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Cross-organizational workflow integration using contracts

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Abstract

Enterprises are lining up into virtual enterprises to meet the ever-increasing customer's demands in a more flexible and effective way than before. Hence, the business processes as well as supporting workflow systems need to be tightly embedded into streamlined, virtual value chains that can transcend organizational boundaries. It is generally recognized that the combination of workflow with business-object component technology provides the required solution. However, today's widespread business workflow modeling techniques suffer from an object bias, ignoring the most essential coordination vehicle in the enterprise: communication, and the resulting commitments. In this paper, we present contracts that encapsulate (formal) commitments laid down as a set of obligations to coordinate and control the interaction between business workflows. We use the business contract specification language XLBC to formally link the Component Definition Language (CDL) specification of business object-based workflow systems. XLBC is an extension of the Formal Language for Business Communication (FLBC) and a framework for the semantics of XLBC transactions is described. Finally, we indicate a feasible implementation architecture on the basis of an emerging internet-enabled business process architecture, ebXML and Trading Partner Agreements (TPAs).

Keywords: Workflow integration; Contracts; Deontic logic; FLBC; TPA; ebXML

1. Introduction

Today's increasingly competitive, expanding global marketplace requires that companies line up into virtual alliances to address rapidly changing market conditions in a more flexible and effective way than ever before. Companies are required to transparently integrate and streamline their business activities to increase their service and shorten delivery times. Value chain integration means more than just doing business over the web: the business processes of several different enterprises need to be seamlessly integrated into more effective and efficient holistic re-engineered business processes.

Emerging technologies, such as business objects, components and XML are generally being perceived as core technologies to successfully deal with these challenges. However, there are several important issues that need to be addressed before these promises become reality.

(1) Enterprise (workflow) models

Most enterprise and workflow models lack the semantics to concisely represent specific activities, tasks,

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roles, business processes, business goals, recourses and organization structures of a business [20]. Traditionally, business models are represented by means of data-oriented techniques (e.g., ER-diagrams), and process models (e.g., Petri-nets).

Only recently, industry has recognized the advantages of modeling (virtual) business workflows as collections of self-sustaining business objects that wrap both business processes and business data [18]. Business objects represent a special category of objects with business semantics such as customer, bill and procurement.

However, even modern business-object-oriented enterprise modeling techniques are not equipped with constructs to specify virtual enterprises as networks of mutual commitments. They lack mechanisms to adequately represent the (in)formal communicational structures that are utilized to coordinate business workflows. Another term for a business workflow is a production workflow. Production workflows [11] constitute a special category of workflows with a high business value and a high repetition factor.

(2)Commitments and contracts

An essential aspect that needs to be taken into account for inter-organizational transactions are mutual commitments that parties are accepting to integrate their business processes. According to our view, contracts are the most natural vehicles to prescribe the coordination between two or more business workflows. Contracts are used to make explicit the (legally binding) commitments that the partners make, and in which future commitments to perform actions are laid down [28,30].

Business commitments comprise the ''glue'' that integrates (autonomous) enterprises into virtual alliances. Business commitments are materialized via contracts and mandate the shared goals (intentions) and policies of the virtual enterprise.

Cross-organizational workflow integration on the basis of contracts exemplifies a complex problem for which current workflow management products offer few solutions. Some research has been conducted on workflow integration, e.g., CrossFlow [12,26], but what is to be included and excluded in these contracts has not yet been extensively investigated.

This paper is organized as follows. In Section 2, a business process integration challenge is introduced as running case. In Section 3, the enterprise models are worked out using Component Definition Language (CDL). Section 4 introduces XLBC and how contracts can be used to glue the inter-organizational workflows together. The semantic framework of contracts based on Deontic Dynamic Logic is described in Section 5. Section 6 makes a link to recently proposed business process architectures, in particular, ebXML. The paper is concluded with a summary, some references to related work and directions for future research.

2. Running case: integration of a semiconductor supplier and a PC-assembler

The computer hardware (sub) component industry is under continuous pressure to deliver qualitatively superior products for low prices and short delivery times. To cope with these demanding requirements, many component manufacturers have decided to outsource their construction activities and limit themselves to the composition of computer configurations into various designs tailored towards the demand of individual customers. These requirements do not only require smooth internal business processes, but also demand close partnerships with all suppliers of semiconductors throughout the supply chain.

In this case that is based on a model company described in Ref. [9], we focus at the business process integration of a PC-manufacturer and a semiconductor (''component'') manufacturer.

The procurement logistics of the PC-manufacturer should be tightly coupled to the sales and distribution processes of the (various) subsystem manufacturer(s) to guarantee a non-hampering production and timely delivered products. Procurement logistics is occupied with delivering the required (often planned) materials, e.g., raw materials and semi-finished products as well as services to the production processes in the enterprise. Sales processing is concerned with the other end of the production process, and deals with sales order processing and delivery processing.

In this situation, a customer order from the PC-manufacturer directly determines the release order