Chapter X
Visual Environment for Supply Chain Integration Using Web Services

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ABSTRACT
This chapter presents a software tool to simplify application integration among enterprises. The visual environment provides facilities to display in a graphical interface the structure of databases and applications. By clicking in the appropriate tables, functions, and fields, enterprises could specify the data sources needed for integration. The details of the applications are extracted from WSDL and metadata definitions. Once the fields for every access are specified, integration code is automatically generated in either Java or C#. The chapter describes the visual tool and its use for automatic supply chain integration from metadata or WSDL descriptions. It describes how users specify the data elements and the integration links and how the code integrating the specified elements is automatically generated. The generated code uses Web services standards to integrate the specified sources.

INTRODUCTION
Today, for a large number of companies, the information systems landscape is a complex mixture of old and new technologies. Traditionally, companies built heterogeneous applications for specific problems and took advantage of business opportunities. The normal approach was that enterprises developed their applications in an isolated way, with every department independently developing their own applications and data storages. Currently, these companies confront the necessity of sharing information among those heterogeneous applications (commonly named legacy systems) and the new systems being developed (Juárez Lara, 2001). The Internet brought...
about an increased necessity for companies: the needs of Web presence and the integration of their systems.

As more and more companies pursue the benefits of electronic business through the Internet, they face the need of enterprise integration (EI) as key technological enabler in transforming their business processes. A typical form of EI is Web integration. In this scenario, a company wants to offer its existing products and services over the Internet, so it builds front-end Web systems and integrates them with its back-end legacy systems. A more complex scenario involves enterprise application integration (EAI). In this scenario, the company links up its previously isolated and separated systems to give them greater leverage (Wing & Shankararaman, 2004). An emerging EI scenario is business-to-business (B2B) integration, which occurs when companies integrate their own business processes with those of their business partners to improve efficiency within a collaborative value chain. Examples of B2B applications include procurement, human resources, billing, customer relationship management (CRM), and supply chains (Medjahed, Benatallah, Bouguettaya, Ng, & Elmagarmid, 2003). Effective and efficient supply chain integration is vital for enterprise competitiveness and survival, and with the emergence of the e-business era, supply chains need to extend beyond the enterprise boundaries (Siau & Tian, 2004). The need for supply chain integration techniques and methodologies has been increasing as a consequence of the globalization of production and sales, and the advancement of enabling information technologies (Ball, Ma, Raschid, & Zhao, 2002).

This chapter describes the design and implementation of a visual tool for automatic supply chain application integration by using Web services technologies within the PyME CREATIVA project (explained later). The tool provides visual specification facilities and the capability of code generation for B2B integration of enterprises in supply chains.

The chapter is organized as follows. The following section describes the PyME CREATIVA project as an example of a project addressed to supply chain integration, and presents an overview of electronic commerce and supply chain integration. Then the chapter describes the core technologies used in implementing the visual tool—EAI, Web services, and code generators—and presents the analysis and design of a visual tool for enterprise integration to a supply chain. Next it describes a study case of supply chain integration using the infrastructure described. Finally, results and conclusions are given.

**THE PyME CREATIVA PROJECT**

The creation of industrial networks to foster the competencies of small and medium enterprises (SMEs) needs integrated information services (e-services) that enable coordination and cooperation among the different SMEs, allowing them to share their technological resources, creating virtual organizations. These e-services should be integrated in an open technological platform that is easy to access, which is known as an e-hub (Molina, Mejia, Galeano, & Velandia, 2006). A main goal in the PyME CREATIVA project is to produce a low-cost management and operational infrastructure for value-added networks of SMEs. Several steps are being applied to build the infrastructure defined by a set of services. The first step is defining the business model of value-added networks. Secondly, one needs to design the IT architecture. The third step consists of designing the services supporting the operation of the network. Lastly, it is necessary to use a combination of open-source technologies to produce a low-cost implementation of the architecture. The e-hub tries to offer a variety of integrated e-services that are necessary for dynamic market competition. This e-hub can be seen as a marketplace platform, where SMEs can execute trading processes, purchase orders, supply chain management, request for quotations,
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