Chapter XV
Towards a Virtual Enterprise Architecture for the Environmental Sector

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ABSTRACT

This chapter introduces a virtual enterprise architecture for environmental information management, integration and dissemination. On a daily basis, our knowledge related to ecological phenomena, the degradation of the natural environment and the sustainability of human activity impact, is growing and as a consequence raises the need for effective environmental knowledge exchange and reuse. In this work, a solution among collaborating peers forming a virtual enterprise is investigated. Following an analysis of the main stakeholders, a service-oriented architecture is proposed. Technical implementation options, using Web services or software agents, are considered and issues related to environmental information management, ownership and standardization are discussed.

INTRODUCTION

On Service-Orientation

Service oriented approaches attract the broad interest of the scientific community, investing on the added value for the digital world of tomorrow. The promising point of service orientation is the synergy of computer science with artificial intelligence theories and computer networks practices. The primitives of distributed computing, the semantic Web, human-computer interaction, software engineering and agent computing are put together in order to design and deploy open, complex yet intelligent and adaptive computer systems that are based on simple agents of fine granularity, which, in turn, provide services in virtual enterprise (VE) environments.

Virtual enterprise architectures could be valuable for efficient information processing and open, loosely coupled service integration, not only in business-related sectors, from where they originate, but also in non-for-profit sectors. For example, consider these sectors related with public domain data and citizen-centered services in the context of e-government, e-health, e-agriculture, e-environment, e-science and so forth. In such a setting, the notion of a virtual enterprise is rather decoupled from its narrow business context, and extended to a broader scheme that accommodates constellations of cooperating service-providers. Service orientation became quite fashionable lately in several implementation variations, as those of software agents, Web services or grid computing. Each one of the technical solutions has advantages and disadvantages that make it more suited in some types of applications. For example, software agents are considered to be active entities, able to take initiatives, in contrast with Web services, which are required to be invoked, that is, operate in a passive way. In this respect, agents are well suited in competitive environments, as those of knowledge brokering and auction-like environments, while Web services are typically used for integrating heterogeneous components in open environments. Finally, grid computing seems more appropriate for computationally-intense applications. Whatever the application case or the suitable technical approach might be, unarguably, service orientation and virtualization remain a critical characteristic that aims in extending sytem capabilities through the composition of fine-granularity service elements with the ultimate goal of providing added-value services in dynamic environments.

This chapter explores the potential of formulating virtual enterprises for the environmental sector. Firstly, the background is set by introducing concepts related to environmental management information systems (EMIS) and the major challenges for environmental information processing and dissemination. Next, a virtual enterprise architecture for environmental information management is introduced and specifies the operational fashion of such a virtual enterprise. Finally, it summarizes latest developments on the field, and discusses the potential for wide-range adoption of virtual enterprises in the environmental sector.

ENVIRONMENTAL INFORMATION AND CHALLENGES

Environmental Data

Environmental data, although considered as public domain, have not been treated as such so far. Environmental information, either collected by public institutes, private industries or generated as a result of scientific computations in academia, has been kept for long in nonreusable, legacy systems and reports. Therefore the vision for enabling access to information and the provision of value-added services that will benefit from the information society initiatives, technologies and tools, often referred as e-environment, or e-agriculture applications, is still in infancy. Nowadays, there are ongoing efforts on defining standards for sharing data about the natural environment, including these published by the US Environmental Data Standards Council in January 2006 (EDSC, 2006) along with the standards developed gradually since 1994 by the european environment information and observation network (EIONET, 1994) and the guidelines (on vegetation plots and classifications) of the Ecological Society of America (VEGBANK, 2006). Also, Food and Agriculture Organization (FAO) of the United Nations has recently made its thesaurus of food and agricultural terms, publicly available through the AGROVOC Web services (AGROVOC, 2006). This task is part of FAO's activities for establishing agricultural information management standards. Significant is the contribution of the OpenGIS specifications by the Open Geospatial Consortium (OGC, 1994) for the standardization