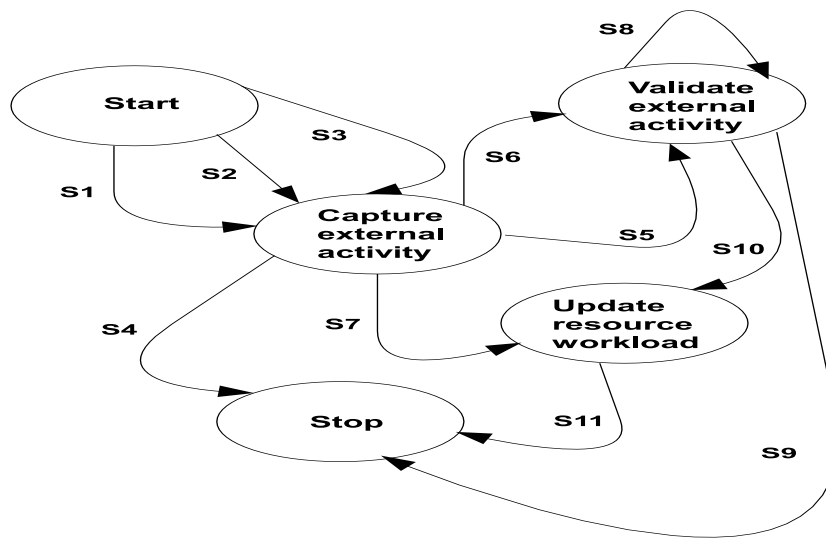


Fig. 3. Actor-driven approach map

Table 1. Map Strategies Description

N	Strategy Name	Definition
S1	Automatic	This strategy aims to capture formalized mails automatically. Mails contain special keywords for being captured.
S2	Fill a form	An activity is integrated to the resource workload if it's relevant and frequent. The form containing information on requested activity is filled by the resource and validated by his supervisor.
S3	Semi-automatic capture	Not formalized mails which are integrated to the repository by the resource.
S4	Request for an irrelevant solicitation	If an activity is considered irrelevant or if it requires a tiny execution time.
S5	Manual validation	The activity is manually validated by a supervisor.
S6	Automatic validation	The activity is automatically validated by the system.
S7	Update workload without validation	Some activities do not require validation and are directly added to the resource load work. They are defined as critical activities or the resource has a high rank in the organization.
S8	Missing information	The request for the activity execution is incomplete and it had to be clarified with additional information
S9	Activity is not validated	The activity is rejected by the supervisor or the system. It has no't to be performed by this resource and need to be reassigned.
S10	Workload update	Once validated, the activity is added to the resource workload
S11	By completeness	The system notifies the resource that the activity has been added to his/her workload.

5 Conclusion

In this paper we proposed an *actor-driven approach* for the smooth enactment of business processes. This approach aims to make transparent the comprehensive workload of resources and thus smoothing it across time, which is impossible when the work items arrive to the actors from different communication channels including the WFMS itself.

We propose to develop a *repository/registry* which contains *external* and *internal/workflow activities* and all the information about resources (role, availability, workload). This repository up to date by the workflow management system(s) after each work allocation, of a work item to an actor by the workflow engine and worklist handler, and also by the environment through the *sensors* (if complete automation is possible) or by the resources themselves (otherwise). We define a sensor for each *communication channel* (telephone, fax, email). Moreover, we propose a centralized *resource manager* to deal with the comprehensive work allocation, i.e also on behalf of the WFMS, taking into account the availability of resources, the organizational structure and the real workloads of human resources.

At this stage of our research we have not chosen yet the implementation technology for the resource repository, although we envisage some solutions closer to service oriented architectures.

Our future works will also include an extension of the *contingency factors* related to the resources and the definition of additional facets such as the localization of the resource and his/her context of work. We also envisage defining other sensors for the capture of *external activities*, and an allocation mechanism for the *resource manager*.

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