Chapter XII

Service-Oriented Middleware for Managing Inter-Enterprise Collaborations

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ABSTRACT

Participation in electronic business networks has become necessary for the success of enterprises. The strategic business needs for participating in multiple networks simultaneously and for managing changes in these networks are reflected as new requirements for the supporting computing facilities. The Pilarcos architecture addresses the needs of managed collaboration and interoperability of autonomous business services in an inter-organisational context. The Pilarcos B2B middleware is designed for lowering the cost and effort of collaboration establishment and to facilitate the management and maintenance of electronic business networks. The approach is a federated one: All business services are developed independently, and the provided B2B middleware services are used to ensure that technical, semantic, and pragmatic interoperability is maintained in the business network. In the architecture and middleware functionality design, attention has been given to the dynamic aspects and evolution of the network. This chapter discusses the concepts provided for application and business network creators, and the supporting middleware-level knowledge repositories for interoperability support.
INTRODUCTION

The globalization of business and commerce makes enterprises increasingly dependent on their partners. Competition takes place between supply chains and networks of enterprises. In this competition, the flexibility of enterprise information systems becomes critical. The IT systems and development teams should be able to respond in a timely manner to the requirements arising from the changing co-operation networks and their communications needs.

Traditionally, inter-enterprise collaboration has been supported by business process driven solutions that focus on the business functionality needs and the technology-homogenizing needs of the collaboration. This leads to situations where a change in the business processes induces large re-development projects. Furthermore, technology changes may cause domino effects cascading on the computing systems of dependent collaborators.

The present goal, instead, is to narrow the gap between business management concepts and the computing solutions. This introduces a new category of dynamic management aspects to the computing facilities, which isolates business processes from the technology, and thus improves the agility of enterprises when it comes to participating in new business networks. In addition, the wave of service-oriented computing facilities creates new possibilities for enhancing the automation of services as building blocks of many different types of business networks simultaneously.

In this work, the major challenge is to develop a middleware that takes the burden of managing these loosely-coupled collaborations and maintains the correct interoperation between business services in a way that supports business management concepts more directly. In comparison to traditional integration solutions, the global solution must lean on federating B2B middleware services that support the management of contract-governed collaborations, as will be discussed below.

We present an overview of the middleware solutions suggested by the Pilarcos project for inter-enterprise collaboration management. Section 2 first outlines the model of global networked business and the B2B middleware role in supporting it, addressing the new computing challenges that are arising. The activities addressed include negotiating and describing new business networks, developing new business services for the open service markets, contracting with partners about a collaboration and forming a new business network, acting as a partner providing agreed-upon business services, and monitoring potential risks and breaches during the activities. As the partners are autonomous and only contractually bound to a common goal, there is no technical guarantee of correct behavior in the business or technical sense. Therefore, a feedback loop for creating a "social pressure" effect is needed: the architecture includes a reputation-based trust management system.

Section 3 in turn outlines the Pilarcos middleware architecture. Since interoperability knowledge is a key issue to address in the architecture, Section 4 gives additional details on the essential knowledge types and roles of the repositories globally available. This interoperability knowledge has several important roles in the architecture: the pieces of information play a role a) in the service and collaboration creation processes, b) in the verification and observation of interoperability at operational time, and c) as elements in the contract structures needed for defining the business goals of the collaborations, which thus enables the validation or breach detection in the business operation across the inter-enterprise collaboration. Section 5 gives further insight into the realization methods of some management activities.

Finally, the discussion is turned to the relationship of the Pilarcos architecture to other current research and development directions, and concludes with usability issues, impacts and future work.