

# Chapter 4.16

## Interoperability Middleware for Federated Business Services in Web-Pilarcos

**Lea Kutvonen**

*University of Helsinki, Finland*

**Toni Ruokolainen**

*University of Helsinki, Finland*

**Janne Metso**

*University of Helsinki, Finland*

### 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 web-Pilarcos architecture addresses the needs of managed collaboration and interoperability of autonomous business services in an inter-organisational context. The web-Pilarcos B2B middleware is designed for lowering the cost of collaboration establishment and to facilitate management and maintenance of electronic business networks. The approach is a federated one: All business services are developed independently and

the 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 article discusses the concepts provided for application and business network creators and the supporting middleware-level knowledge repositories for interoperability support.

### INTRODUCTION

The globalisation 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 timely to the requirements rising from the changing co-operation networks and their communications needs.

At present, development and research is directed towards autonomous enterprises with sovereign services and loosely-coupled, contract-governed business networks formed between them. In this kind of environment, several strategical, process-related and technological needs must be attended by the business network management:

- Formation of new business networks that provide added value services for clients.
- Joining multiple networks at the same time without unnecessary restrictions on technologies or operational policies.
- Taking up new business processes and services with relatively low cost.

This article is based on work performed in the Pilarcos and web-Pilarcos projects at the Department of Computer Science at the University of Helsinki. The Pilarcos project was funded by the National Technology Agency TEKES in Finland, Nokia, SysOpen, and Tellabs. In web-Pilarcos, active partners have been VTT, Elisa and SysOpen. The work integrates much with RM-ODP standards work and has recently found an interesting context in the INTEROP NoE collaboration:

- Moving existing business networks to new phases of life-cycle so that new collaboration forms can be used.
- Monitoring the progress and correctness of the collaborative processes.
- Automating some collaboration establishment and correction events.
- Protecting local services and computing solutions from the changes and failures of the collaboration partner services and solutions.

To address these management needs, we need to use concepts and operations for forming electronic business networks, e-communities, and managing their life-cycle by e-contracts. The business services themselves should not be burdened, but these facilities are to be introduced as generic B2B middleware.

Thus, from the computing infrastructure side, the enterprise's needs can be addressed by an architecture where business level services, B2B middleware, and abstract communication services are clearly separated from each other and the relationships between collaboration life-cycle, B2B middle-ware, and software engineering tools are changed from the traditional approach.

Traditionally, inter-enterprise collaboration has required integration of enterprise computing systems or applications. The topical integration techniques vary from new generation ERP systems, and process-orientation to distributed workflow management systems. A significant amount of research is currently focusing on virtual-enterprise approaches. Virtual enterprises are joint ventures of independent enterprises joining a shared collaboration process. In many projects like PRODNET (Afsamanesh, Garita, Hertzberger, & Santos Silva, 1997), MASSYVE (Rabelo, Camarinha-Matos, & Vallejos, 2000), FETISH-ETF (Camarinha-Matos & Afsarmanesh, 2001), and WISE (Lazcano, Alonso, Schuldt, & Schuler, 2000; Alonso, 1999), the support environment consists of a breeding environment and operational environment. The breeding environment provides facilities for negotiating and modeling the collaboration processes; the operational environment controls the enactment of the processes. Many of the virtual enterprise support environments use a unified architecture approach: there is a shared abstract model to which all enterprises have to adapt their local services.

In contrast to this, the approach in the web-Pilarcos project is federated: enterprises seek out partners that have services with which they are able to interoperate (within the strategically

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