Workflow Planning for E-learning Center Management

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Abstract

Workflow technology was developed in order to help to understand, coordinate and orchestrate the processes that make an organisation work. It is perfectly suitable for the management of an e-learning center, where a course manager have to allocate the execution of a set of tasks among the existing human resources. This paper presents how to make the most of an e-learning business model stored in XPDL, converting it into a planning representation, using the HTN paradigm. The subsequent goal is to obtain an action plan that distribute the tasks needed for the creation and configuration of an online course to a set of workers.

1. Introduction

The introduction of new technologies in the educational field compels all the roles involved in the development of this new framework to face up a lot of new challenges, and the correct interaction between these roles will be essential for the successful development of high quality learning material. In case we want to represent and store the organisation model, workflow technology will be helpful. However, outlining the business processes for the management of an e-learning center make us understand that its activity is quite complex, and that different processes of the center can be closely related. Representing those relations can be a hard task for the designer of the workflow, since capturing all the possible sequences that the information follow implies a certain degree of difficulty and knowledge of the center operation. In these cases, Planning and Scheduling technology can be helpful in order to automate the generation of transitions not seen at first glances (using preconditions and effects information). As others have realised[5], there are some similarities between workflow management and planning that we must exploit.

What we propose in this paper is to use the output of the so-called "Process Definition Tools", in XPDL format, as input of a tool able to identify workflow common patterns[6] and to convert them to PDDL[4] planning language, as detailed in section 3. This would allow the later generation of an action plan, so that the manager of the center can allocate the tasks that comprise the creation and configuration of an online course among the available human resources at a specific moment. This contributes to easy management of an e-learning center, improving productivity and communication among the existing workers. Even more, the resulting plan could also be converted into a form readable by these process definition tools, like BPEL.

2. E-learning management scenario

Let's imagine that we want to create an online course within a Learning Management System. This task implies the participation of different roles (graphic designers, HTML developers, instructive designers, tutors, students,...). The workflow will be customised based on the operation of a specific e-learning center, and the human resources it has.

To reach the objective of preparing an online course to be started, some of the tasks needed can only be done by a specific worker/role, and they can have some previous requirements. For example, the task "adding metadata to learning objects" could only be completed by a content author and, before doing it, the task of uploading those learning objects into the system had to be completed. So, the election of a specific worker (or role) for a specific task will be conditioned by his capacity to complete it, and possibly by his temporal availability (or any implicit condition of the problem, i.e. the worker is not working in more that n courses at the same time). Another issue we must tackle in the prob-

lem resolution is the notification of a completed task to the tasks marked as dependency of that one, in a convenient way.

For each **task** we can identify:

- Duration: Estimated duration for the task to be completed.
- Web Service: Web Service associated to the task execution (in case it is needed)
- Requirements: Requirements for the task execution.
- Dependencies: tasks to be completed before the possible execution of the task.

For each **worker** of the center we can identify:

- Abilities: a list of abilities to achieve tasks requirements.
- Number of courses: number of courses the worker is working on.
- Availability dates: Dates in which the worker is available to be assigned a task.

This information will help us to establish the preconditions to execute actions in the workflow/plan and to represent temporal knowledge associated to the problem.

3. Our approach

In this section we show the shortages of XPDL for the problem we want to solve, and we introduce the HTN-PDDL technology.

XPDL lacks of some power for the correct representation of some workflow patterns, as stated on [6], so we will try to make use of those patterns that can be represented and are expressive enough for the domain. Furthermore, XPDL was conceived to store and exchange the process diagram, but not to execute it. So firstly, we have drawn the workflow for the management of CEVUG[1], considering the necessary roles, in close cooperation with their managers. Afterwards, we analyzed patterns present in that workflow, and how they could be transformed from its XPDL representation[6], into PDDL planning language[4] as described next.

For this transformation, we used the Hierarchical Task Network (HTN) paradigm which is based on the same three concepts than any other planning approach: 1) the *initial state* is a set of literals that describe the facts that are true at the beginning of the problem; 2) the *goal* is a description of what we want to achieve (the set of tasks to be completed) with a plan; 3) the *domain* is the set of available actions or rules to achieve the goals.

[1] University of Granada E-learning Center, http://cevug.ugr.es

HTN planning domains are designed in terms of a hierarchy of compositional activities (which correspond to a workflow scheme definition). Lowest level activities, named actions or primitive operators (workflow activities), are non-decomposable activities which encode changes (workflow transitions) in the environment of the problem. On the other hand, high level activities, named tasks, are compound actions that may be decomposed into lower level activities (a concept similar to subflows). Unlike non HTN planners, goals are described as a partially ordered set of tasks that need to be carried out.

We used the HTN planner SIADEX for this research, as we already know how to translate workflow patterns for semantic web services composition[3], it has already shown its feasibility for practical applications[2], as well as its adaptation to temporal knowledge[1]. Therefore, plans obtained using the task representation described above can be interpreted as workflow instances.

4. Conclusions

The main benefits of introducing P&S for the management of an e-learning center, based on an initial workflow representation, is that we can obtain an automated plan, i.e. as a gantt diagram, of the actions needed for the preparation of a course (or any other scenario), whatever they are human actions or remote calls to web services, but overcoming the traditional obstacle for P&S: the need to know a planning language (which is usually complex) to model the domain.

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