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Business-to-business workflow interoperation based on process-views

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Abstract

When cooperating with each other, enterprises must closely monitor internal processes and those of partners to streamline business-to-business (B2B) workflows. This work applies the process-view model, which extends beyond conventional activity-based process models, to design workflows across multiple enterprises. A process-view is an abstraction of an implemented process. An enterprise can design various process-views for different partners based on diverse commercial relationships and, in doing so, establish an integrated process that consists of internal processes and process-views that each partner provides. Participatory enterprises can obtain appropriate progress information from their own integrated processes, allowing them to collaborate effectively. Furthermore, B2B workflows are coordinated through virtual states of process-views. This work develops a uniform approach to manage state mappings between internal processes and process-views. The proposed approach enhances prevalent activity-based process models adaptable to collaborative environments.
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1. Introduction

Enterprises cooperate strategically to develop a competitive business alliance or virtual enterprise. Cooperative relationships are formed by merging the operational processes of participants. Workflow technology enables an enterprise to construct a process-oriented organization efficiently. Business-to-business (B2B) workflows are streamlined if value-added activities are arranged from a process-oriented aspect as

well as controlled automatically by integrating workflow management systems (WfMS) of participatory enterprises. However, managing workflows among multiple enterprises is more complex than doing so for an individual enterprise.

To remain competitive, a cooperating enterprise must conceal its internal process structures. However, collaborating enterprises must exchange business information. For example, a notebook computer manufacturer may submit a purchase order to a hard disk manufacturer. In addition to the data required for interaction, if an enterprise provides adequate progress status, its partners may respond as anticipated. For example, if the notebook company exposes appropriate progress data of its assembly workflow, then

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the hard disk manufacturer may deliver products just in time. Thus, the notebook company can reduce the stock cost required for storing materials such as hard disks. Moreover, distributed and heterogeneous WfMSs of cooperating enterprises must be integrated to automate B2B workflows.

From the perspective of decision support, a WfMS offers an integrated environment for decision makers to analyze, simulate, design, enact, control, and monitor the overall business processes of an enterprise. As the outsourced tasks grow, workflows extend across several enterprises. Workflow technology is expected to support decision-making within an interorganizational environment, just as it does within a single enterprise.

Our previous study [17] proposed a process-view model that enhances the capability of process abstraction in conventional activity-based process models [7]. A process-view, i.e., a virtual process, is abstracted from an actual process. According to distinct organizational roles' requirements, a process modeler can design various process-views, hence providing the appropriate process information to each participant. However, the preliminary process-view model does not consider managing workflows within interorganizational collaboration.

This work proposes a process-view-based coordination model that extends the preliminary process-view model [17] to effectively address the issues of managing B2B workflows. A process-view abstracts critical commercial secrets and is an external interface of an internal process. An enterprise can design various process-views, which are unique to each partner. Process-views of participatory enterprises comprise a collaboration workflow. Moreover, this work employs *virtual states* to coordinate B2B workflows. The virtual states (execution states) of a process-view represent progress status of an internal process. A uniform means is developed to manage state mappings between internal processes and process-views. An enterprise can monitor and control the progress of partners' processes through the virtual states of their process-views. Furthermore, data abstraction is proposed to derive meaningful *process-view relevant data* since our previous work focus only on the control flow of process-views. With these extensions, the enhanced process-view model contains a modeling tool that can accurately describe

interorganizational workflows as well as an interoperation mechanism to coordinate autonomous, heterogeneous and distributed WfMSs.

The rest of this paper is organized as follows. Section 2 presents the process-view model and its applications within inter-enterprise cooperation. Section 3 then summarizes how to define an order-preserving process-view as presented in Ref. [17]. In addition, data abstraction is proposed for deriving process-view relevant data. Next, Section 4 presents the coordination of B2B workflows through the virtual states of process-views. Section 5 presents a prototype to demonstrate the effectiveness of the proposed approach. Section 6 then discusses some properties of the process-view-based approach and reviews related work in collaborative workflow management. Conclusions are finally made in Section 7.

2. Process-view-based coordination model

This section first introduces process-view model and then presents the process-view-based B2B coordination.

2.1. Basic definitions: base process and process-view

A process that may have multiple process-views is referred to herein as a *base process*. A process-view, i.e., an abstracted process derived from a base process, provides abstracted process information. From the users' perspective, a process-view resembles a typical process that consists of activities and dependencies although it is an abstracted form of an implemented process. Based on the process-view definition tool, a modeler can define various process-views to achieve different levels of information concealment. The following summarizes basic definitions of base process and process-view. Please refer to Ref. [17] for detailed definitions, semantics and examples.

Fig. 1 shows an example of base process, where the split and join structures are defined by the Workflow Management Coalition (WfMC) [29]. *AND-SPLIT*: An activity splits into multiple parallel activities that are all executed. *XOR-SPLIT*: An activity splits into multiple mutually exclusive alternative activities, only one of which is followed. *AND-JOIN*: Multiple parallel executing activities join into a single