

Chapter XI

Web Service Discovery and Composition for Virtual Enterprises

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ABSTRACT

One main characteristic of virtual enterprises are short-term collaborations between business partners to provide efficient and individualized services to customers. The MOVE project targets at a methodology and a software framework to support such flexible collaborations based on process oriented design and communication by Web services. MOVE's framework supports the graphical design and verification of business processes, the execution and supervision of processes in transaction-oriented environment, and the dynamic composition and optimization of processes. A business process may be composed from a set of Web services, deployed itself as Web service and executed in the framework. The composition of processes from Web services is implemented with methods from AI-planning. We apply answer set programming (ASP) and map Web service descriptions and customer requests into the input language of the ASP software DLV. Composition goals and constraints guide a composition challenge. We show the performance of our program and give some implementation details. Finally we conclude with some insights.

INTRODUCTION

A *virtual enterprise* is a business model (with many variants) in which different legally independent companies cooperate electronically (mainly by means of the Internet) to offer better services to customers that cannot be offered by one single member. The configuration of new services for customers is faster and more flexible than in traditional business models because a cooperation is initiated electronically.

Since one of our industrial partners comes from the tourism sector and another partner is an Austrian mobile communication provider, we use scenarios from the tourism sector extended with mobile communication features. In the tourism sector, partners in a virtual enterprise are for instance airlines, taxi drivers, hotels and others. In particular, the better coordination of services (e.g., flight arrival, luggage transport, taxi drive and hotel check-in) is an advantage for customers achieved by sophisticated information and communication technology in a virtual enterprise. Moreover, the possibility to contact the customer anytime and anywhere by means of mobile communication can result in continually better services. Of course, there are also benefits for single members of the virtual enterprise (e.g. the taxi driver), because they can schedule their workload better.

Mainly small enterprises exist in the tourism sector. These can participate in the development of larger products—so called *dynamic holiday packages* with the virtual enterprise concept. In contrast to actual business practices between tour operators and hotels, the virtual enterprise concept leads to more flexibility in defining such packages. A small enterprise can define a new service, announce it in the virtual enterprise and a customer can select this service immediately.

It is assumed that the cooperation is often short-term because the collaboration is established only for one individual service. Thus, the establishment of a collaboration must be achievable very

easily without great organizational or financial efforts, but it must conform to certain standard behavior in order to guarantee high quality. For example, let us consider that the luggage of an airline customer is automatically transported to the hotel by taxi without requiring the customer to take care of it. Since the virtual enterprise has all required data, the taxi is already waiting for the customer and the luggage is immediately transported from the aircraft to the taxi. This process has to be controlled and supervised electronically to avoid the luggage loss. An architecture based on standardized Web services is a promising technique for achieving the required flexibility as well as the quality. The interfaces between members of the virtual enterprise (i.e., the data transmitted) are implemented on basis of international standards, especially those based on XML. Furthermore, open source software is reused as much as possible in the Move-project. Hrastnik (2004) and Rainer (2004) describe these infrastructure aspects in more detail.

Members of a virtual enterprise do not commit themselves to any financial or legal obligations. However, each member has to express which services it will supply under which conditions to the virtual enterprise and for the end customer in a transparent way. Some central decision support system to enable fast and flexible reactions to customer queries has to exist. The ideal solution would be an automatic decision based on centrally stored knowledge as well as knowledge distributed over all partners accessible through electronic communication. However, there may also be problems that require human expert knowledge. There will be a variety of commitments from members to such a decision support system.

Given a Web services based architecture, we can define a planning component as one Web service that obtains the customer query as input and produces a document containing several proposals as output. If the user selects one proposal, a second Web service can reserve and book this proposal. The first Web service calls further Web

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